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September 10, 2007

File: TFL14 Timber Supply Analysis Report

B.C. Ministry of Forests
Forest Analysis Branch
Box 9512 Stn. Prov. Government
Victoria, BC V8W 9C3

Attention: Bud Koch, RPF
Senior Analyst – TFL s

Dear Sirs:

Re: TFL 14 Timber Supply Analysis Report - Version 2.0

Enclosed for your acceptance is version 2.0 of our Timber Supply Analysis Report related to the Management Plan 9 process for TFL 14. Also enclosed is a summary of the comments we received on version 1.0, and responses that are incorporated into this new version.

Please also note that Tembec has submitted an extension request for the current Management Plan (July 27th 2007) that offers rationale and an opportunity for government to review the timber supply impacts associated with FSC certification in BC prior to approval of a new Management Plan.

If you have any questions or concerns with regard to this submission, please fee free to contact me at (250) 426-9252.

Yours truly,
Tembec Enterprises Inc.
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DPC

D.P.C.Brown, RPF, Divisional Forester,
Tembec Forest Resource Management
Western Canada –BC Division

Copy:

Qiong Su, Timber Supply Analyst (assigned to TFL 14 MP#9)

Tree Farm License 14
Management Plan 9

Analysis Report

Version 2.0

September 10, 2007

Prepared For:

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Acknowledgements

Forsite would like to thank each of the parties that contributed to the Timber Supply analysis in TFL 14. The time and commitment provided by everyone contributed greatly to this document and allowed it to be completed in a timely fashion. We would like to specifically thank government staff for their timely provision of data and thorough review/acceptance process within an expedited timeframe. We thank licensee staff for access to their time and prompt efforts in provided required information.

Government staff who reviewed and provided comments on the Data Package are

- Mike Black (Stewardship Forester) and Gary Dolynchuk (Tenures Supervisor) in the Rocky Mountain Forest District.
- Jeff Stone (Timber Supply Analyst) and Peter Rennie (Landscape Forester) in the Ministry of Forests, Southern Interior Region.
- Tamara J. Brierley (Forest Mensurationist) of the Forest Analysis and Inventory Branch reviewed the natural stand yield curves (VDYP curves).
- Mario DiLucco (Growth & Yield Applications Specialist) reviewed the managed stand yield curve methodology and assumptions (TIPSY curves).
- Qiong Su (Timber Supply Forester) of the Forest Analysis and Inventory Branch reviewed the modeling methodology and reports, while also coordinated the input of the others.

Input on the SIBEC site index adjustment procedures was provided by:

- Shirley Mah (Interpretations Ecologist) of Research Branch/Forest Analysis and Inventory Branch, and
- Dr. Gordon Nigh (Leader, Strategic Analysis) of Research Branch.

Executive Summary

This report documents the Management Plan 9 timber supply analysis completed for Tree Farm License 14 (TFL 14), held by Tembec Industries Inc (Tembec). The purpose of the review is to examine the short- and long-term effects of current forest management practices on the availability of timber for harvesting in the TFL. A review of this type is typically completed every five years in order to capture changes in data, practices, policy, or legislation influencing forest management in the TFL. The previous timber supply analysis for Management Plan 8 (MP8) was completed in 2000 with a final Annual Allowable Cut (AAC) determination on March 28 2001. The Assistant Deputy Chief Forester then signed an AAC review postponement order on July 15, 2005 extending the MP8 AAC determination. This current analysis is working toward a new AAC determination to be in place on November 1, 2007.

The current allowable annual cut (AAC) for the TFL is 160,000 m3/yr and no partitions exist.

The TFL14 MP9 Information Package, a document providing detailed technical information and assumptions regarding current forest management practices, policy and legislation for use in this analysis, was released on April 25, 2007 and then ultimately accepted by Forest Analysis and Inventory Branch on May 8, 2007. The release of this Analysis Report is the next step in the Management Plan process. Its purpose is to summarize the results of the timber supply analysis and provide a focus for public discussion and provide British Columbia's Chief Forester with much of the information that is needed to make an informed AAC determination.

This report initially focuses on a forest management scenario that reflects currently required management practices in TFL 14. This 'Base Case Option' was then used as the basis for sensitivity analyses that assessed how results might be affected by uncertainties in land-base or forest management assumptions. Two other management scenarios were also analyzed:

1. Tembec's Sustainable Forest Management Plan (SFMP): This scenario reflects Tembec's ongoing commitment to implement forest management practices consistent with the Forest Stewardship Council's (FSC) BC standard. TFL 14 is currently certified by FSC and implementation of Tembec's current vision of FSC certification practices is described in their SFMP. This scenario attempts to illustrate the timber supply impacts of these practices.
2. Mountain Pine Beetle (MPB) Epidemic: This scenario is designed to explore the implications of a large outbreak occurring and causing significant mortality in the TFL. The outbreak is assumed to kill 92% of the susceptible pine volume in stands with >40% Pl in the TFL over the next 15 years. This scenario illustrates the large changes in harvest flow associated with an MPB epidemic.

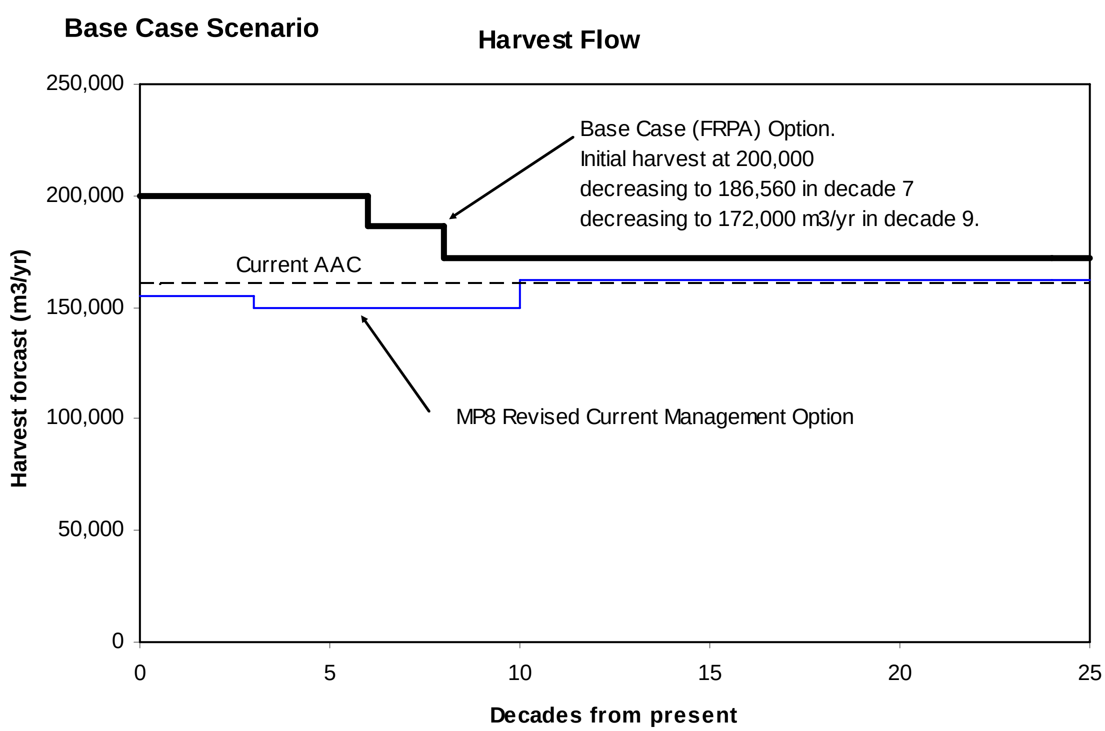
TFL 14 covers approximately 150,000 hectares in the south-eastern corner of British Columbia. The portion of this area considered available for timber production and harvesting under current management practices is called the timber harvesting land base (THLB). The THLB has been estimated through the analysis of spatial map layers and assumptions detailed in the Data Package (Appendix B). The result is a description of the area that is available for timber harvesting in the TFL. Based on these inputs, the THLB is estimated to be 52,822 hectares, a small decrease of 1% (442 ha) since the last timber supply analysis.

Since the last timber supply analysis for TFL 14, many changes effecting forest management have occurred. The major changes are:

- The Kootenay Boundary Higher Level Plan Order (October 26, 2002) gave legal status to Landscape Units, Biodiversity Emphasis Options with specific Old and Mature Retention Targets, Connectivity Corridors, Caribou Management Areas, Scenic Corridors, and Enhanced Resource Development Zones.
- The HLPO established targets for old seral retention while eliminating mature seral targets within TFL 14. The old targets are different from those modeled in the last analysis. Old growth management areas (OGMAs) have been spatially located for all LU-BEC units in the TFL to address the old seral targets in the short to midterm.

- The caribou habitat mapping used in the MP8 was updated by a HLPO variance in 2005- although almost no mapped caribou habitat exists in the TFL.
- SIBEC adjustment values used in MP8 have been updated using new plot data collected in 2002. The SIBEC adjustments have been included in the base case on the premise that the Terrestrial Ecosystem Mapping (TEM) for TFL 14 successfully meets the accuracy assessment currently underway[1].
- MP8 used a genetic worth (GW) of 10% for future managed spruce only. This analysis applied class A seed volume gains to both existing managed stands and future managed stands. Existing managed stands had GW values of 1% for larch and 2% for spruce. Future managed stands had GW's of 14% for Fd, 16% for Lw, 7.1% for Pl and 25.2% for spruce (Sx) applied (2016 projected gains).
- New ecosystem based ungulate winter range guidelines have been adopted.
- Field checks were completed on portions of the operability line for the TFL in 2005 to confirm the merchantability and silviculture viability of these forest stands. A slight reduction in operable area occurred as a result.
- New Visual Quality Objectives (VQO's) were made known by the District Manager in March 2003. The new VQO's are very similar to the previous version in terms of area and management intent.

Results show the base case harvest flow starting at 200,000 m3/yr, declining to 186,560 m3/yr in decade 7, then declining to 172,000 m3/yr in decade 9 where it remains for the rest of the planning horizon. These levels are 25%, 16.6% and 7.5% above the current AAC, respectively.



Sensitivity analysis of the base case revealed that the short-term harvest level is very stable. No sensitivity analyses resulted in a drop in the first decade's harvest level, although numerous factors influenced the duration that the initial harvest level could be maintained. The mid- and long-term harvest levels were sensitive to numerous assumptions as described below.

[1] TEM Accuracy Assessment completed August 2007, and has been recommended for use in Timber Supply Analysis.

Uncertainties that altered the short-term harvest level (decades 2-3) were:

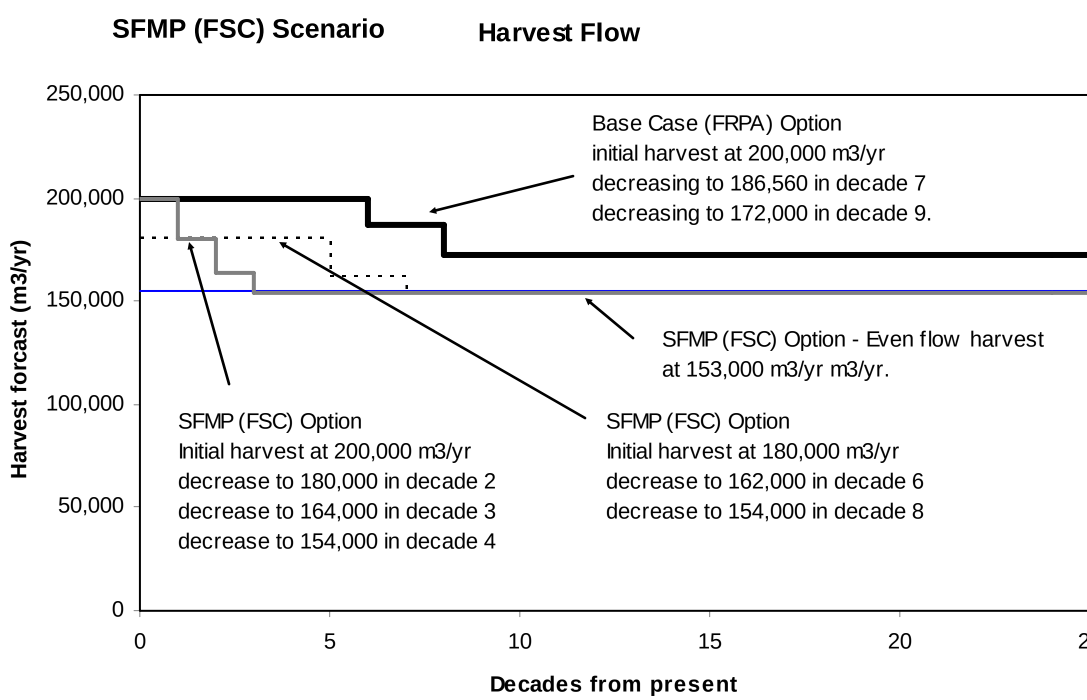
- changes to the size of the timber harvesting land base (-10%),
- changes to existing natural stand yields (-10%), and
- increases in minimum harvest ages (+10 yrs).

Uncertainties that altered the long-term harvest level by at least 3% were:

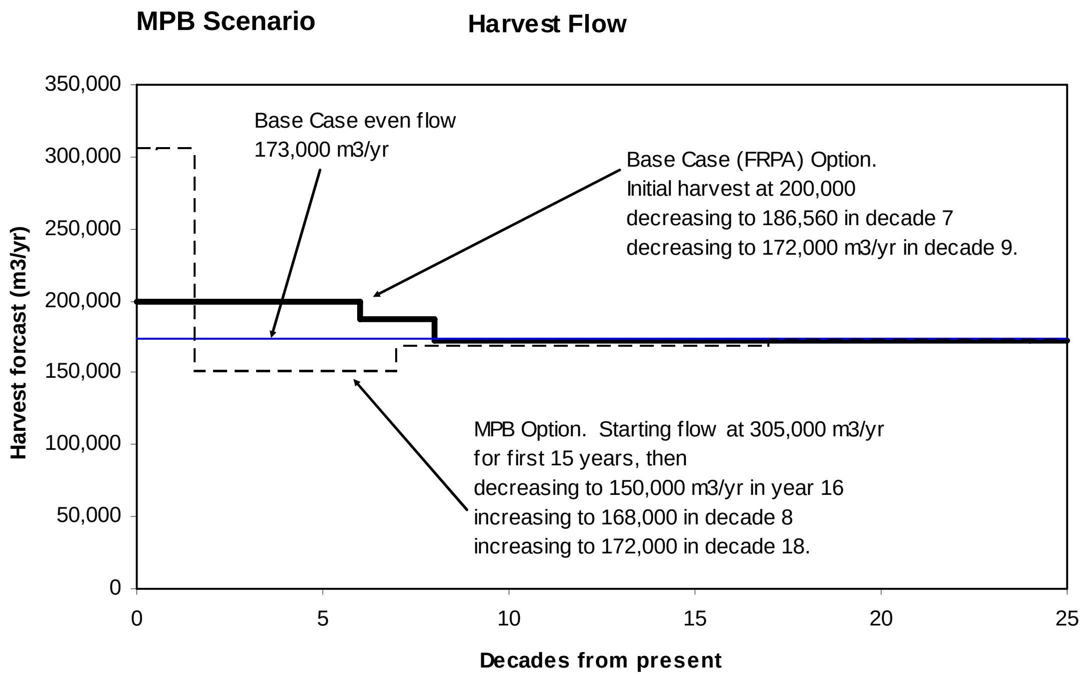
- changes to the size of the timber harvesting land base (±10%),
- changes to future managed stand yields (±10%),
- changes to minimum harvest ages (±10yrs),
- removal of class A seed volume gains,
- removal of SIBEC site index adjustments.

The Tembec SFMP (FSC) scenario resulted in a reduction in timber availability throughout the planning horizon because of increased constraints and a 10.2% reduction in THLB area. Tembec's preferred management option is reflected by their SFMP and is consistent with FSC certification standards. As implementation of the TFL 14 SFMP is quite recent (1-2 yrs), it was not used as the base case however it does represent the current management practices on the TFL. As such, Tembec believes the new AAC for the TFL should be set based on the SFMP scenario results.

Several harvest flows are consistent with Tembec's SFMP, including 1) one decade of harvest at the initial base case level (200k m^3/yr) before stepping down to a long term level 10.5% below that of the base case (154,000 m^3/yr), or 2) a non-declining flow of 153,000 m^3/yr, or 3) the preferred alternative – an initial harvest level of 180,000 stepping down over a longer time interval to a long term level 10.5% below that of the base case.



The MPB scenario shows an increased harvest flow for the first 15 years (305,000 m^3/yr) because it assumes high levels of attacked pine and attempts to capture the majority of the impacted Pl volume while it is still viable for saw log production. The harvest then falls into a midterm trough for 65 years (150,000 m^3/yr) before recovering to a long-term level of 172,000 m^3/yr. If the initial harvest level had been left at the base case level, the midterm trough would have been worse because more THLB stands would have gone unsalvaged and had longer regeneration delays.



Tembec requests an increase in AAC to 180,000 m^3/yr for the next 5-year term. This is a conservative increase relative to the modeled base case forecast of 200,000 m^3/yr, and will provide flexibility to address potentially increasing MPB impacts over the next 5 years. Tembec believes this harvest level and approach also provides long term flexibility to potential or unforeseen impacts of implementing FSC certification and the SFMP management framework.

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1.0 Introduction

Timber supply is the amount of timber available for harvest over time. Assessing timber supply involves consideration of a wide range of physical, biological, social, and economic factors that can influence the acceptable rate of timber harvesting within a management unit. These factors encompass both the timber and non-timber values found in our forests and ensure that timber harvesting objectives are balanced against other social and ecological values such as wildlife, biodiversity, watershed health, recreational opportunities, to name a few.

This document contains a timber supply analysis specific to Tree Farm License 14 (TFL 14) and is an important part of the provincial Management Plan (MP) process for TFL's. The general objective of the analysis process is to examine the short and long-term effects of current forest management practices on the availability of timber for harvesting in the TFL. A review of the timber supply is typically completed once every five years in order to capture changes in data, practices, policy, or legislation influencing forest management in the TFL. The previous analysis (MP 8) was completed in March 2000 with a final Annual Allowable Cut (AAC) determination on March 28, 2001. The Deputy Chief Forester signed an AAC review postponement order on July 15, 2005 extending the MP8 AAC determination. The current analysis process (MP 9) is working toward a new AAC determination to be in place by November 1, 2007.

The Data Package, a document providing detailed technical information and assumptions regarding current forest management practices, policy and legislation for use in this analysis, was released in April 2007[2] and the final version that was accepted by the Forest Analysis and Inventory Branch on May 8, 2007. The release of this Analysis Report is the next step in the timber supply analysis process. Its purpose is to summarize the results of the timber supply analysis and provide a focus for public discussion and provide British Columbia's Chief Forester with much of the information that is needed to make an informed AAC determination. **This report does not define a new AAC – it is intended only to provide insight into the likely future timber supply of TFL 14 and recommend a future course of action to the Chief Forester.** The final harvest level will be determined by the Chief Forester and published along with his rationale in an AAC Determination document.

This report initially focuses on a forest management scenario that reflects currently required management practices in TFL 14. This "Base Case Option" is also the basis for sensitivity analyses that assessed how results might be affected by uncertainties in land-base or forest management assumptions. Two other scenarios were also analyzed:

1. Tembec's Sustainable Forest Management Plan (SFMP): This scenario reflects Tembec's forest management practices consistent with the Forest Stewardship Council's (FSC) BC standard. TFL 14 is currently certified by FSC and forest management practices are described in their Sustainable Forest Management Plan. This scenario illustrates the timber supply impacts of these practices.
2. Mountain Pine Beetle (MPB) Epidemic: This scenario examines the impacts of a severe mountain pine beetle infestation and assumes significant mortality in pine stands over a very short period of time.

Together, these scenarios and sensitivity analyses form a solid foundation for discussions with government and among stakeholders in the determination of an appropriate timber harvesting level.

The following legislation and government policy currently guide forest management within TFL 14:

- Forest Practices Code of BC Act and /or Forest and Range Practices Act
- Kootenay-Boundary Higher Level Plan Order, October 26, 2002.

[2] The Tree Farm License 14 Data Package v1.0 was released in February 17, 2007 and was used for public and First Nations consultation. Version 2.1 was submitted to government for acceptance on April 25, 2007 and accepted by government staff on May 8 2007.

- Kootenay-Boundary Land Use Plan Implementation Strategy, 1997.
- District Manager Direction Letter on Visual Quality Objectives, March 2003.
- Provincial Wildlife Tree Management Policy and Recommendation, 2000.
- Landscape Unit Planning Guide, 2000.
- Identified Wildlife Management Strategy, Feb 1999.

2.0 Description of TFL 14

The Tree Farm License 14 (TFL 14) is within the Southern Interior Forest Region - Rocky Mountain Forest District and is administered out of the district office in Cranbrook. The Rocky Mountain Forest District (RMFD) is situated in the southeastern corner of British Columbia and was created in 2003 by amalgamating the old Invermere and Cranbrook Forest Districts. The TFL covers approximately 150,000 hectares within the RMFD.

TFL 14 is situated between the height of land of the Purcell Mountains, to the west, and the Columbia River valley, also known as the Rocky Mountain Trench, to the east. TFL 14 is bounded by the Invermere TSA to the south and east, the Golden TSA to the north, and the Kootenay Lake TSA to the west. It also borders three protected areas (Glacier National Park, Bugaboo Alpine Recreation Area, and the Columbia Wetlands Wildlife Management Area).

The major streams in the TFL are the Spillimacheen, Bobbie Burns and Vowell Creeks. These generally drain east and then south-east from the Purcell Mountains into the Columbia River, which forms a large portion of the eastern boundary of the TFL. The Columbia River flows north to Golden, through a large, complex wetland ecosystem called the Columbia Wetlands.

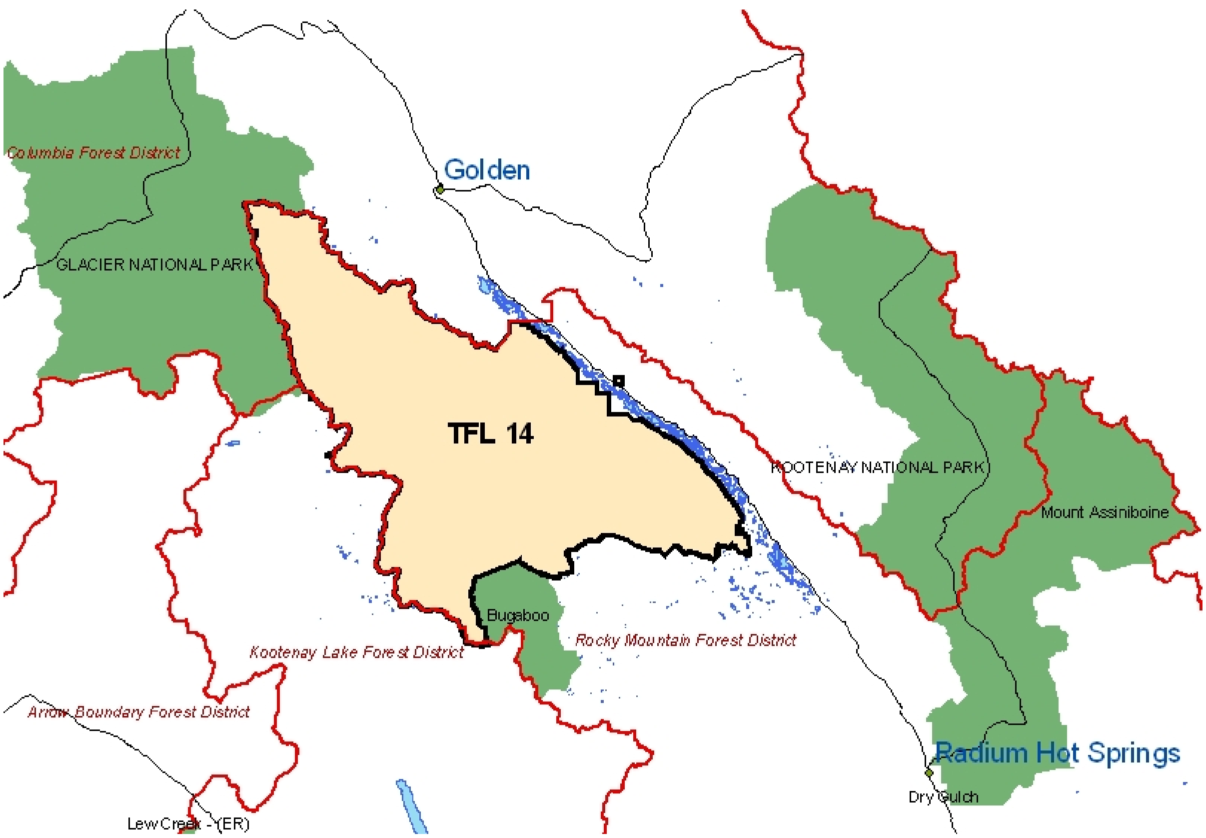


Figure 1. Tree Farm License 14 Overview map

The larger population centers near to the TFL are Golden (pop. 4500), Invermere (pop. 3400) and Radium Hot Springs (pop. 900). Smaller communities include Parsons, where the Tembec TFL operational staff is located, and Edgewater. Tembec's nearest sawmill is located to the south at Canal Flats.

The previous timber supply analysis' (MP8) determination resulted in a decrease of AAC, by 4,000 cubic meters, to the present value of 160,000 cubic meters per year. The AAC has no partitions.

2.1 First Nations

The Tree Farm Licence area is entirely within the traditional territory described by the Ktunaxa/Kinbasket **Treaty** Council's Statement of Intent filed with the BC Treaty Commission in 1993. Initially the Ktunaxa/Kinbasket **Tribal** Council included five member Bands, of which, two band communities (Columbia Lake Band [3] at Windermere and the Shuswap Band at Invermere) are within proximity to the TFL. In 2006, the Shuswap Band ceded their membership with the Ktunaxa, and the Ktunaxa Nation Council was formed to represent the four remaining Ktunaxa communities.

The Shuswap Band members are linguistically and culturally aligned with the Shuswap Nation (Shuswap Nation Tribal Council) however they are now independent of both the KNC and SNTC.

Archeology Overview Assessment mapping has been completed in the TFL and is being used to help protect cultural resources. In addition, a number of Archaeological Impact Assessments have been completed to identify sites of archaeological significance and develop strategies to protect them.

It is recognized that ongoing treaty negotiations with First Nations have the potential to impact timber supply in the TFL, however no settlement has yet been reached. This timber supply analysis does not limit, nor is it intended to limit ongoing Treaty negotiations between the Ktunaxa Kinbasket Treaty Council, British Columbia and Canada.

2.2 The Environment

The TFL contains five biogeoclimatic zones: Interior Cedar Hemlock (ICH), Interior Douglas Fir (IDF), Montane Spruce (MS), Engelmann Spruce-Subalpine Fir (ESSF), and Alpine Tundra (AT). The majority of the TFL's timber harvesting land base occurs in the MSdk, ESSFdk1, IDFdm2, and the ICHmk1. See Figure 2 for a full area breakdown.

[3] Columbia Lake Band has also undergone changes and are now called **Akisq'nuk First Nation**

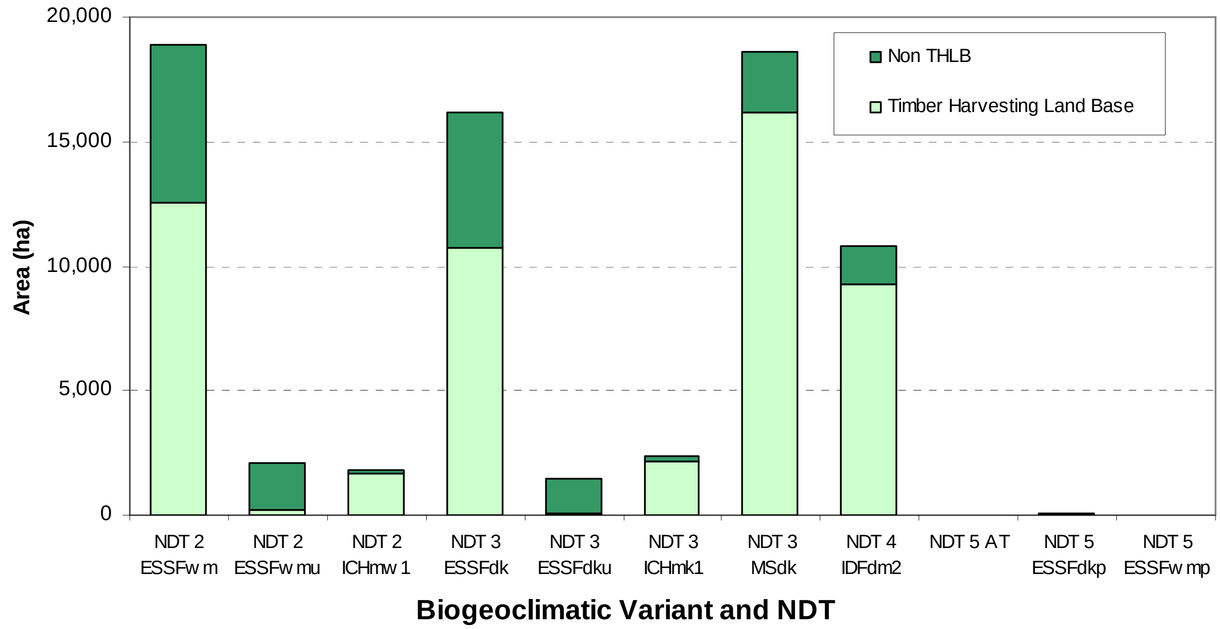


Figure 2. Biogeoclimatic ecocsystem classification area summary

TFL 14 is within the East Kootenay region, which is unique in North America due to its density and diversity of wild ungulate and large predator populations. Wildlife resources are abundant throughout the Licence and adjacent area. The broad variety of habitat types support populations of elk, mule deer, white-tailed deer, moose, black and grizzly bear, mountain goat, as well as numerous small mammals, birds and fish. The Columbia Wetlands is an important habitat for nesting and migration of numerous bird species. Approximately one hundred and four (104) species of birds are known to use the TFL area.

There are wildlife species in the TFL that are at risk due to declining populations across the province. There are 10 red-listed (Endangered or Threatened) and 16 blue-listed (Species of Concern) species that occur or have the potential to occur in TFL 14 (Table 1).

Table 1. Red & blue listed species that occur or have the potential to occur in TFL 14

Red-listed (Endangered or Threatened)		**Blue-listed (Species of Concern)**	
Scientific Name	English Name	Scientific Name	English Name
Aechmophorus occidentalis	Western Grebe	*Aeronautes saxatalis*	White-throated Swift
Buteo swainsoni	Swainson's Hawk	*Ardea herodias herodias*	Great Blue heron, *herodias* subspecies
Falco mexicanus	Prairie Falcon	*Asio flammeus*	Short-eared Owl
Falco peregrinus anatum	Peregrine Falcon, anatum subspecies	*Botaurus lentiginosus*	American Bittern
Lycaena dione	Dione Copper	*Buteo platypterus*	Broadwinged Hawk
Martes pennanti	Fisher	*Chrysemys picta*	Painted Turtle
Rana pipiens	Northern Leopard Frog	*Clethrionomys gapperi galei*	Southern Red-backed Vole, galei subspecies
Rangifer tarandus pop. 1	Caribou (southern population)	*Corynorhinus townsendii*	Townsend's Big-eared Bat
Sphyrapicus thyroideus nataliae	Williamson's sapsucker, nataliae subspecies	*Grus canadensis*	Sandhill Crane
Tamias ruficaudus ruficaudus	Red-tailed Chipmunk, ruficaudus subspecies	*Gulo gulo luscus*	Wolverine, *luscus* subspecies
		Myotis septentrionalis	Northern Long-eared Myotis
		Oncorhynchus clarki lewisi	Cutthroat Trout, *lewisi* subspecies
		Otus flammeolus	Flammulated Owl
		Salvelinus confluentus	Bull Trout
		Tamias minimus oreocetes	Least Chipmunk, oreocetes subspecies
		Ursus arctos	Grizzly Bear

Source: Conservation Data Center database query, March 2004, in addition to local input / knowledge.

The TFL 14 license area includes the entire watershed of the Spillimacheen River and its tributaries, Bobbie Burns and Vowell creeks. Although water is not drawn directly for local use, the watershed has significant downstream value as part of the Columbia River catchment area. BC Hydro operates a Run-of-the-River hydro-electric facility on the lower Spillimacheen River. Additionally there are several small domestic watersheds predominantly in the eastern portion of the TFL, which supply water to one or two dwellings.

Most of the streams flowing through TFL 14 are glacial in origin and have relatively low biological productivity. Only Driftwood Creek and the small tributaries of the Columbia River along the eastern slope are non-glacial in origin and these waters are generally warmer, less turbid and more productive, depending on gradients.

Fish are found in the main stems of the major rivers as well as many of the smaller tributaries provided stream gradients are favourable and barriers are not present. A notable fish-limiting barrier (10 meter waterfall) is located on the lower Bobbie Burns River approximately 3 km upstream of its confluence with the Spillimacheen River. Many of the lakes scattered throughout the TFL are stocked with game fish and support a popular sport fishery. Fish species found in the TFL include Eastern brook trout, rainbow trout, west-slope cutthroat trout, bull trout, mountain whitefish, pygmy whitefish, sculpins and suckers.

2.3 Integrated Resource Management Considerations

Integrated resource management is a basic premise for the practice of forestry in TFL 14. Timber harvesting is planned and managed in such a way that allows a wide range of other values to co-exist on the land base. The manner in which each value is considered is dictated by federal or provincial legislation or BC government policy and described by Tembec's Sustainable Forest Management Plan. Examples of these are the federal Fisheries Act, the Forest Practices Code, the Forest and Range Practices Act, the Kootenay Boundary Higher Level Plan Order, the Kootenay Boundary Land Use Plan Implementation Strategy, and the Rocky Mountain Forest District Policy on Scenic Area management.

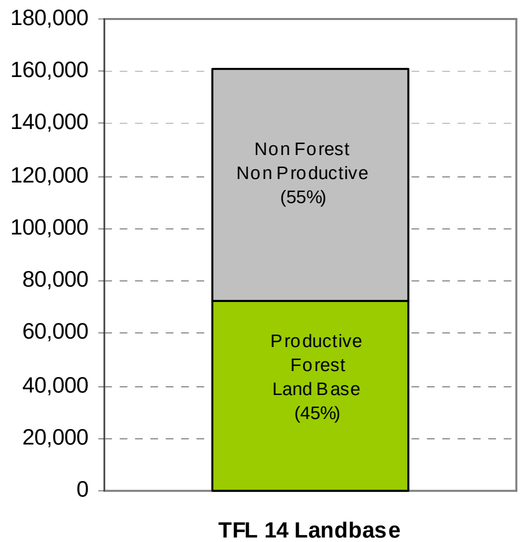
These documents address the legislated requirements for a wide range of non-timber issues. The most significant issues influencing forest management in TFL 14 are:

- Biodiversity
- Riparian / Fish Habitat
- Viewscapes in Scenic Corridors
- Domestic Watersheds
- Ungulate Winter Range
- Grizzly Bear
- Forest Recreation

The areas affected by each of these non-timber resource values and the specific forest management practices required to address them are discussed in Section 3.3.1.

2.4 Current Attributes of TFL 14

This section of the document describes the current state of the TFL and provides descriptions and statistics useful for understanding the timber supply analyses presented later in the document. The Timber Harvesting Land Base (THLB) and the productive land base (equivalent to the Crown Forested Land Base (CFLB) in timber supply reviews in Timber Supply Areas) are referenced in this section and defined in detail in Section 3.1.



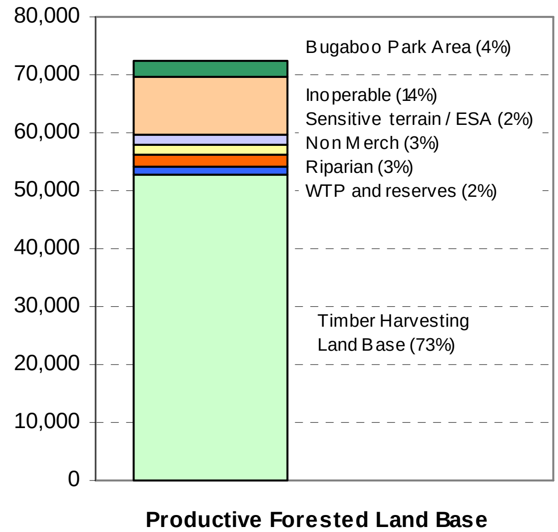


Figure 3. TFL land base breakdown

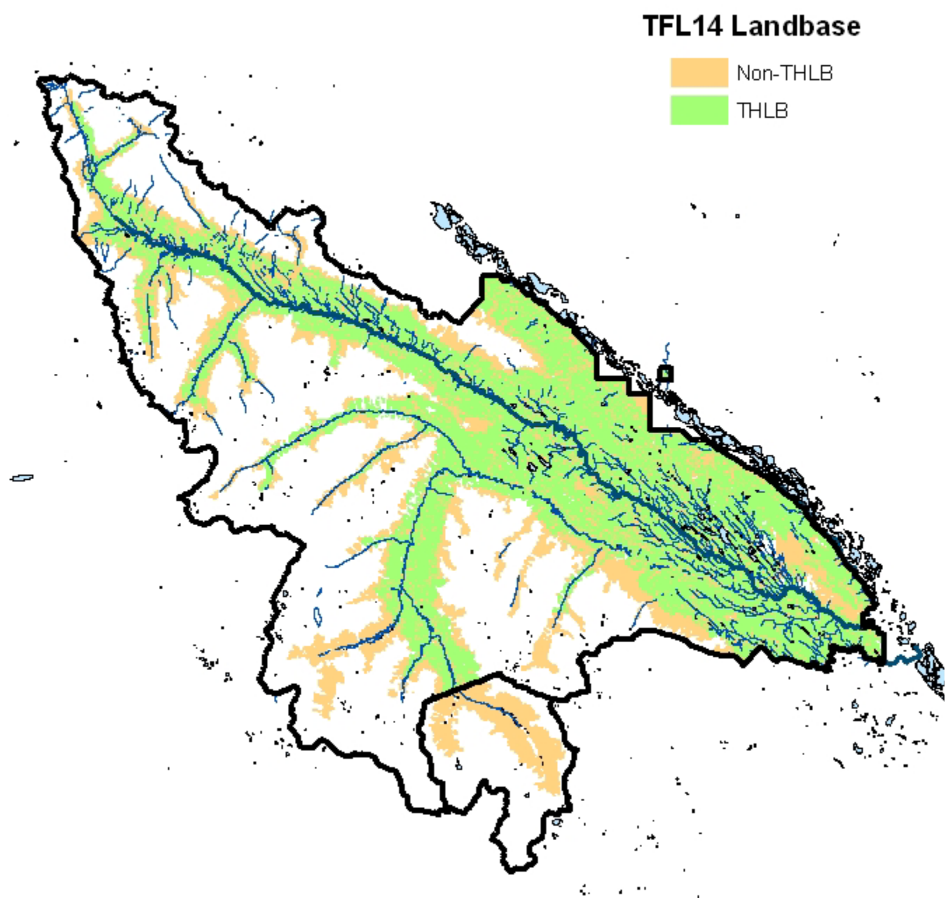


Figure 4. TFL 14 land base classification map

Approximately 45% of the total area of the TFL is considered productive forest land. The remaining 55% is considered non productive (i.e. rock, ice, alpine, etc). Within the TFL's productive land base, 73% is considered available for timber harvesting (33% of the total TFL area). See Figure 3. A portion of the Bugaboo park is within LU I34 and is therefore included in this analysis (2,662 ha of productive forest) for purposes of satisfying landscape level biodiversity requirements only, and is otherwise not part of the TFL, and does not contribute to the THLB.

A coarse map illustrating the locations of productive forest and THLB in the TFL are shown in Figure 4.

The forests of the TFL are dominated by lodgepole pine (43%), Douglas-fir, Engelmann spruce, subalpine fir or balsam (Figure 5). Other tree species that occur less commonly in the TFL include ponderosa pine, western hemlock, western red cedar, whitebark pine, cottonwood, birch and aspen. Approximately 44% of the THLB is older than the minimum harvest ages defined in this document.

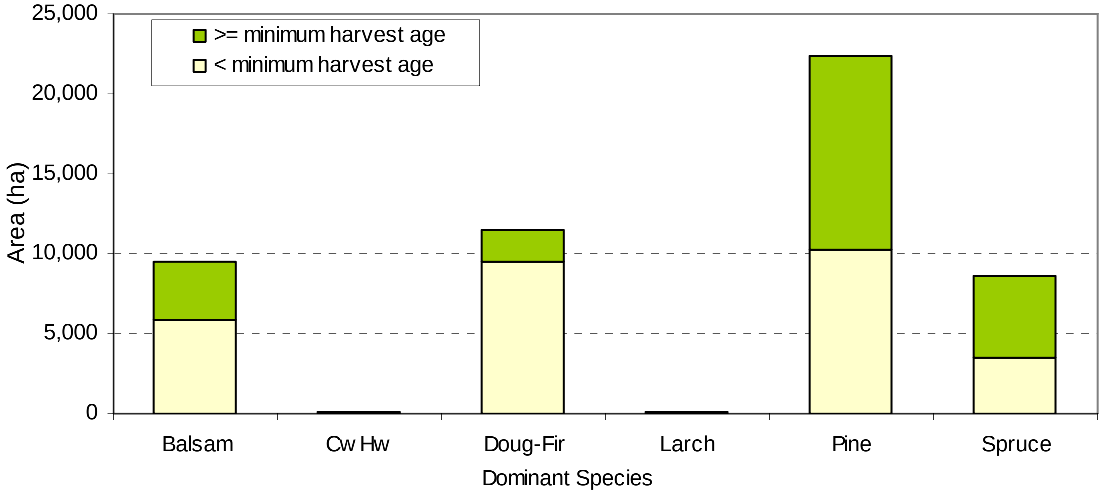


Figure 5. THLB area by dominant tree species relative to minimum harvest age

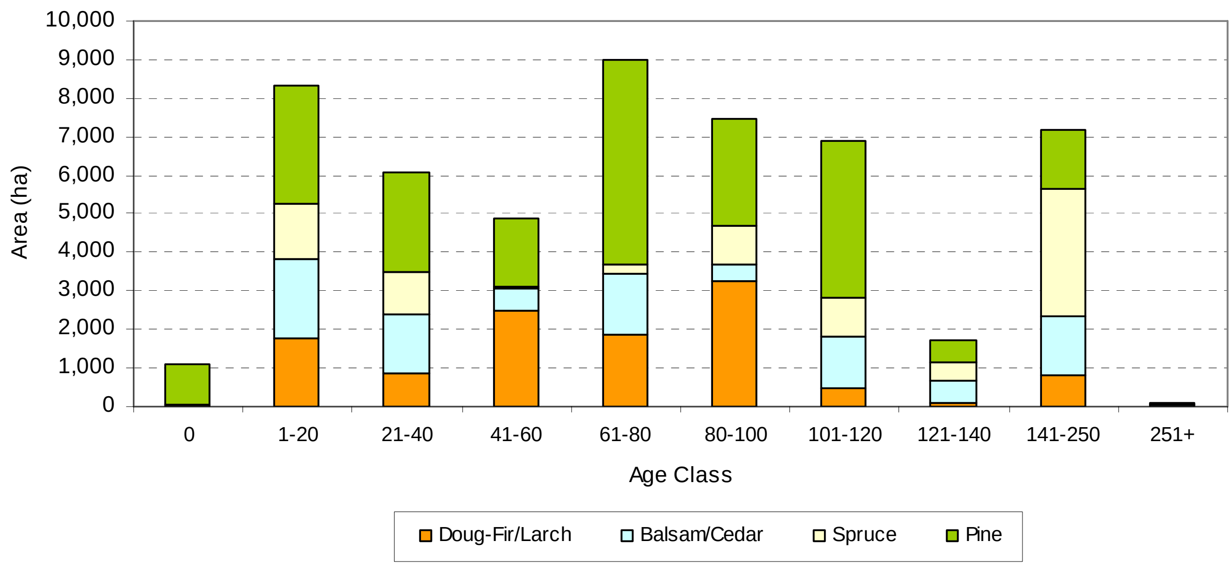


Figure 6. THLB area by age class and leading species

As indicated by Figure 6, the TFL has a significant amount of mature lodgepole pine leading stands. Classes are common MoF age classes (Age Class=1 represents stands with age 1-20, Age Class=2 represents stands with age 21-40, etc. Age Class=0 represents stands with no age, or NSR.) There are approximately 60,000 ha of lodgepole pine over 60 years old on the THLB. This represents 63% of the area of pine stands within the THLB; or 27% of the total area of THLB in the TFL. This pine is considered susceptible to attack by mountain pine beetle.

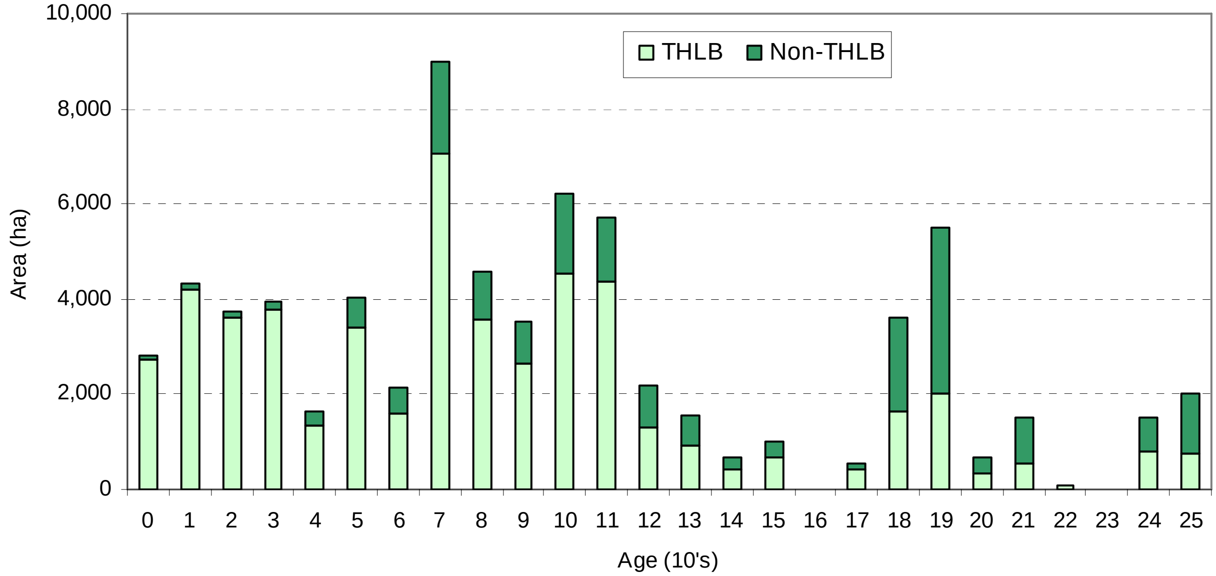


Figure 7 . Productive forest area age classes

The age class structure over the entire productive land base is shown in Figure 7. Class widths are 10 years (Age10=0 represents stands with age of 1-5, Age10=1 represents stands with age 6-10, etc.) Area is distributed over a wide range of age classes, with most area falling within 0-130 and 180-200 years old, with some spikes in the 7, 10, 11 and 19 year age classes.   The THLB has a higher proportion of younger age classes than the non-THLB because non-THLB has not experienced much disturbance. It escaped the major fires that burned in 1985 and 2003 in the adjacent Invermere TSA.

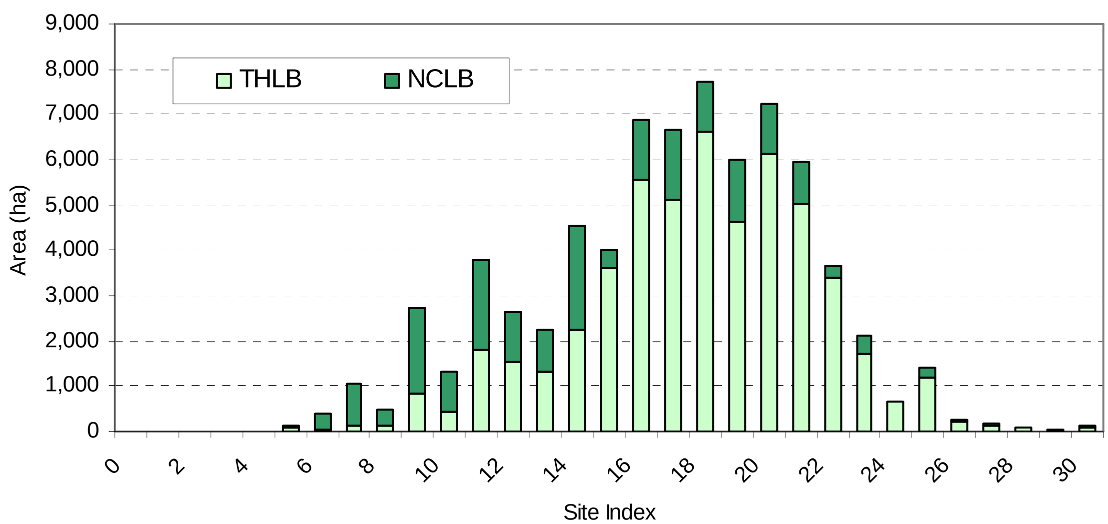


Figure 8 . Site Productivity by Landbase Type (Existing Inventory Estimates)

A summary of area by site productivity (adjusted inventory site index) is shown in Figure 8. It indicates a high portion of the THLB area is within the higher site indexes. Consistent with the low site index net down criteria listed in Appendix B, little THLB area has a site index less than 10. The areas with site index <10 are pine types or previously logged areas. The average site index in the THLB is 17.5m and the average site index in the forested non-THLB is 14.3m.

The average site index for all future managed stands on the THLB was calculated as 19.3m using the SIBEC site index adjustment process (see Appendix B – Section 8.1.2.1). This is 1.8m or 10.3% higher than the inventory estimate after adjustments made due to the enhanced inventory audit adjustment project (see Appendix B – Section 5.1).

3.0 Timber Supply Analysis Methods

A large amount of information is required to complete a timber supply analysis. Information must be obtained in four broad categories: land base, forest inventory, management practices, and forest dynamics. This information is then translated into a model formulation that can explore sustainable rates of harvest in the context of integrated resource management. This section summarizes the data inputs, assumptions, and modeling procedures contained in Appendix B.

3.1 Land Base Definition

The *productive forested land base* is the area of forest that contributes to landscape level objectives for biodiversity and resource management. The *productive forest land base* excludes non-forest and non-productive areas. For the purpose of this analysis, it includes the portion of Bugaboo Park falling within landscape unit I34.

The *timber harvesting land base* (THLB) is the portion of the management unit where timber is harvested. The THLB is a subset of the *crown forested land base* and excludes areas that are inoperable or uneconomic for timber harvesting, or are otherwise off-limits to timber harvesting. Table 2 summarizes the land base for the TFL.

Table 2. Crown forested land base area netdown summary

	MP 8 Area (ha) Total	MP 9 Area (ha) Total	MP9 % of Total	MP9 % of Productive
Total crown forested land base	150,431	161,210	100.0%	
Reductions (*)				
Water	1,411	1,483	0.9%	
Non-forest, non-productive forest	74,631	85,396	53.0%	
Non-commercial brush	168	230	0.1%	
Roads, trails, landings	----	1724	1.1%	
Total productive land base (**)	**74,221**	**72,378**	44.9%	100.0%
Reductions (*)				0.0%
Bugaboo Park - LU I34 (***)	---	2,662	1.7%	3.7%
Inoperable	13,571	9,859	6.1%	13.6%
Unstable terrain	1,087	1,069	0.7%	1.5%
Environmentally sensitive	511	413	0.3%	0.6%
Non-merchantable	3,756	1,913	1.2%	2.6%
Riparian Reserves	1,482	1,843	1.1%	2.5%
Wild life tree patches / block reserves	496	1,764	1.1%	2.4%
PSP reserves	--	33	0.0%	0.0%
Total Reductions	21,084	19,556		
Current Timber Harvesting Land Base (THLB)	**53,304**	**52,822**	32.8%	73.0%
Future WTPs	--	581	0.4%	0.8%
Future roads and trails	647	998	0.6%	1.4%
Net long-term Timber Harvesting Land Base	**52,675**	**51,253**	31.8%	70.8%

All totals are subject to rounding.

* Effective net-down reductions are shown based on the % of Productive Column and represent the area that was actually removed as a result of a given factor. Removals are applied in their hierarchical order shown above, thus areas removed lower on the list do not contain areas that overlap with factors that occur higher on the list.

** Productive forest denotes the forest area that contributes to forest management objectives, such as landscape-level biodiversity, wildlife habitat and visual quality. It does not include alpine forest or non-productive areas with trees species.

*** Current policy allows for the Bugaboo Park to contribute to the biodiversity modeling and therefore some of the Bugaboo Park area has been added for biodiversity modeling on the productive land base. The park area is not included in the THLB .

Exact comparisons with MP 8 are not possible because different net downs sequences were used. However, several key differences in productive forest, current THLB and long term THLB are discussed below:

- The gross TFL area reported in Table 2 is larger than reported in MP8 as MP8 chose to not include the Bugaboo Park area in the netdown table. It is reported in this analysis as current policy allows the park area to contribute to the productive forest landbase, and to contribute to old seral requirements.
- The productive forest in this analysis is 1843 ha less (1.02% difference).
- The current THLB in this analysis is within 1% of the MP 8 analysis. Current THLB is the landbase after all currently existing netdowns.
- The final estimate of the future, or long-term THLB is 2.8 % less than that used in MP8 (1429 ha). Future THLB is the landbase after all existing and future reductions (i.e. future roads/trails/landings and WTPs). For the most part, the reduction is due to an increase in the estimate of future RTL's (647 ha to 998 ha) as well as the inclusion of future WTP's (581ha) that were not shown in the MP8 net down.

3.2 Forest Inventory Data

The forest cover inventory is a key component of the analyses. The forest cover for TFL 14 was created in 1986, and regular updates of the inventory have been completed since then. The inventory currently exists in FIP-rollover status. The forest inventory attributes (age, height, volume etc) have been re-projected to December 2006 and updated to account for harvesting and fire disturbances to September 2006 (+/-).

The inventory (height, age, volume) has been adjusted based on an enhanced inventory audit project[4] as described in Appendix B – Section 6.0. Adjustments were only applied to stands over 40 years old.

Site index estimates for managed stands have also been updated using SIBEC correlations (see Appendix B – Section 8.1.2.1)

3.3 Management Practices

Management practice assumptions can be grouped into three broad categories: Integrated Resource Management, Silviculture, and Harvesting.

3.3.1 Integrated Resource Management

Forest cover requirements are applied within the timber supply model to accommodate the timber and non-timber resource objectives. These requirements maintain appropriate levels of specific forest types needed to satisfy the objectives for wildlife habitat, visual quality, biological diversity, etc. Forest cover requirements are used by the model to limit harvesting within the THLB.

The type of objectives modeled and the size of the land base affected by each objective are summarized in Figure 9 and Table 3. The specific forest cover requirements modeled for each objective are provided in Appendix B – Section 10.0.

[4] This project was very similar to a VRI phase 2 adjustment project but was completed prior to any published VRI phase 2 methodology.

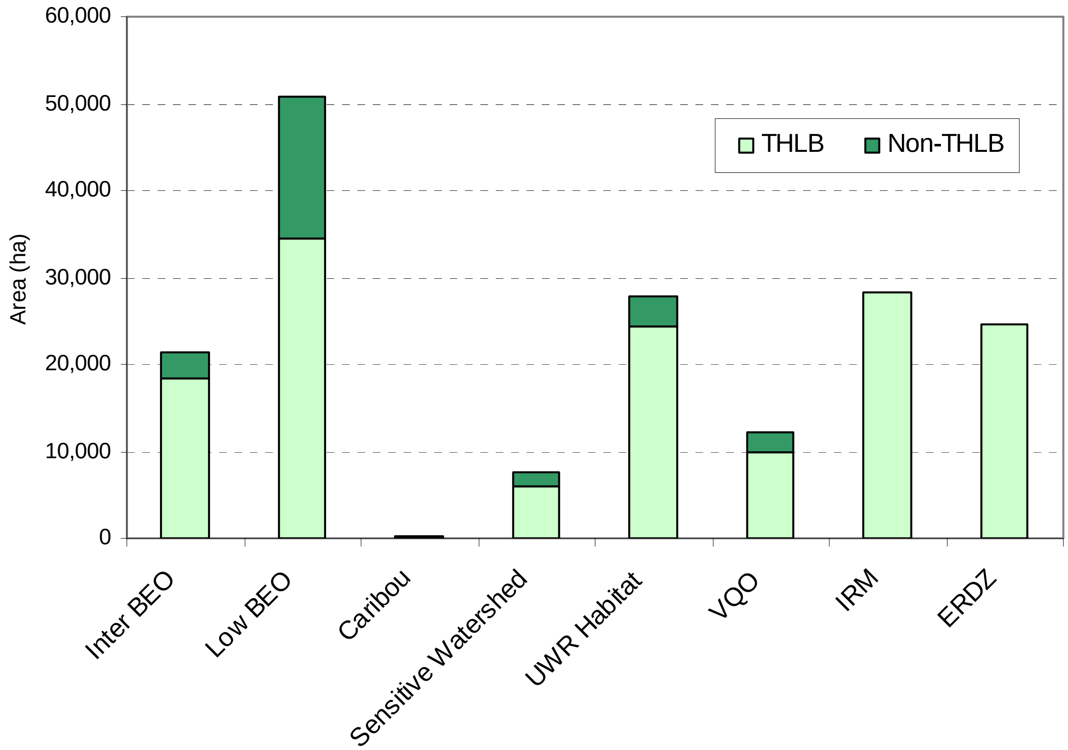


Figure 9 . Integrated Resource Values: Area Summary by Land Base Type

A summary of the areas over which various non-timber resource values occur is provided in Table 3. These areas cannot be summed to determine the total area affected because many of the values overlap.

Table 3. Integrated Resource Values: Area Summary by Land Base Type

Name	CFLB (ha)	THLB	Non THLB	% of Total CFLB	% of Total THLB	Description
High Biodiversity BEO	0	0	0	0.0	0.0	Biodiversity Emphasis Options define the amount of old and/or mature that must be retained in each LU/BEC variant combination
Intermediate BEO	21,473	18,398	3,075	4.2	34.8	
Low BEO	50,903	34,422	16,481	22.8	65.2	
Caribou	206	2	204	0.3	0.0	Caribou habitat areas in base case.
Domestic Watersheds	7,511	5,914	1,597	10.4	11.2	Domestic and sensitive (no CWS)
UWR Habitat	27,737	24,470	3,267	38.2	46.3	Ungulate winter range
Visual Quality Objectives	12,177	9,832	2,345	16.8	18.6	Visual Quality Objectives
Preservation	0	0	0	0	0	
Retention	0	0	0	0	0	
Partial Retention	9592	8035	1557	13.2	15.2	
Modification	2585	1797	788	3.6	3.4	
Integrated Resource Management (IRM)	28,189	28,189	0	38.9	53.4	All THLB not within the ERDZ.
Enhanced Resource Development Zone (ERDZ)	24,633	24,633	0	34.0	46.6	Defined spatially by HLPO – based on older THLB definition.

3.3.2 Silviculture

Historical and current silvicultural practices in the TFL have been included in the model. These include:

1. Silvicultural systems (clearcut versus partial cutting systems),
2. Regeneration assumptions such as establishment method, species distribution, and establishment density,
3. Regeneration delay (time between harvesting and when the site becomes stocked with crop trees), and
4. Use of select seed.

Most harvesting was modeled as clearcut with reserves. A portion of the land base is being managed under partial cutting regimes.

3.3.3 Timber Harvesting

Assumptions around timber harvesting practices have also been included in the model and include:

- Minimum harvest ages that ensure a viable log is produced and long term volume production is maximized. (Appendix B – Section 10.2.1)
- Minimum economic criteria for log size and stand volumes (Appendix B – Section 6.8).
- Land base definition criteria (unstable slopes, inoperable areas, low sites, etc.). These assumptions are outlined in detail in Appendix B- Section 6.0.
- Harvest priorities across the land base. Priorities were established based on: analysis units (pine-leading and partial cutting), cable harvest blocks (capped at 15% of the harvest for the first decade, and 20% for subsequent decades), 20 Year Plan blocks, and stand age (oldest first) were all used to prioritize the stands chosen for harvest. The pine-leading choice was based on the objective of managing mountain pine beetle (MPB) issues. Partial cutting stands, which undergo multiple stand entries, were prioritized to keep the stand entries on schedule (i.e. 30 years apart). The cable harvesting and 20 Year Plan priorities were included to ensure feasibility of the harvest schedule for the 20 Year Plan. (Appendix B – Section 8.8.6, Table 4.)

Table 4 Twenty year plan harvesting system harvest profile (by 5 year period).

Harvest system	Total Chance Plan Profile	Period 1	Period 2	Period 3	Period 4
Cable	20.7%	15	15	20	21
Conventional	75.6%	85	84	70	75
Helicopter	2.0%	0	0	1	1
Longline	1.7%	0	1	9	3
Totals	100%	100%	100%	100%	100%

3.4 Forest Dynamics

Forest dynamics refers to the changing state of the forest through time. Changes occur as the forest ages, or when natural or human caused disturbances occur. The way in which the model addresses these issues is described below.

3.4.1 Growth and Yield Projections

Timber growth and yield refers to the prediction of the growth and development of forest stands over time, and of particular interest, the volume and size of trees that would occur at the time of harvest. For modeling purposes, stands of similar characteristics, growth rates, and management are grouped together into Analysis Units (AUs). Analysis Units are described in Appendix B – Section 7.0.

Each analysis unit is associated with its own yield curve, which is a prediction of the gross and net volume per hectare at various stand ages. Minimum harvest ages are determined by comparing the yield curves to merchantability criteria, such as the minimum volume per hectare, or minimum stand diameter that must be reached before the stand will be eligible for harvest.

Two growth and yield models were used to estimate the yield curves used in the TFL 14 analysis. The Variable Density Yield Prediction (BatchVDYP 6.6d) model, supported by the Forest Analysis and Inventory Branch, was used for estimating timber volumes for all existing natural stands. The Table Interpolation Program for Stand Yields (BatchTIPSY 3.2k), developed by the Research Branch was used to estimate timber volumes for both existing and future managed stands. Existing managed stands are those that are currently under 30 years of age, or older stands that have a history of planting and/or density control practices. Future managed stands are stands that will regenerate after they are harvested by the model during the planning horizon.

Based on timber volume estimates, the current timber inventory or growing stock on the timber harvesting land base is approximately 9.6 million cubic meters. Approximately 76% of this growing stock (7.3 million m^3) is currently merchantable (i.e. in stands older than their minimum harvest age).

3.4.2 Disturbances

The timber supply model relies upon three mechanisms to disturb stands. Harvesting is the most common method of disturbance in the model (either clearcut or partial cut) and occurs only within the timber harvesting land base. In order to recognize that natural disturbances also occur on the land base, the following are also modeled:

<u>Natural disturbances in the timber harvesting land base</u>:

Each year timber volume is damaged or killed on the THLB and not salvaged or accounted for by other factors. These losses are due to a number of factors that cause tree mortality, including insects (mountain pine beetle included), disease, blowdown, snowpress, wildfires, etc. In order to address losses from catastrophic natural events in the THLB, the model ‘harvests’ an extra volume of timber in each time period that is not counted toward harvest levels. Endemic pest losses are dealt with through factors applied in the growth and yield models. The annual unsalvaged loss applied in this analysis was 2,947 m^3/yr. See Appendix B- Section 9.0 for more detail.

Unsalvaged loss estimates address only the loss of merchantable volume from mature stands. The losses associated with immature stands also impact the rate at which timber becomes available in the TFL but little data is available to estimate the extent or impact of these losses. These disturbances are not modeled, but are captured during periodic inventory updates and are therefore reflected in subsequent timber supply analyses.

<u>Natural disturbances outside the timber harvesting land base:</u>

Because stands outside of the THLB contribute toward several forest cover objectives (i.e. landscape level biodiversity), it is important that the age class distributions in these stands are also modeled in a manner that is consistent with natural processes. By simulating natural disturbance in these stands, a more natural age class distribution can be maintained in the model and a realistic contribution toward seral goals ensured. An area of 47 ha is disturbed each year in the analysis to prevent age classes in the non-THLB from becoming unrealistically old during modeling. (Appendix B – Section 10.1.5.2). This disturbance causes the non-THLB stands to be turned over, on average, every 270 years.

3.5 Timber Supply Analysis Methods

Forest Planning Studio (FPS) version 6.0.2.0 was used to complete the timber supply analysis. FPS was developed by Dr. John Nelson at the University of British Columbia (UBC) and is a spatially explicit forest estate simulation model. All events in the model are directly linked to stand level polygons or harvest units and thus allow tracking of individual stand attributes and spatial relationships through time. Each polygon belongs to a specific stand group (Analysis Unit) and has attributes such as age, harvest system, and land base status (THLB or Non-THLB). Results are typically aggregated for reporting at higher levels (i.e. harvest flow for the entire unit).

A wide range of constraints can be modeled on the land base: harvest exclusion, spatial adjacency/maximum cutblock size, maximum disturbance/young seral, minimum mature/old seral, and equivalent clearcut area (ECA) limits. Constraints are applied to groups of polygons (cliques) and harvest is restricted if a constraint is not satisfied. A single polygon can belong to many overlapping cliques and each of them must be satisfied in order to allow harvest of the polygon. Where a mature or old cover constraint is not met, harvesting may still occur if there are any eligible stands remaining after the oldest stands are reserved to meet the constraint.

Harvest is implemented using a set of priorities to queue stands for harvest. In each period, the model harvests the highest priority eligible stands until it reaches the harvest target or exhausts the list of opportunities. Harvest periods can be set at single years, multiple year periods or a combination of these. Where periods are used, the midpoint of the period is typically used as the point where harvest opportunity is evaluated because it is a good balance between the start of the period (pessimistic) and the end of the period (optimistic).

The purpose of this analysis is to examine both the short- and long-term timber harvesting opportunities in TFL 14, in light of current forest management practices. Modeling assists the timber supply analyst in assessing the harvest flows associated with various scenarios. Management scenarios are groups of assumptions that define the extent of the timber harvesting land base, timber volumes, and the management regimes. The dominant scenario in this report is the Base Case Option, or current management scenario. Modeling was completed for a minimum of 350 years for each scenario to confirm that the harvest and growing stock levels remain stable, but only the first 250 years are presented in the report.

The results of the analysis are an important part of the annual allowable cut determination process and aim to document future harvest flows that will not restrict future options in the TFL. The results presented here do not define a new AAC – they are intended only to provide insight into the likely future timber supply of Tree Farm License 14. The final harvest level decision will be made by the Chief Forester and published along with his rationale in an AAC Determination document.

3.6 Major Changes from Previous Timber Supply Analysis (MP8)

Changes have occurred in both the input data and management assumptions since the last timber supply analysis for the TFL (Management Plan 8 - MP 8). The major changes or differences from the last analysis are:

Landbase definition changes:

- Total Landbase. The difference in total landbase for the legal TFL area (ignoring Bugaboo area) is 121 ha (150,431ha in MP8, and 150,310 ha in this analysis). The MP 8 netdown table did not include the Bugaboo Park area in its totals, although that area was included in the MP8 analysis, as it was in this analysis.
- Bugaboo Park boundary. The exact location of the boundary delineating the Bugaboo Park extension and TFL 14 has been in question since the last timber supply analysis (2000). The park boundary used in this analysis correlates well with at least one government-estimated location (see Appendix B. Section 5.2. Ownership). The boundary used in this analysis is the one that has been consistently used by Tembec for the past five to six years. Any differences should be so small as to have little to no affect on the timber supply.
- Operability map. The last major change to the operability mapping was made at the time of the MP8 analysis. This was the consolidation of two maps: an “economic operability” and a “physical operability” map, into one operability map. In 2005 field checks were made to confirm the operable status and a few minor reductions were made to the operability map. The large difference of 3,712 ha (comprising 5% of the productive forest) between the operability netdown applied in this analysis (9,859 ha) and the last (13,571 ha) is due to the hierarchical order of their application. The final THLB numbers for both analyses are very similar, as the other netdowns further down the sequence tend to cancel out this difference. Unfortunately, the difference in operability at this point in the netdown sequence makes direct comparisons to the other categories further down in the table largely unrelated..
- Definition of non-merch stands. Most of the definitions of non-merchantable stands were adopted directly from the MP8 analysis. Minor changes were made in this analysis that made the definitions more stringent, such as increasing the minimum volume for pine stands, and using net-coniferous only versus whole stand volume in the low volume netdown. However, at the same point in the netdown sequence in this analysis the non-merchantable netdown was 1843 less (1913 this analysis, 3,756 last analysis). This is likely due to the larger reductions made higher up in the netdown hierarchy used in this analysis.
- Riparian netdowns. New fish stream inventories were conducted in 2001 following the last analysis. Riparian reserves and the effective area of reserve zones for all riparian classes were spatially removed. This resulted in an additional area of 361 ha of riparian netdown in this analysis (1,843 ha) versus the last analysis (1,482 ha).
- Future WTPs. Future wildlife tree patch reserves were estimated in MP8 using a total chance plan mapping exercise. Future WTP reductions in this analysis (581 ha) were based on the WTP strategy developed for the TFL’s approved Forest Stewardship Plan (FSP). The difference in WTP reductions is 1.6% (2.7% MP8 and 1.1% in this analysis.) These WTP reductions were applied in both analyses by reducing the future managed stand yield curves.
- Future roads trails and landings. In MP8 the future reductions were estimated based on a total chance plan mapping exercise. In this analysis the future RTL reduction was based on extrapolating current road densities. The difference in estimates is 351 ha (647 in MP8 and 998 ha in this analysis). In both analyses these reductions were applied by reducing the future yield curves.

The net result after all reductions are applied is a reduction in the current THLB of 422 ha (53,304 in MP8 and 52,822 in this analysis), and a reduction in the future THLB of 1,404 ha (52,657 in MP8 and 51,253 in this analysis).

Changes related to yield estimates:

- SIBEC site index adjustments. Site index values were adjusted in both analyses using SIBEC relationships for all site series with valid SI estimates. The MP 8 analysis used SIBEC adjusted values from a smaller dataset than MP9. The MP8 estimates were based on the results of a TFL SIBEC project completed in 1999. The SIBEC data for this analysis came from a pool of Provincial SIBEC estimates combined with the results of a TFL14 SIBEC project completed in 2002.

- Analysis Units. The analysis units used in MP 8 were the starting point for this analysis. The clearcut analysis units' species definitions (Fd, Lw, etc) and slope class breaks (0-45%, 45%+) were retained. Changes were made to the site index breaks for some of the analysis units to form groups with more equal areas, and some of the MP8 analysis units were pooled together because they comprised such small areas. The result is that there isn't a 1:1 relationship between MP8 AUs with MP9 AUs.
- Partial cut analysis units. In this analysis all stands within the partial retention VQOs were assigned to partial cut analysis units. In MP8 the non-pine leading stands within the partial retention VQO polygons were assigned to clearcut analysis units, and the remaining to partial cut analysis units. Along with the new VQO inventory, this causes some differences. The area under partial retention (PR) VQO class in this analysis is 5,444 ha with 3,865 ha of that being non-pine-leading stands. The area in MP8 was 5,125 ha of non-pine leading stands.
- TIPSY and PROGNOSIS curves. The MP8 analysis used PROGNOSIS to develop the partial cut yield tables. All the managed stand yield curves in this analysis were developed using TIPSY.
- Genetic gains. The MP8 analysis assumed a genetic worth (GW) of 10% for spruce only, for future managed stands only. No other genetic gains were applied. This analysis applied genetic gains to both existing managed stands and future managed stands. Existing managed stands had GW values of 1% for larch and 2% for spruce. Future managed stands had GW's of 14% for Fd, 16% for Lw, 7.1% for Pl and 25.2% for spruce (Sx). These are considerably higher than in MP8.
- Operational Adjustment Factors (OAF). The standard OAF1 and OAF2 values of 15% and 5% were used in both analyses. This analysis used an additional 30% OAF applied to the Fd component of stands in the ICH for Armillaria (OAF-DRA).

Changes impacting management assumptions:

- Non-recoverable losses. The estimate of NRLs in this analysis (2,947 m3/yr) is 5,684 m^3/year lower than the MP8 analysis (8,631 m3/yr).
- Special Resource Management Zone. MP8 modeled a special resource management zone (SRMZ) that was mapped in the Kootenay Boundary Land Use Plan (KBLUP). The requirement was to allow no more than 25% of the THLB to be less than 5 m height. That zone, comprising 1575 ha, was not established in the Higher Level Plan Order and therefore was not modeled in this analysis.
- Visual Quality Objective Inventory. A new inventory of Visual Quality Objectives (VQO's) was made known by the District Manager of the Rocky Mountain Forest District in March 2003 after the MP8 analysis. The new VQO inventory was used in this analysis and is very similar to the old version. VQOs of Modification (VQO=M) were modeled in both analyses using an early seral restriction (i.e. maximum percent of forest can be less than a given height.) Partial retention VQOs (VQO=PR) were placed under a partial cutting regime in both the MP8 and this analysis. There are small differences in the area of VQOs, as well as area of partial cutting AUs (see above).
- Ungulate winter range (UWR). Ungulate winter range requirements in the MP8 were based on the Kootenay Boundary Land Use Plan Implementation Strategy (KBLUP IS). UWR requirements in this analysis are based on the Invermere GAR Order. The forest requirements for MP8 were applied to a smaller percentage of the CFLB and THLB, however the percent forest required and the age of required forest were higher than those in this analysis.
- Riparian management. MP8 analysis estimated the area of riparian areas in a similar manner to this analysis, however the riparian reserves in MP8 were modeled as landbase netdowns while the management zones were modeled as partial cutting. In this analysis, both the reserves and management zones were equated to an effective reserve width and modeled as a netdown.
- Adjacency Control and Block Aggregation. MP8 modeled adjacency (greenup) for the first 30 years of the modeling period, using a 10 year greenup period. This analysis used an early seral restriction as a surrogate to adjacency requirements. No spatial adjacency was modeled in this analysis as patch size management has been found to provide the flexibility needed to be consistent with an early seral limit.

- Patch size. MP8 analysis imposed maximum patch sizes of 20 ha on VQO areas, 40 ha on the UWR areas, and maximum patch sizes of 250ha on all other areas. No maximum patch sizes were implemented in MP9.
- Biodiversity. The Higher Level Plan Order (HLPO, October 26, 2002) has given legal status to Landscape Units, Biodiversity Emphasis Options with Old and Mature Retention Targets, Connectivity Corridors, Caribou Management Areas, and Scenic Corridors.
- Biodiversity Emphasis Option (BEO). At the time of the MP8 analysis the landscape unit boundaries and the BEO assignments had not been finalized. The MP8 analysis modeled an old seral requirement based on a BEO proportion of 10% high / 45% Intermediate / 45% low. Those old seral requirements are higher, on average, than in this analysis where the BEO assignments are 0% high / 30% intermediate / 70% low.
- Old seral retention. Spatially explicit Old Growth Management Areas (OGMA) have been mapped in all LU/BEC combinations. OGMAs are used in this analysis as no-harvest zones for the first rotation. The old seral requirement is modeled as a percent requirement for the following rotations.
- Mature seral retention. MP8 modeled full mature requirements in all landscape units (a minimum of 20 to 28% forest over 100-to-120 years of age). The HLPO no longer requires mature retention in the TFL so none were modeled in this analysis.
- Disturbance of the non-THLB. MP8 did not model disturbance of the non-THLB. In this analysis an average disturbance rate of 0.37% was applied (landbase turned over every 270 yrs).
- Caribou habitat. No caribou habitat requirements were modeled in MP8 analysis. Caribou requirements were modeled in this analysis, but only two hectares of THLB are covered by a no-harvest, caribou zone.

4.0 Base Case Analysis

The base case scenario presented in this report is based on the best information currently available and reflects currently required management practices in the TFL. The current allowable annual cut (AAC) for TFL 14 is 160,000 m^3/yr. This AAC was made effective as of March 28, 2001. Non-recoverable losses in the THLB are estimated to be 2,947 m^3/yr and have, except where noted, been subtracted from the graphs, tables, and harvest forecasts in this report.

4.1 Alternative Harvest Flow Scenarios

Numerous alternative harvest forecasts are possible for a given set of modeling assumptions (i.e. the base case defined in Section 3.0). These alternative flows represent tradeoffs between short, mid, and long term harvest level objectives. Figure 10 shows three potential harvest flows for the TFL base case.

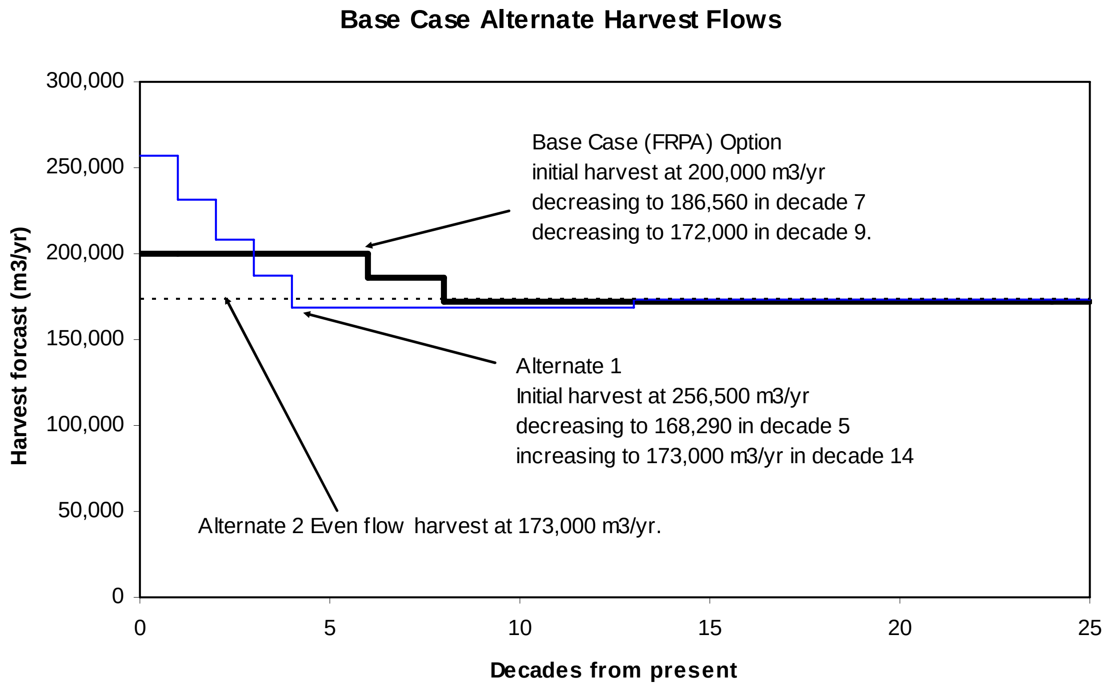


Figure 10. Alternative harvest forecasts for TFL 14

Alternative 1 illustrates the highest initial harvest rate (256,000 m3/yr) that can be maintained for one decade before declining at a rate of 10% per decade, to a low of 168,290 m3/yr in the fifth decade (34% below the initial harvest rate). The rise to the long term harvest level occurs in decade 13 (173,000 m^3/yr). This is 8.1% above the current AAC.

Alternative 2 is a non-declining harvest scenario with an initial harvest of 173,000 m3/yr. This harvest level, which is 8.1% above the current AAC, is sustained for the full planning horizon.

The third alternative ('Base Case (FRPA) Option') seeks to maintain a harvest of 200,000 m3/yr for as long as possible, and maximizes the long-term harvest level. It is able to maintain the harvest for 6 decades before decreasing to 186,500 in decade 7 and 172,000 in decade 9. It then maintains this harvest at 172,000 m3/yr (7.5% above the current AAC) for the long term.

4.2 Selected Base Case Harvest Flow

The third alternative from Figure 10 was selected as the Base Case flow (Figure 11) and is shown relative to the MP8 harvest flow projection. This flow best meets the provincial policy objective of providing for managed and gradual transition from short term to mid to long term while avoiding large and abrupt disruptions in timber supply. The harvest attributes and forest level attributes presented in this section correspond with this base case harvest forecast. The sensitivity analyses that follow are compared to this base case harvest forecast.

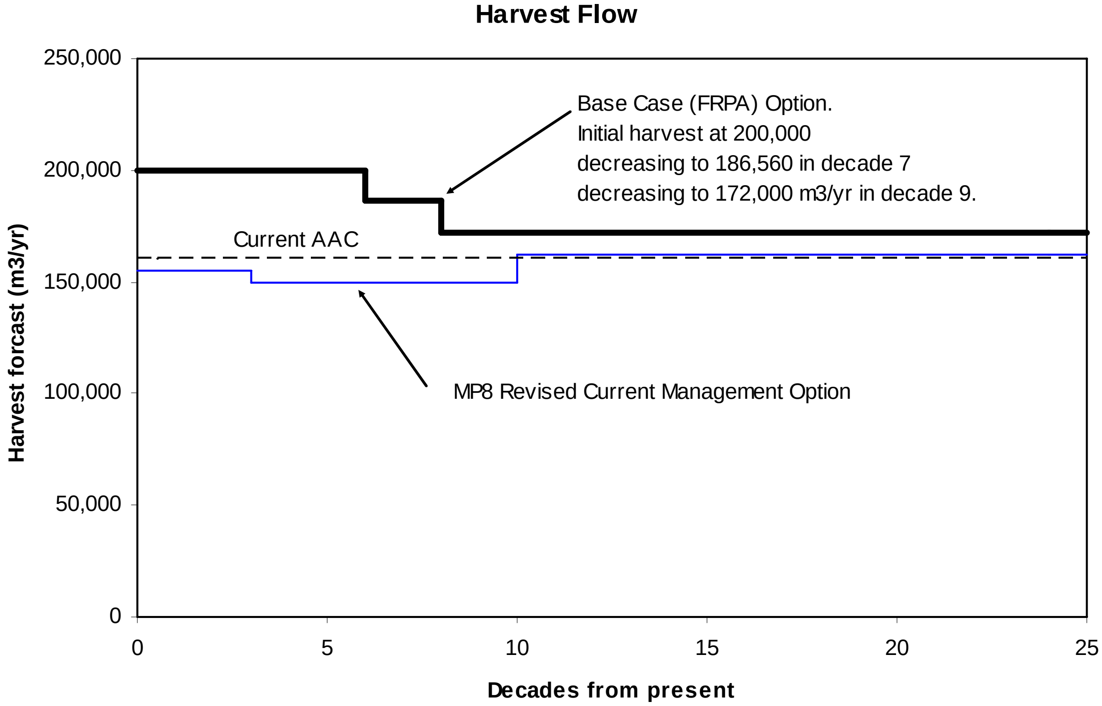


Figure 11. Base case harvest forecast, TFL 14, 2007

A comparison to the previous MP8 Base Case harvest forecast is also provided in Figure 11. This run was described in the Chief Forester's determination document because it was completed after the analysis report was published to correct an error in the modeling of partial harvesting. In this harvest forecast, the initial harvest of 155,000 m3/yr was maintained for 3 decades before declining to a low of 153,000 m3/yr in decade 4. The rise to the long term harvest level occurs in the eleventh decade and results in a long term harvest level of 162,000 m3/yr.

4.3 Base Case Attributes

In order to understand and evaluate the base case harvest forecast, this section describes the stands being harvested and the state of the forest over time. Numerous forest management assumptions have been modeled in the base case analysis, many of which impact the condition of the forest through time. Using the information presented in this section, it is possible to validate these assumptions and review their impact on the overall composition of the forest.

4.3.1 Growing Stock

The total current volume on the timber harvesting land base is nearly 9.6 million cubic meters (Figure 12). Of this total volume, just over 7.3 million cubic meters is currently merchantable. By comparison, the published MP8 base case total growing stock was approximately 9.5 million cubic meters and the merchantable growing stock was approximately 8.2 million cubic meters. Based on a similar initial total growing stock and less merchantable stock, MP9 is able to achieve significant increases in timber harvest in the short term over MP8. This is because timber availability (after considering constraints) is much higher in MP9 than in MP8 (i.e. MP8 first period: 2.7 million m^3available, MP9 first period: 4.0 million m^3 available). This is caused by the reduced constraint levels (i.e. old/mature, spatial adjacency) in MP9. See Figure 40 for more information on MP9 timber availability.

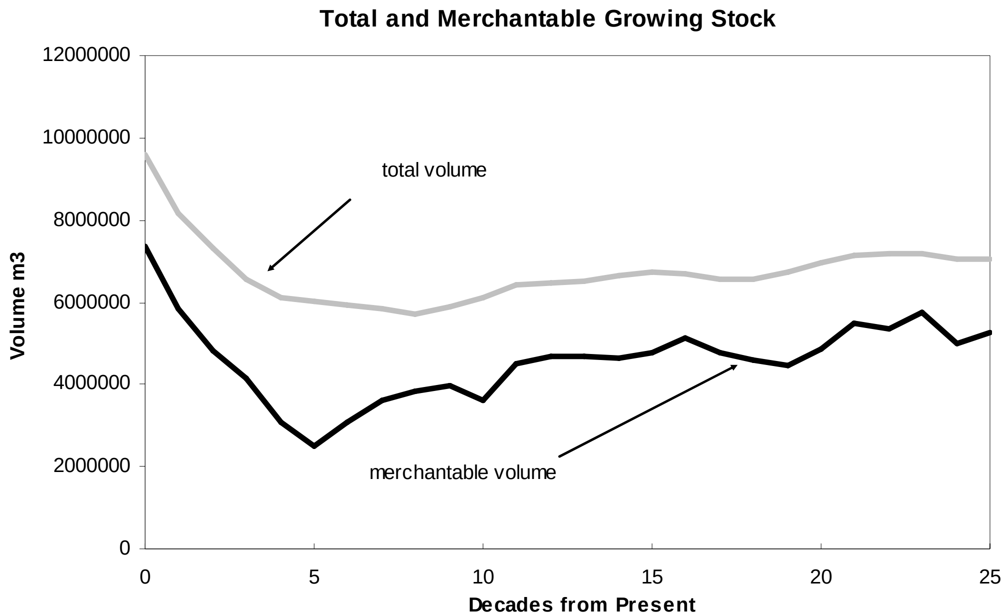


Figure 12. THLB Merchantable and Total Growing Stock

Short term and near mid-term merchantable growing stock is the lowest in decade 5, corresponding to the beginning of the transition from harvesting natural stands to managed stands (Figure 13). As more managed stands come online in subsequent decades, the merchantable growing stock rises to around 5 million cubic meters. The growing stock remains fairly stable during the rest of the planning horizon. Although not graphed, it was modelled into the 35th decade.

4.3.2 Harvest Attributes

Figure 13 depicts the transition from harvesting of natural stands to managed stands. In the first 2 decades the harvest of timber is exclusively from existing natural stands. In the 6th decade the harvest of natural stands drops significantly as existing managed stands become available for harvest. From the 6th decade onward managed stands comprise a greater proportion of the harvest than natural stands. By the 12th decade, the harvest of managed stands comprises 75% or greater of the total harvest, and by the 22nd decade the harvest is virtually all managed stands.

Throughout the planning horizon, although the total harvest flow is smooth, there are significant spikes in the amount of natural versus managed stands. Some of the reasons for the spikes can be easily identified. For example, the 9th decade is the time at which the locations of old-growth management areas were allowed to shift from their original location to other suitable locations and this frees up existing natural stands for harvest.

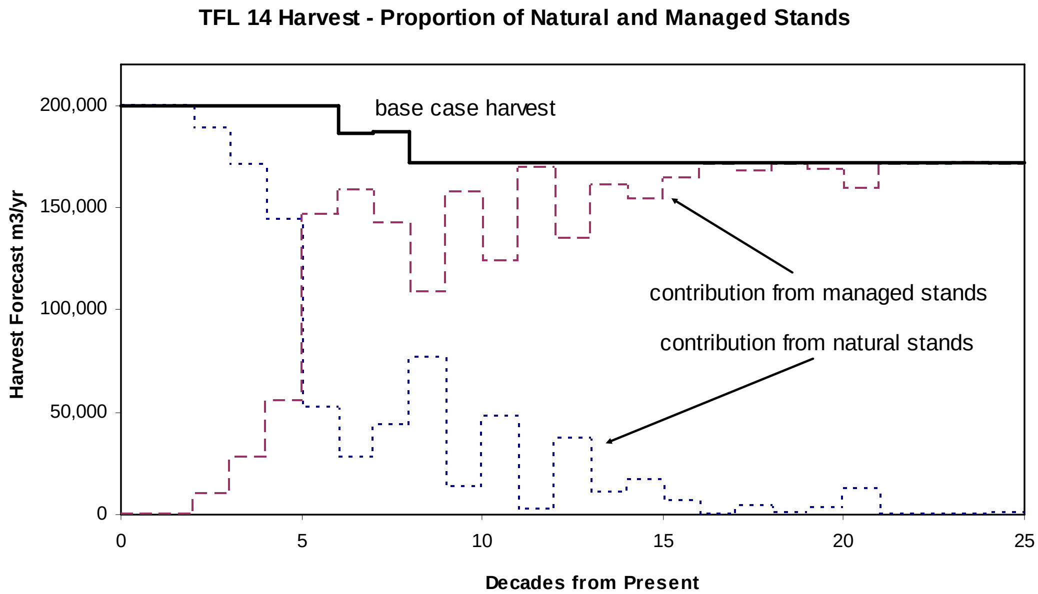


Figure 13. Transition of Natural Stands to Managed Stands

Priority Stand Types

Pine-leading stands and partial cutting stands were prioritized for harvest in the model. The concentration on pine-leading stands reflects the current practice of targeting these stands for mountain pine beetle management and salvage harvesting. The priority on partial harvest stand units ensures that the model harvests these stands at the earliest window of time between the multiple stand entries.

Pine-leading stands make up only 43% of the THLB, but 53% of the total harvest, with variations from 20% to 90% in any one decade (Figure 14). Large fluctuations occur because there is no attempt to limit the amount of pine harvested in a decade. Stands are harvested when they become available. Fluctuations occur as several large age cohorts become available and then go through a regrowth period.

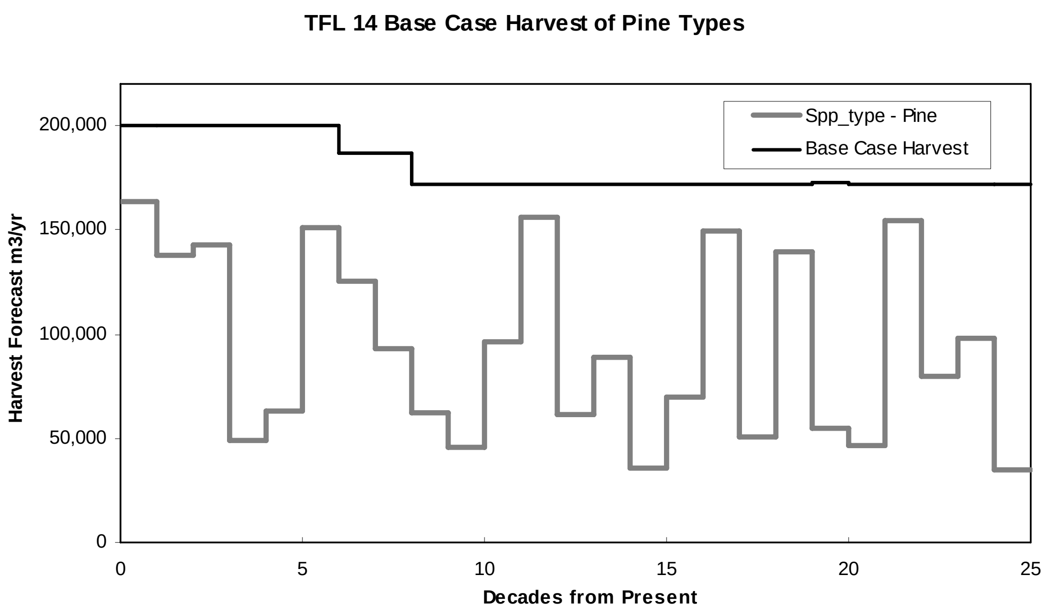


Figure 14. TFL14 Base Case harvest – pine types.

This cycling of pine stands also impacts average harvested age and volume/ha over time. Cohorts of stands that have relatively high harvest ages (such as natural stands) or low minimum harvest ages (such as managed pine-leading stands) will cause spikes (or valleys) in the harvest attribute graphs (such as the average harvest age graph). The impact will be proportional to the size of the cohort.

Figure 15 is an example of a priority-harvest-pine cohort with a repeating harvest cycle. Analysis unit 123 (Pl leading, good productivity, >140 yrs, < 45% slope) regenerates to AU 223 after harvest. The harvest of AU 123 is concentrated in decades 1 and 2. This is followed by a repeating pattern of harvest (AU 223) in decades 7, 13, 19 and 25. While the area harvested in decades 1 and 2 is largely the same as in decades 7 and 8, the volume is less because natural stands (in this case AU 123) are harvested at older ages with higher volumes per hectare than managed stands (in this case AU 223).

The effects caused by combination of many cohorts of different types are hard to display but the ‘crankshaft’ pattern in the graphs indicate that cohorts are generally being harvested when as they become available, which is strongly influenced by their minimum harvest ages (MHA) and their harvest priority.

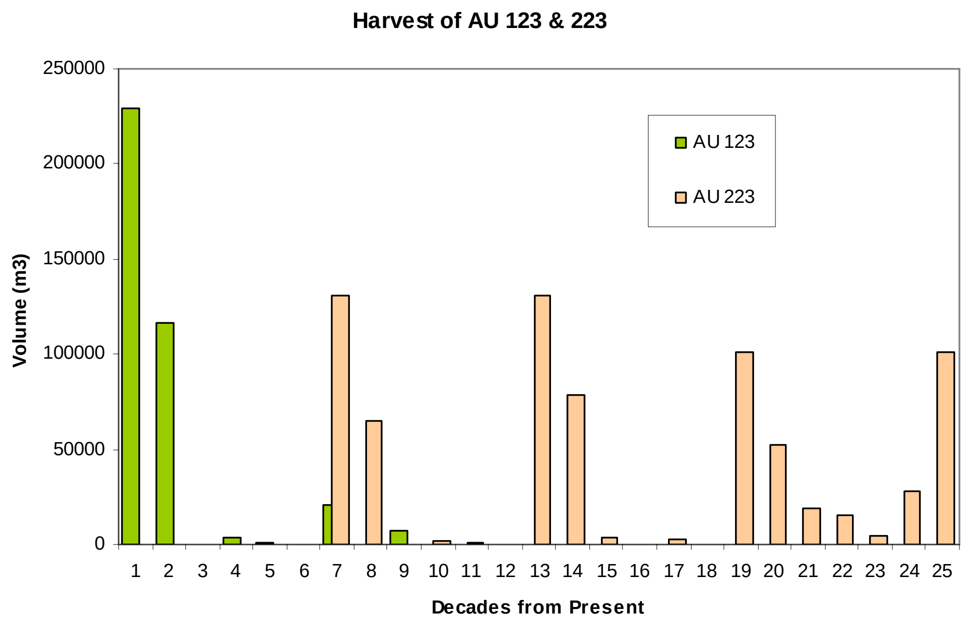


Figure 15. Harvest Volume of Analysis Unit 123 and 223

The oldest-first priority is usually reflected in the average harvest age, stand volume, and harvest area statistics. Mean harvest age provides an indicator of the type and age of stands harvested over time. The oldest first priority in the Base Case is tempered by the additional harvest priorities placed on cable harvest blocks, 20 yr plan blocks, and preferential species types (Pl-leading and partial cut stands). The result is that the initial harvest ages are not particularly old.

The average harvest age, volume and area statistics are composed of two quite different populations: the clearcut and partial cut stands. Graphs are provided of the harvest age for the TFL as a whole (Figure 16) and for clearcut and partial cut stands separated (Figure 17).

The trend in harvest age for partial cut stands (ignoring the first period value which is an anomaly due to the small area harvested in that period) is a gradual increase in harvest age until decade 10 (Figure 17). Then, it abruptly falls to a range between 90-100 years. This pattern corresponds with the existing stand continuing to age in the model until all of the original stand area has been harvested once (3 entries), then the stand age drops to a ‘managed’ condition (constant MHA of 90 years).

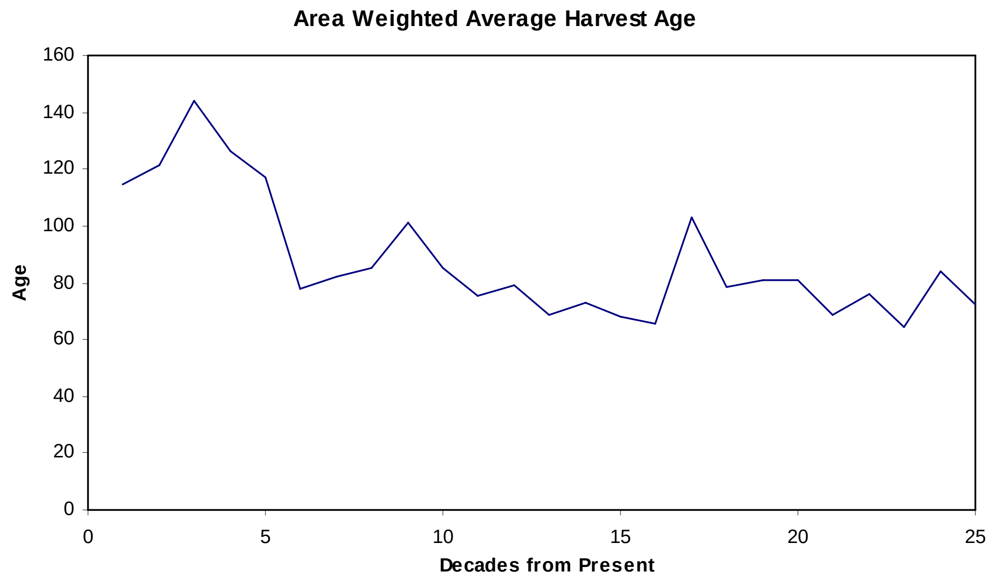


Figure 16. Mean Harvest Age for All Stands Combined

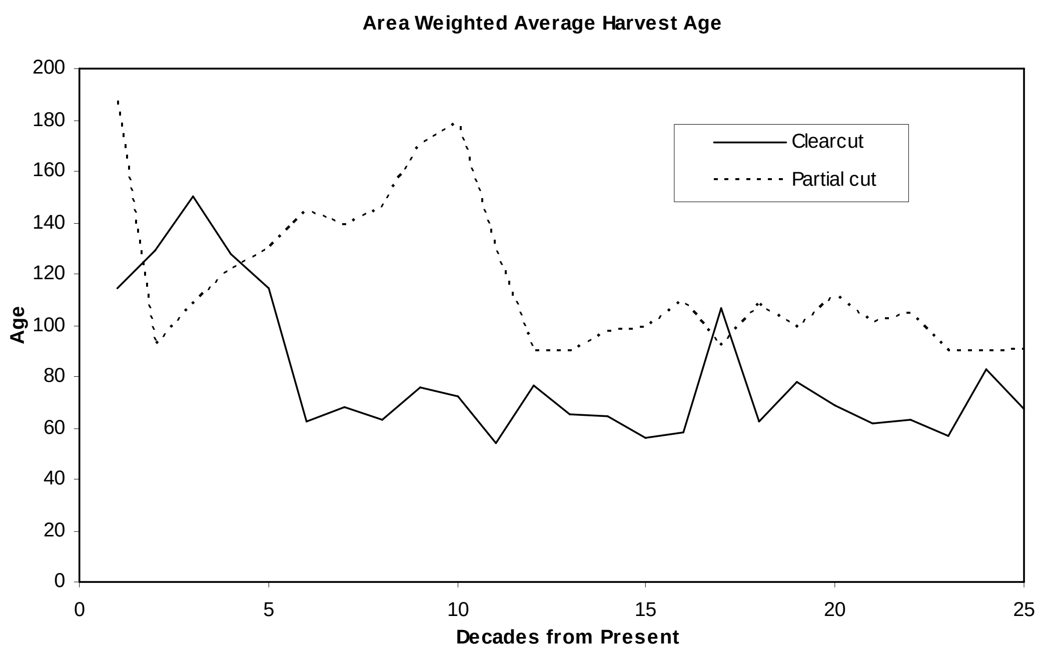


Figure 17. Mean harvest age for clearcut and partial cut stands

Mean harvest age is initially between 115 and 145 and then drops to a long term level of approximately 80 years.

The mean harvest volume per hectare (Figure 18) starts relatively high (~325 m^3/ha) and then trends downwards over time (250m^3/ha). This corresponds with the general trend of harvesting higher-volume, natural stands in the short term, to lower volume managed stands in the long term.

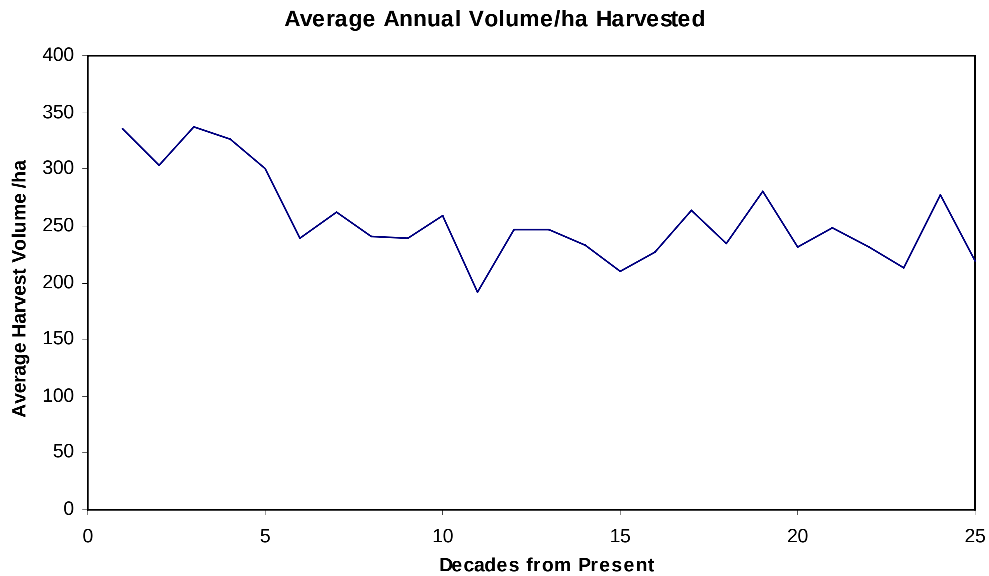


Figure 18. Average volume per hectare harvested – TFL 14 base case

The average volume/ha for partial cut stands corresponds with the multiple entries into existing natural stands over the first 10 decades, with an abrupt decrease to approximately 50 m3/ha after decade 10 (Figure 19). Partial cutting is assumed to be group selection based on harvesting 1/3 of the stand each entry (one hectare out of each three hectares). These volumes are for the whole stand. The 50 m3/ha that is reported for partial cutting is actually harvested from only 1/3 of the stand area and so the harvest within each group (patch within a stand) is actually 150m3/ha.

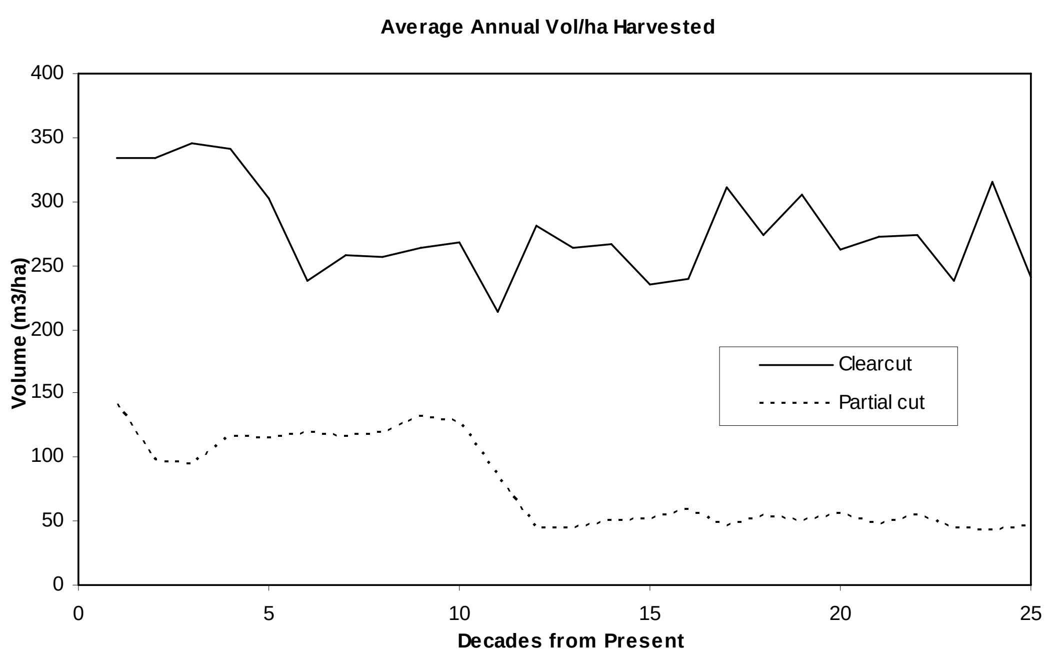


Figure 19. Average volume per hectare harvested for clearcut and partial cut stands

Total harvest area has a reverse relationship with harvest volume per hectare. As harvest volume goes up, the harvest area goes down, and vice versa. Figure 20 shows the total harvest area in the TFL. Harvest area is at it's lowest in the short-term at 600 hectares per year harvested in decade 1. Harvest area climbs and, with significant fluctuations, remains around 800 ha/year. The annual harvest area averages 778 ha/year after the estimated area of unsalvaged losses is removed.

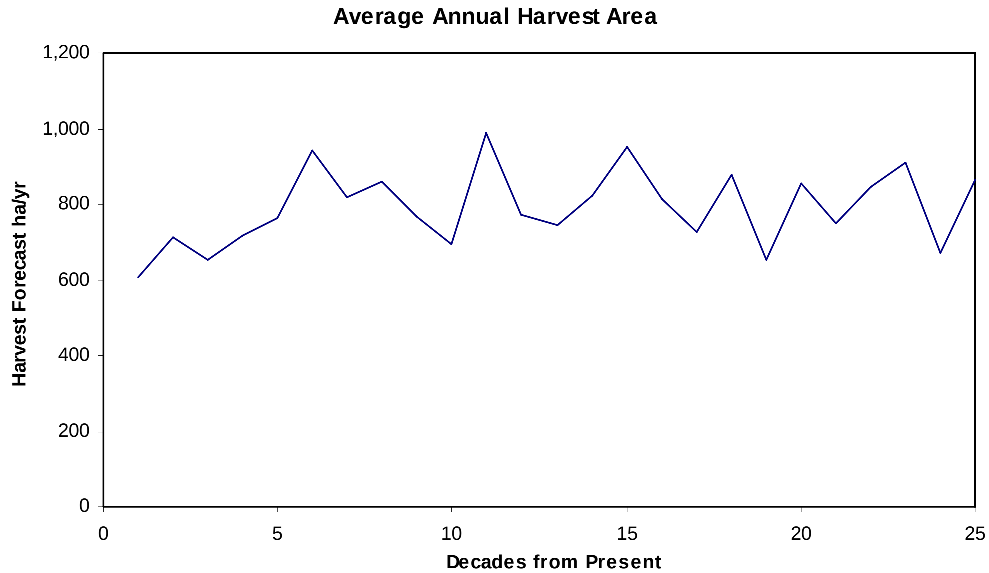


Figure 20. Total harvest area per year – TFL 14 base case

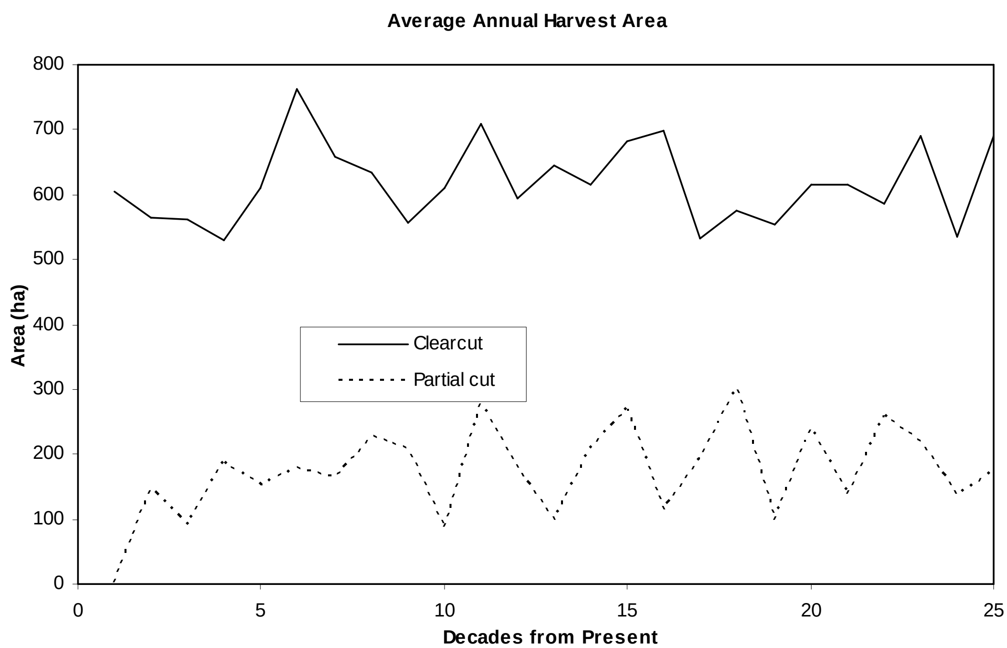


Figure 21. Total harvest area per year for clearcut and partial cut stands

4.3.3 Age Class Distribution

Figure 22 provides a temporal forecast of the age-class distribution for the TFL in 50 year increments. The present day stand ages are well distributed over the range of age classes from 1 to 110. Gaps and spikes appear in the older age classes. These fluctuations are likely an artifact of the mid-pointing of stand ages during forest cover typing.

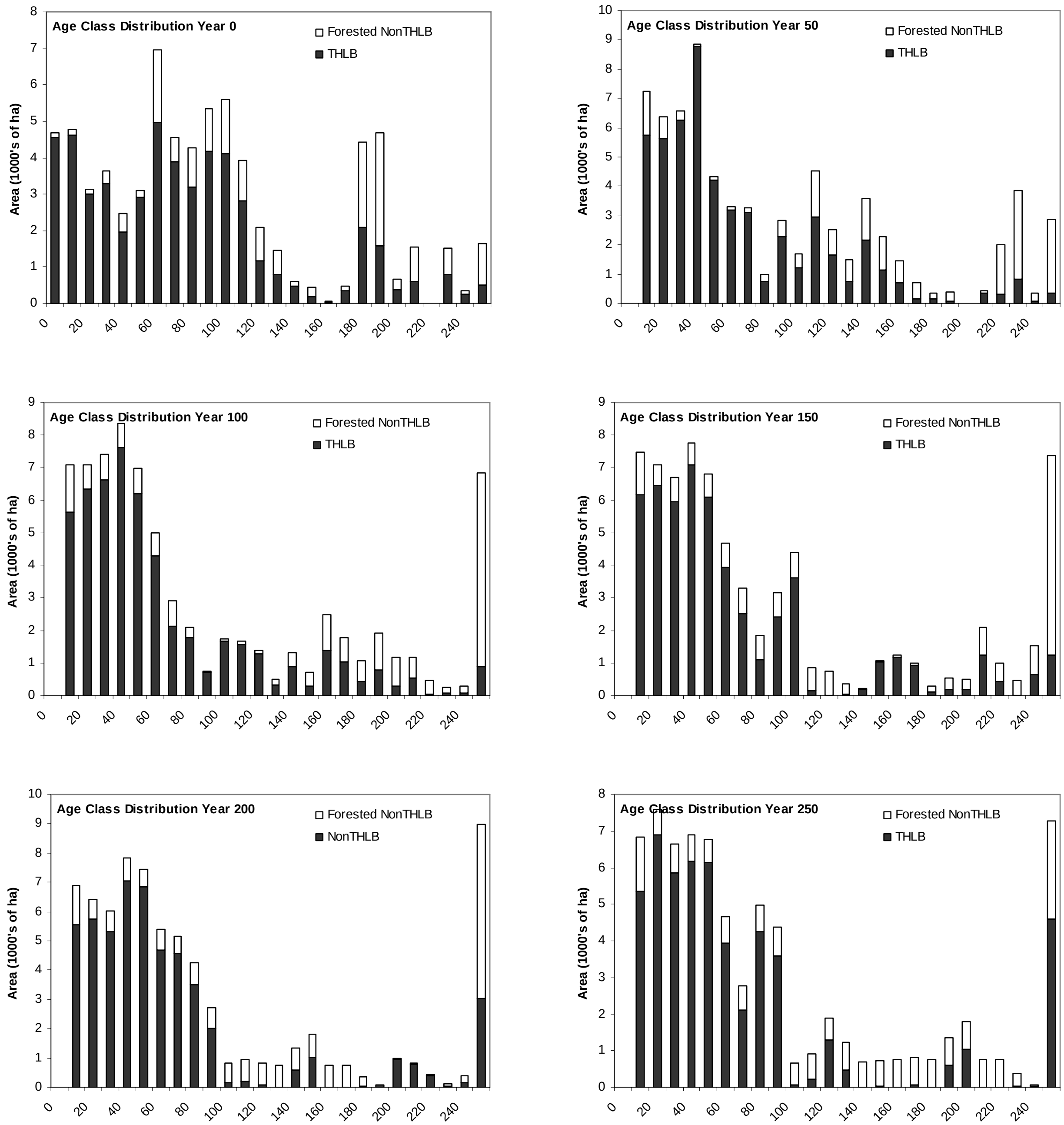


Figure 22. Age class projections for TFL14 landbase, MP9 base case

As discussed earlier, the THLB is initially skewed to younger age classes because of higher levels of recent disturbance (logging). Over time, the THLB area becomes concentrated into a group of stands under 100 years old and another set of older stands (mostly >250 yrs). The stands over 250 years old are an artifact of the modeling process. These are stands that the model reserves (from harvest) to meet non timber objectives (i.e. old seral objectives). As no disturbance is applied to the THLB, these stands will age indefinitely and cause the spike in very old stands.

In the long term, the modeling of natural disturbances within the non-THLB (NHLB) stands creates a relatively uniform age class distribution within the NHLB. The average rate of natural disturbance is approximately 270 years, and this creates a uniform age class distribution that is distributed over ages from 1 to 270 years.

4.4 Constraints Analysis

In the analysis, cover constraints are modeled to ensure that non-timber values are represented on the land base. These constraints address issues related to wildlife habitat, biodiversity, and visual quality and are described in Section 3.3.1. This section of the report provides a summary of some of the most significant cover constraints in the base case, and how the constraints are being met over the 250 year planning horizon. There are too many resource management units to describe each one individually. Examples are provided for the TFL as-a-whole, and for a selection of management zones (such as an individual watershed, an individual landscape unit, one type of UWR management zone, etc.)

The impact of any particular constraint is influenced by the total area impacted by the constraint, the level of constraint applied (X% and Y age), the proportion of the constraint area in the THLB, the overlap with other constraints, and the age class distribution of the forest within that zone. When the existing percentage of required forest is close to a limit (i.e. close to a desired max or minimum percentage) then harvesting conditions are considered as ‘tight’, and harvest may be constrained.

This is most true in the case of early seral constraints (i.e. “no more than X% of the area below Y age”). The model will stop harvesting within an early seral-type zone when it reaches the early seral limit. In the case of a minimum old forest requirement (such as “maintain at least X percent of forest older than age Y”) the model will not simply stop harvesting if the targets are not met. Instead, the model will “recruit” the oldest forest available and reserve that area from harvest, and then consider harvest for any other stands that are older than their minimum harvest age. Thus, a tight old seral constraint does not necessarily eliminate harvest from an area when conditions are ‘tight’.

4.4.1 Biodiversity Old Seral

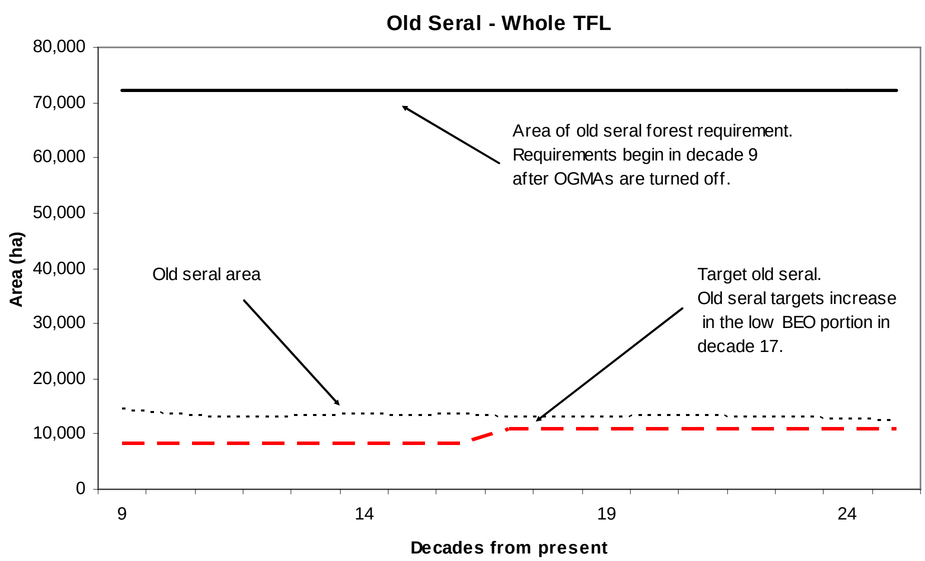


Figure 23. Old seral requirements in all LUs combined.

LU and BEC combinations define the biodiversity management zones. The HLPO designated approximately 70% of the LU-BEC area in the TFL as low emphasis biodiversity emphasis (BEO), with the rest as intermediate BEO. Targets within the low emphasis zones change over time: they are initially set at 1/3 of full targets in the first rotation (decades 1 to 8), 2/3 of targets in the second rotation (decades 9 to 16), and at full target values in the third rotation (decades 17+).

In the first rotation the old seral percentage requirements are met by spatially identifying (mapping) the old growth management areas (OGMAs). These are treated as no-harvest zones in the model. Starting in decade 9, the OGMA no-harvest rule is 'turned off' and the 2/3 old seral requirements are turned on. In the 17^{th} decade the low BEO targets increase to full targets.

The final old seral requirement as-a-whole within any given geographic area is a combination of the fixed requirement within the intermediate BEO component area (which has a relatively higher percentage of target old seral compared to the low BEO) and an increasing target requirement within the low BEO component area (which has a relatively small percentage requirement of old seral compared to the intermediate BEO).

Old seral requirements are met for the TFL "as-a-whole" (Figure 23) with a surplus over the whole planning horizon. However, specific LU/BEC units are tight (Figure 25 and Figure 24). At the TFL level, the old seral targets become increasingly tighter over the planning horizon, and more LU/BEC units are limiting harvest. Note that in these and subsequent figures, the heavy black lines depict the total area of forest that the constraint is applied against. This line provides an indication of how influential this constraint may be to the harvest flow. Management zones with larger area generally have more impact on the TFL harvest flow than those with smaller area.

The effect of the biodiversity requirements is not one of preventing harvesting across the TFL. Instead, the effect is to reserve from harvest ("lock up") a portion of the THLB (this area is used to meet the forest requirement) while allowing harvesting to proceed on the remaining landbase. Two age groups emerge, the "locked up" area, which tends to grow older and older, and the area being harvested, which gets distributed within the <100 year age classes (Figure 22).

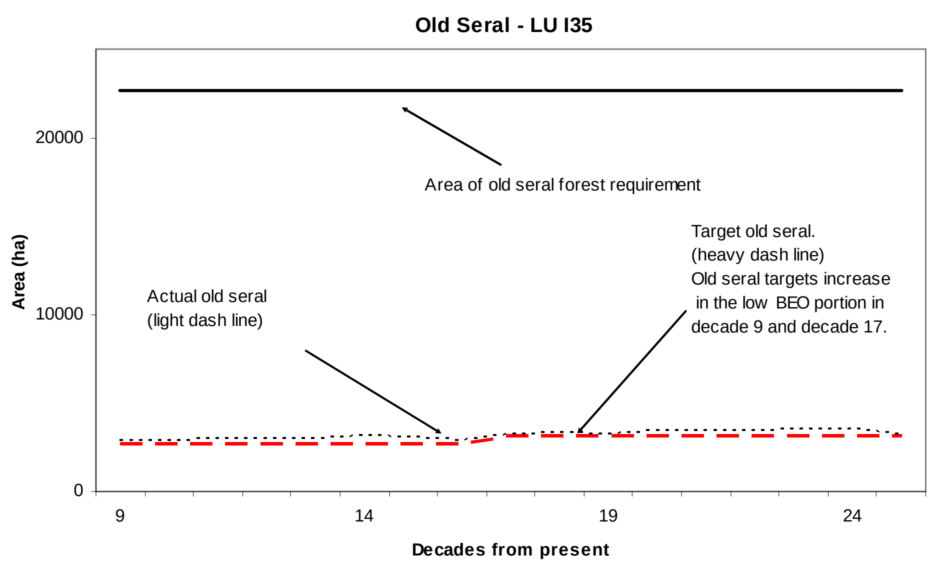


Figure 24. Old seral requirements in LU I35 (a mix of low and intermediate BEO)

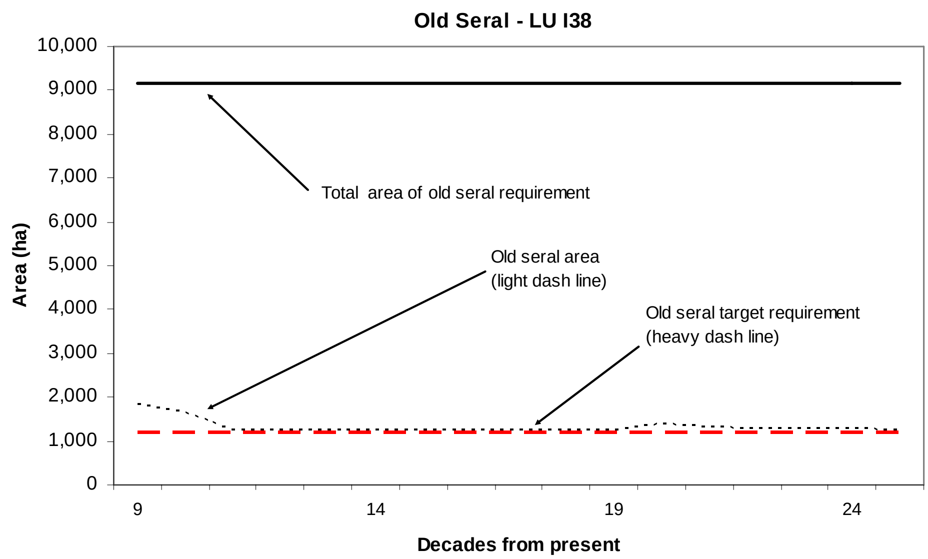


Figure 25. Old seral requirements in LU I38

4.4.2 Ungulate winter range

The Ungulate Winter Range (UWR) zones are defined by ecosystems grouped by moisture levels and landscape units (LU34-wet, LU34-moist, LU34-transition, LU34-dry, etc). These zones have one or two forest requirements applied to them: either a percentage of forest older than 60 years, or older than 100 years.

The required and existing area of 100+ year forest within UWR is provided in Figure 26 (for the TFL as a whole) and Figure 27 and Figure 28 (for landscape units I35 and I38). The UWR 100 year+ constraints are limiting the harvest in the first decade in some LUs. After the first decade they do not appear to limit the harvest.

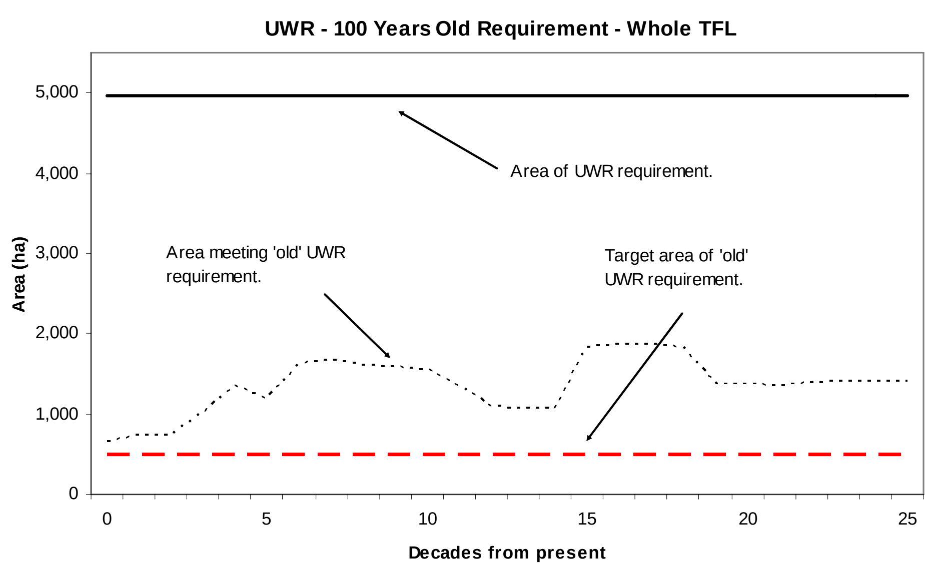


Figure 26. Ungulate winter range 100 year+ constraints for the TFL.

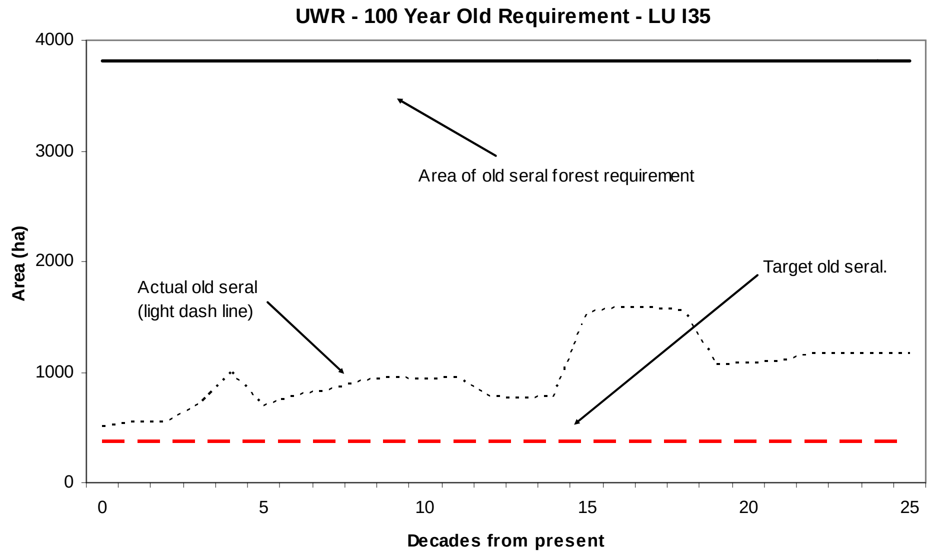


Figure 27. Ungulate winter range 100 year+ constraints within LU I35.

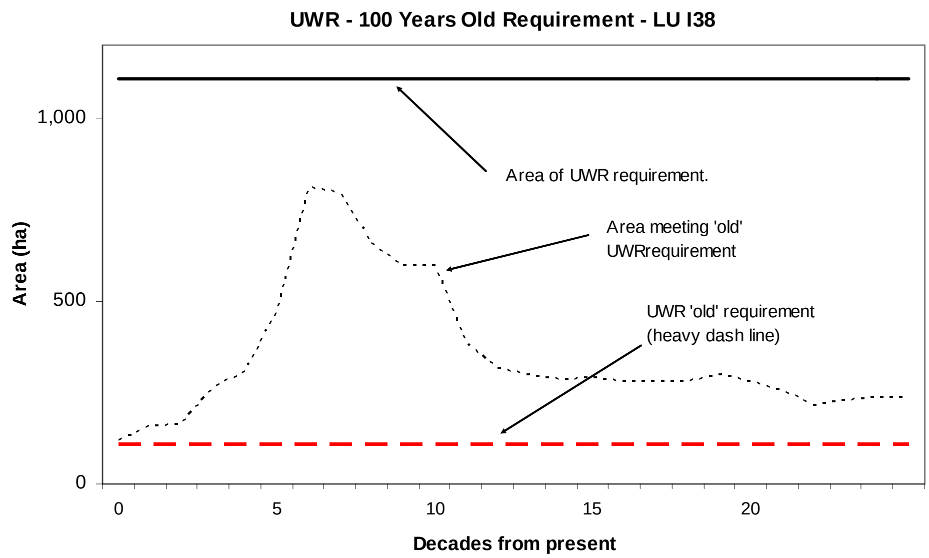


Figure 28. Ungulate winter range 100 year+ constraints within LU I38.

The required and existing area of 60+ year forest within UWR is provided in Figure 29 (for the TFL as a whole) and Figure 30 and Figure 31 (for landscape units I35 and I38). The UWR 60 year+ constraints do not appear to be limiting the harvest at any time.

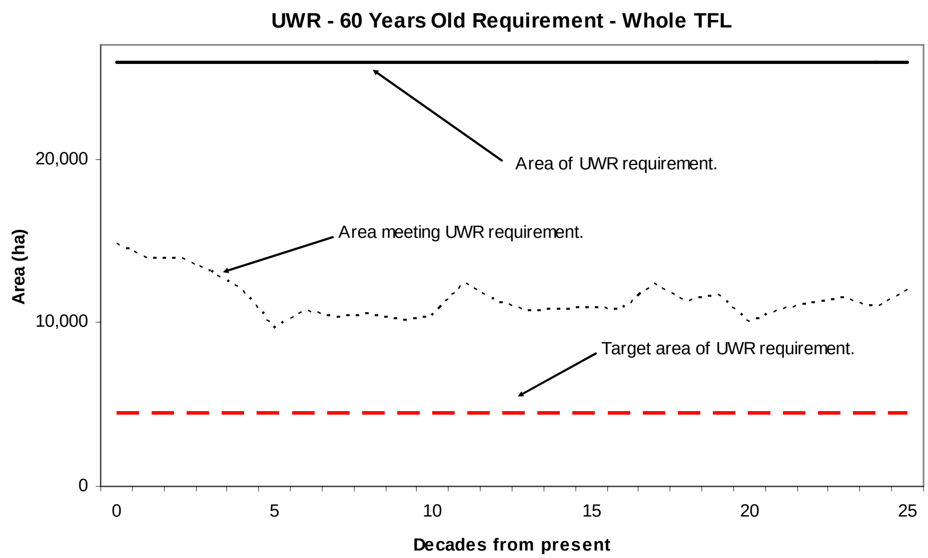


Figure 29. Ungulate winter range 60 year+ constraints for the TFL

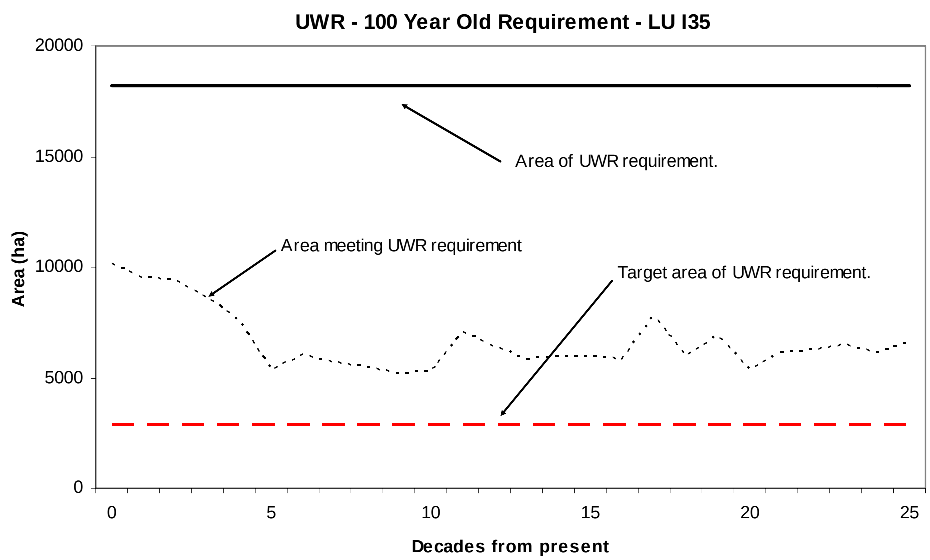


Figure 30. Ungulate winter range 60 year+ constraints within LU I35

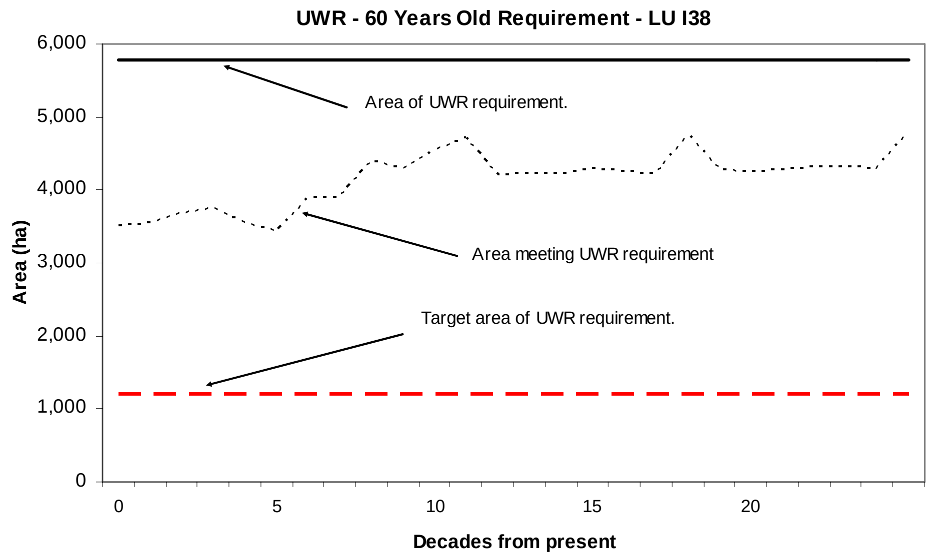


Figure 31. Ungulate winter range 60 year+ constraints within LU I38

4.4.3 Watershed Equivalent Clearcut Area

In the case of the domestic and sensitive watersheds in the TFL, a maximum of 30% equivalent clearcut area (ECA) is allowed within each watershed at any one time. The model will not permit harvesting within watersheds if the constraint would be exceeded. Figure 32 shows the cumulative ECA within all watersheds. Individual watersheds may have significantly higher variation over time (Figure 33) but overall the area of ECA is at or below 15% for most of the planning horizon. At the TFL level this constraint does not appear to limit harvest but it does limit harvest for individual watersheds, for brief periods of time. This circumstance tends to occur in the smaller watersheds where harvesting a single block can have a proportionally higher impact.

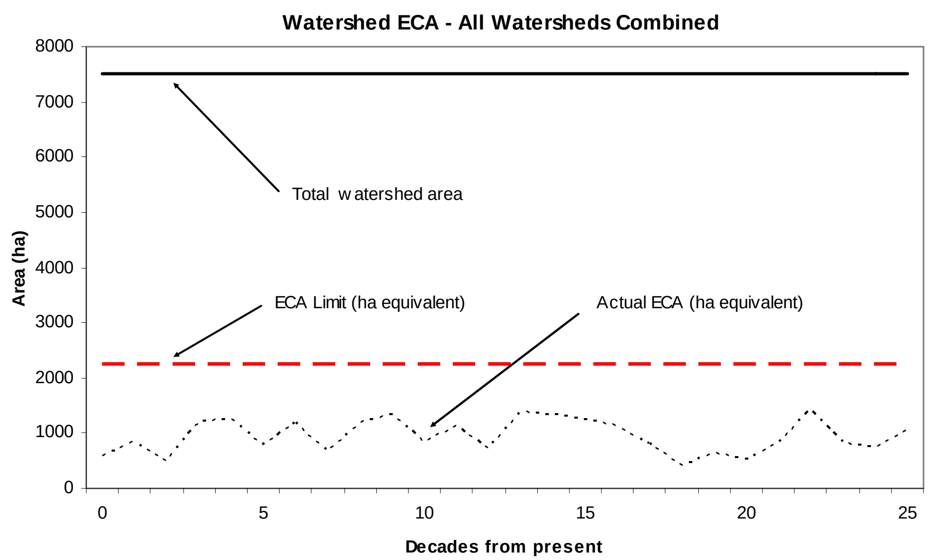


Figure 32. Watershed ECA in the TFL watersheds combined

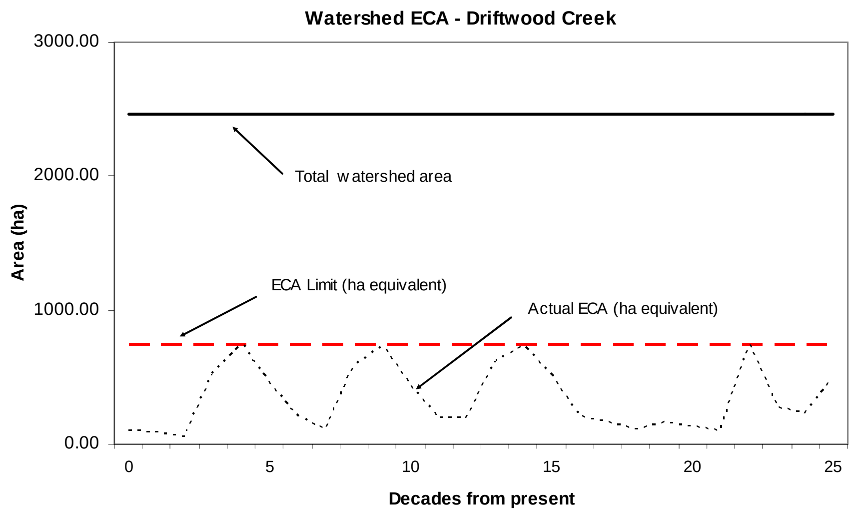


Figure 33. Watershed ECA in the Driftwood Creek watershed

4.4.4 Integrated Resource Management Zone

Standard cut-block adjacency and green-up requirements were modeled as two zones: the integrated resource management (IRM) zone, and the enhanced resource development zone (ERDZ). Together, these zones cover the THLB. The ERDZ is defined by the Higher Level Plan Order. The IRM areas are any THLB not within the ERDZ.

The IRM greenup requirement was modeled on 28,189 ha of THLB and limited stands under 12 years old to a maximum of 33% of the IRM area within each LU. The IRM requirements are much more onerous than the ERDZ requirements, which are only "a maximum of 33% < 2 years". Figure 34 provides a rollup of all the IRM zones in the TFL. It indicates that between 10 and 25% of the area is less than 12 years old throughout the planning horizon. A review of each IRM zone indicated that percentages varied widely. For example, landscape unit I38 rarely exceeded 10%, but landscape unit I35 reached the 33% maximum four times during the planning horizon. Integrated resource management requirements limited timber harvest within some landscape units at isolated times throughout the planning horizon.

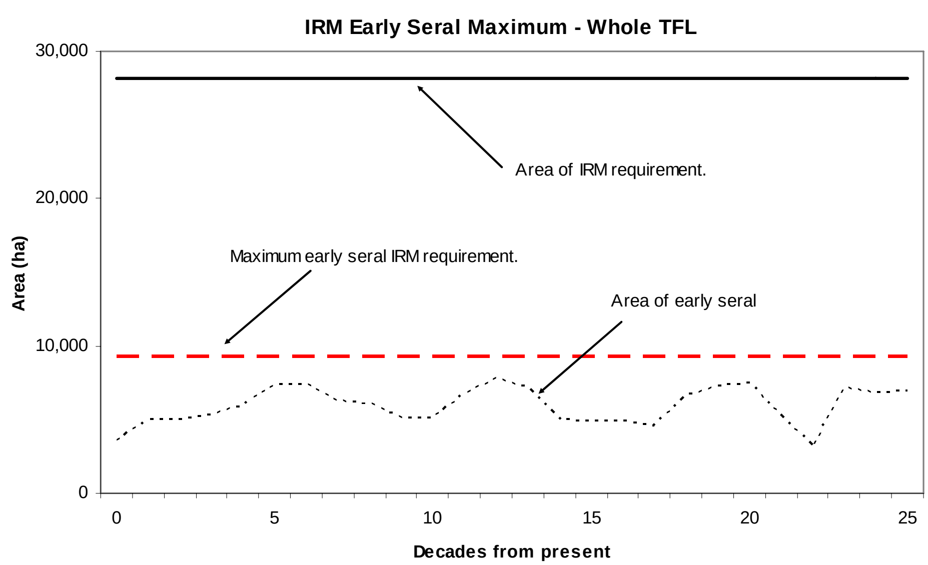


Figure 34. Integrated resource management zone within TFL 14.

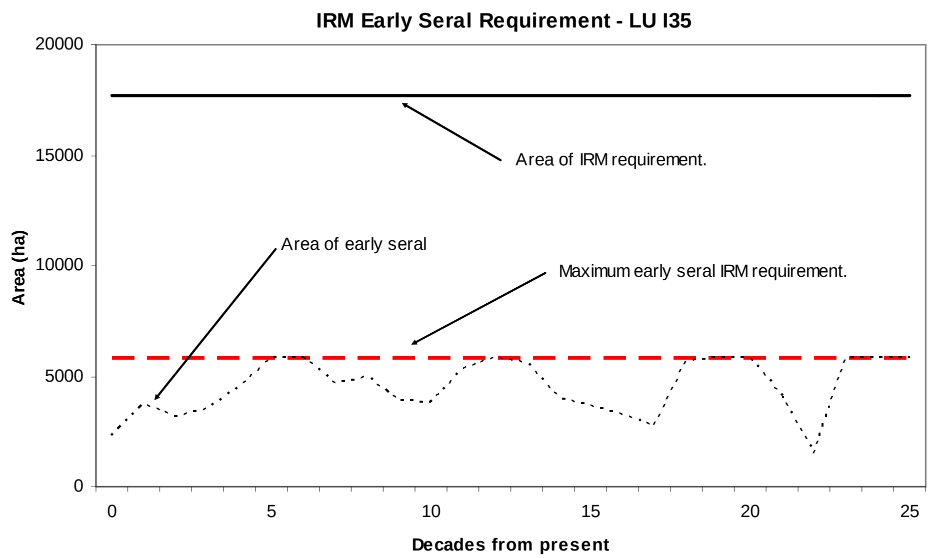


Figure 35. Integrated resource management zone within landscape unit I35

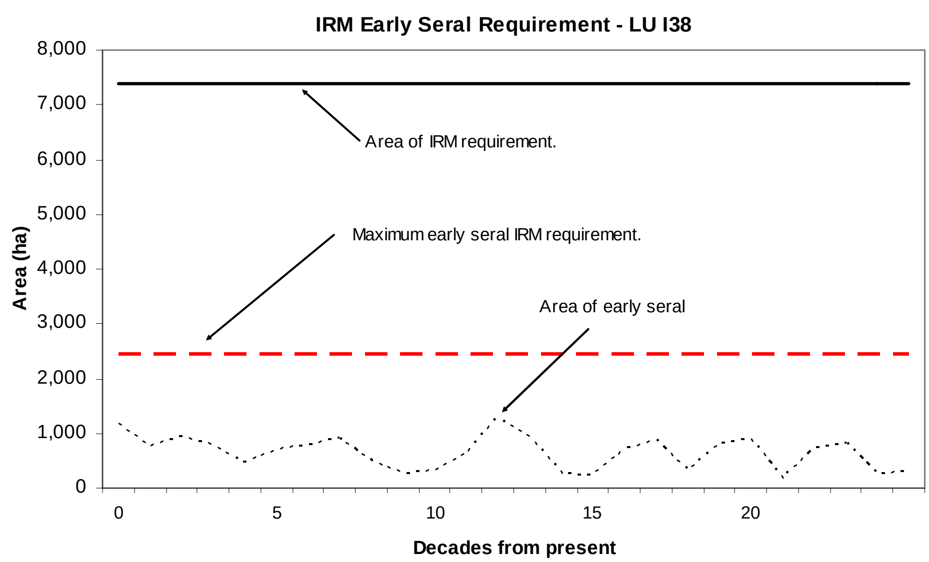


Figure 36. Integrated resource management zone within landscape unit I38

4.4.5 Scenic landscapes (visual quality objectives)

Visual quality objectives (VQOs) are met by applying maximum disturbance percentages to areas in the model. As well, all stands within the partial retention VQO polygons were assigned to partial cut analysis units. Figure 37 shows a rollup of all the VQO areas in the TFL. Each VQO polygon has a different maximum disturbance limit and visually effective greenup (VEG) height. The roll-up includes some partial retention (PR) and modification (M) visual quality zones (see Appendix B). The graph shows that the model is harvesting up to the maximum allowable disturbance at isolated times throughout the planning horizon. The same trend can be seen with the graph for polygon #26 (Figure 38). This is a partial retention polygon with a maximum disturbance limit of 17% < 19 years old.

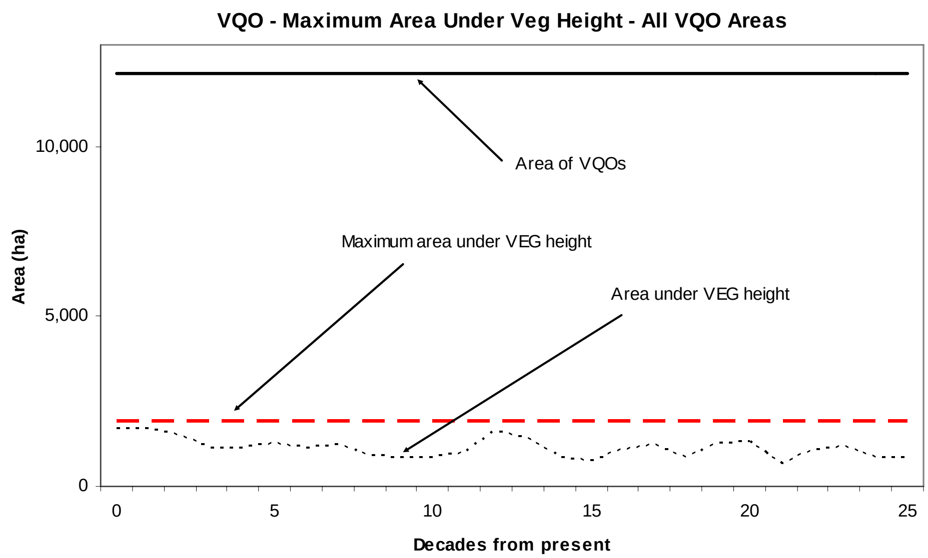


Figure 37. Visual quality objective constraints for TFL 14.

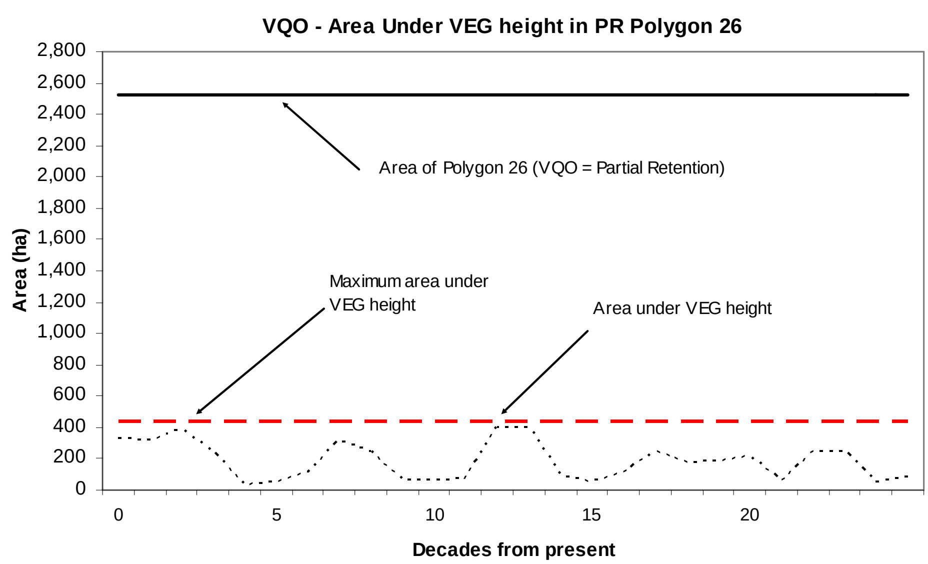


Figure 38. Visual quality objective constraints for partial retention polygon #26.

4.4.6 Overall Constraints

How each of these constraints interact to impact timber supply in the TFL is important toward understanding the base case harvest flow presented in this report. The interaction between all of the cover constraints and their impact to the timber supply is important to understanding the Base-case harvest flow.

Figure 39 charts the total area of THLB that under 'tight' conditions, by constraint type. Based on this chart the timber supply should be most constrained in decades 9 to 13, 16 to 20 and 23 to 25. The general trend is an increasing amount of area in 'tight' conditions from the beginning of the planning horizon towards the end. The resource zones with the most area in 'tight' conditions are the IRM early seral and the biodiversity old seral constraints.

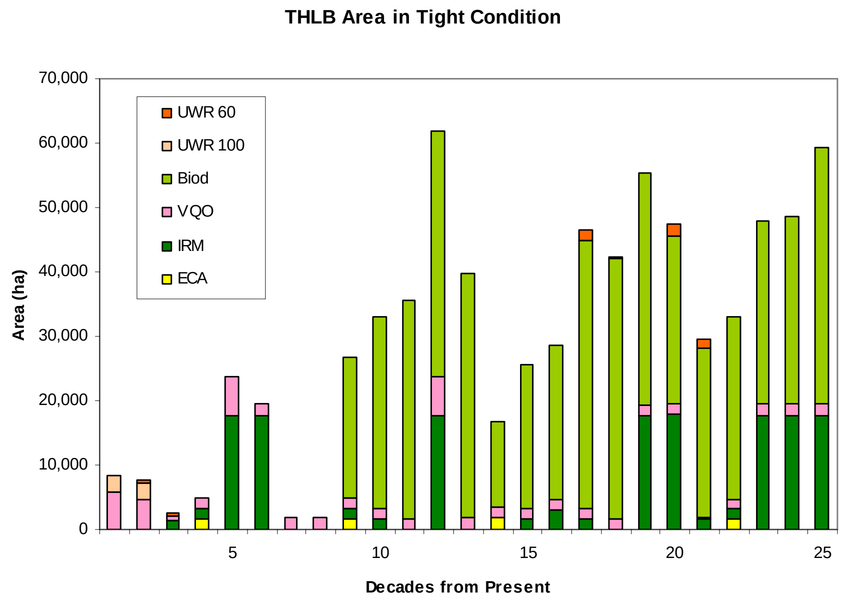


Figure 39. Area of THLB in Tight Condition

"Timber availability" is used to illustrate when timber harvesting options are more or less constrained in the model. Figure 40 illustrates the trend in harvest availability over time for the base case management scenario. The availability shown in the graph does not represent a potential harvest flow - it identifies the slack in the system or, the total volume available for harvest in each decade, assuming the harvest flow was followed for all prior periods. The data for each period is built from a separate model run (one model run for each of the 30 periods depicted in Figure 40).

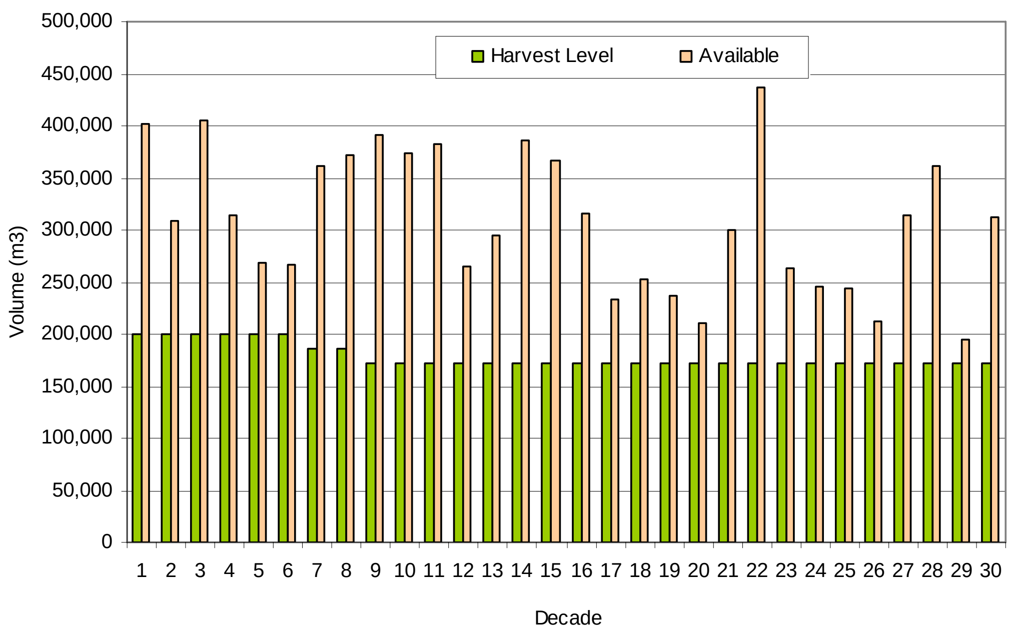


Figure 40. Periodic harvest availability for the Base Case Option

Period 29 is the 'pinch point' in the long term, or the period that defines the maximum level for the long term harvest level. Other pinch points occur in decades 5 and 6, and decades 12, 20 and 26. Those periods are "local pinchpoints" for the decades immediately near to them. These periods are slightly coincidental to the periods with the total area of THLB in 'tight' conditions, implying that the forest requirements are not necessarily the constraining factor(s) to the harvest level – age class distributions and stand volumes are also part of the equation.

5.0 Base Case Differences from MP 8

Relative to MP 8, the base case presented here shows a much-improved harvest forecast. This section summarizes and explains, where possible, the differences between the harvest flows. More details on the different inputs and assumptions included in the two analyses can be found in Section 3.6. Of note, the Chief Forester ultimately set the AAC at 160,000 m3/yr, 5,000 m3 higher than the MP8 harvest forecast, because the harvest forecast was felt to be overly conservative.

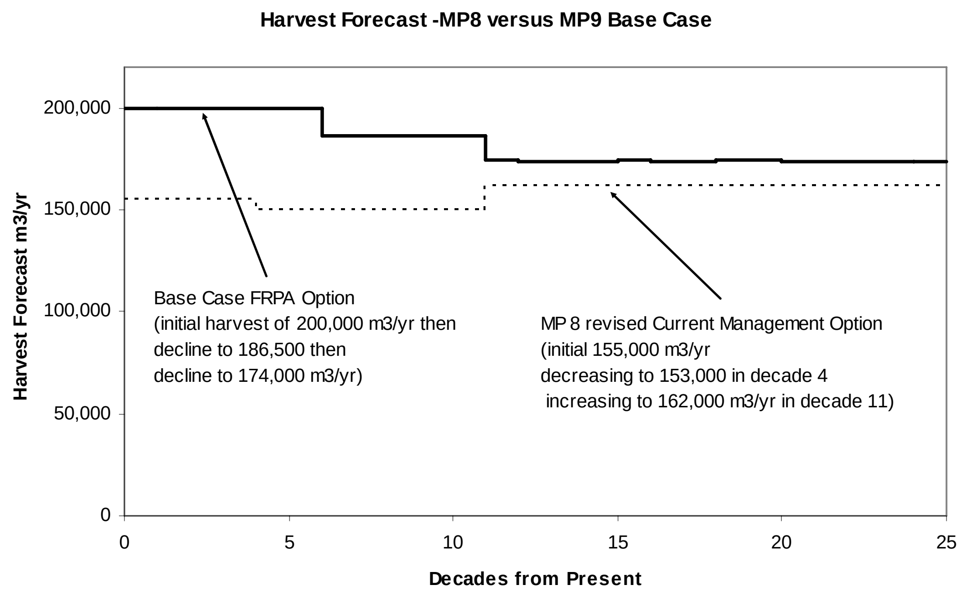


Figure 41. TFL14 MP8 and MP9 base case harvest projections

Comparisons made below are made relative to the MP 8 revised Current Management run shown in Figure 41. It should be noted that time zero in the MP8 run is 6 years earlier than time zero in the Base Case FRPA Option although the graph presents them both using 2006 as time zero.

Downward pressures on MP9 base case timber supply relative to MP8

- The MP 9 current THLB is 1% smaller than the THLB in MP8.
- The MP9 analysis modeled disturbance of the non-THLB (NHLB). This stops the NHLB from aging perpetually and prevents a disproportionate number of the forest cover requirements from being met within the NHLB.
- The estimate of future RTLs is higher in MP9 than in MP8 (998 ha versus 647 ha, respectively).
- MP9 added a 30% operational adjustment factor for armillaria (OAF-DRA) to Fd leading stands in the ICH. MP8 did not apply an OAF-DRA.
- Partial retention harvesting was applied to all stands within the partial retention (PR) visual quality objective (VQO) class. In MP8, partial cutting was applied to only the non-pine leading stands within the PR VQO class.
- In MP9, an ECA threshold of 30% was modeled within each domestic or sensitive watershed. No ECA requirement was modeled in MP 8.

Upward pressures on MP9 base case timber supply relative to MP 8

- MP8 applied full mature seral targets in all LU-BEC combinations. No mature seral targets are applied in this analysis. This frees up significant volume in the short term and ensures more of the THLB is contributing in the long term.
- MP 8 applied higher old seral retention targets than those in MP 9. As a general comparison, MP8 used blended retention targets based on a mix of 10%/45%/45% (proportion of high, intermediate, and low BEO area) for all the LU-BEC units, while MP9 applied retention rates that were 0%/30%/70% (proportion of high, intermediate, and low BEO area, on a total area basis). The net effect is that MP9 applied lower old seral retention rates to a higher proportion of the landbase. This frees up significant volume in the short term and ensures more of the THLB is contributing in the long term.
- Updated SIBEC estimates resulted in increased site index adjustments on portions of the landbase. Improved SI's mean managed stands are available to harvest sooner and/or with more volume.
- Regeneration delays for analysis units have decreased by 1 year (from 3 to 2 years).
- MP 8 modeled green-up (spatial adjacency) for the first three decades, whereas, green-up requirements were modeled as an early seral limit in this analysis. The two approaches are very different. The methodology in MP 8 was overly constraining and could produce timber flow results of greater than 30%, especially in the short term (Nelson, 2000). MP 9 uses modeling that more realistically estimates timber flow and is consistent with the "early seral" patch assessment methodology used in the adjacent Invermere TSR 3 process.
- Modeled UWR constraints in MP9 are considered to be less constraining than those applied in MP8. Sensitivity analysis completed in the Invermere TSA using the two versions of UWR show the new ecosystem based guidelines have less timber supply impact than the older KBLUP guidelines.
- The estimate of NRLs in this analysis are 5,684 m3/year lower than the MP8 analysis.

Unknown influence on timber supply relative to MP 8

- OGMA's and Mature Management Areas (MMA's) are spatially defined in MP9 for the first 8 decades of the analysis. MP8 modeled old seral retention targets using percent forest requirements.
- There are numerous other differences between the MP8 and MP9 analyses as listed in Section 3.6 but their impact on timber supply is unclear or very small.

6.0 Base Case Sensitivity Analyses

The data and assumptions used in timber supply analysis are often subject to uncertainty. To provide perspective on the impacts of changes to data or assumptions, sensitivity analyses are commonly performed. Usually only one variable (data or assumption) from the information used in the base case is changed in order to explore the sensitivity of that variable. Sensitivity analysis is a key component of any timber supply analysis process as it permits the determinant (the Chief Forester) to gauge the potential impact of uncertainty around assumptions and data that make up the base case. Sensitivity analyses help to frame the potential impacts of uncertainty by analyzing scenarios that are more pessimistic and more optimistic than the base case.

Table 5 provides a list of the sensitivity analyses completed on the TFL 14 MP9 base case.

Table 5. Completed base case sensitivity analyses

Sensitivity analysis	Zone/ group / analysis unit subject to uncertainty	Suggested Changes in Sensitivity Run
Size of THLB	Timber Harvesting Land Base (THLB)	The timber harvesting land base will be increased and decreased by +/– 10%.
Managed Stand Yields	Managed Stands	The volume associated with managed stands will be increased and decreased by +/- 10%
Natural Stand Yields	Natural Stands	The volume associated with natural will be increased and decreased by +/- 10%
Minimum Harvest Ages (+/- 10yrs)	All Stands	Minimum harvest ages will be increased and decreased by +/- 10 years.
Minimum Harvest Ages (95% MAI only)	All Stands	Minimum harvest ages will be based only on achieving 95% of maximum mean annual increment.
Minimum Harvest Ages (Merch criteria only)	All Stands	Minimum harvest ages will be based only on merchantability criteria (volume/ha).
Harvest Priorities	Timber Harvesting Land Base (THLB)	Harvest priority on pine and partial cut stand types is removed.
Regeneration Delays	Future Managed Stands	Regeneration delays increased to 4 years, and reduced to 1 year.
Use of Select Seed.	Future Managed Stands	No gains applied to future managed stands (no select seed use).
Managed Stand Site Productivity	Future Managed Stands	SIBEC site index adjustments are removed.

6.1 Size of Timber Harvesting Land Base

Several factors that determine of the size of the THLB have uncertainty around their definitions (operable area, problem types, low sites, riparian management, impacts from trails and landings, etc). Different market conditions in the future or changes in harvesting or milling technology can also serve to reduce or expand the land base considered to be economical.

The timber harvesting land base in the TFL has changed over time. It is not known if the THLB used in this analysis is over or under-estimated; so two sensitivity runs have been completed. These runs increase and decrease the size of the THLB by 10%.

Methodology

Run	How was it Analyzed?
Timber harvesting land base + 10%	The modeled size of each polygon in the THLB was increased by 10% to a total of 58,104 ha. The non-THLB was reduced so that the total CFLB remained the same.
Timber harvesting land base - 10%	The modeled size of each polygon in the THLB was decreased by 10% to a total of 47,539 ha. The non-THLB was increased so that the total CFLB remained the same.

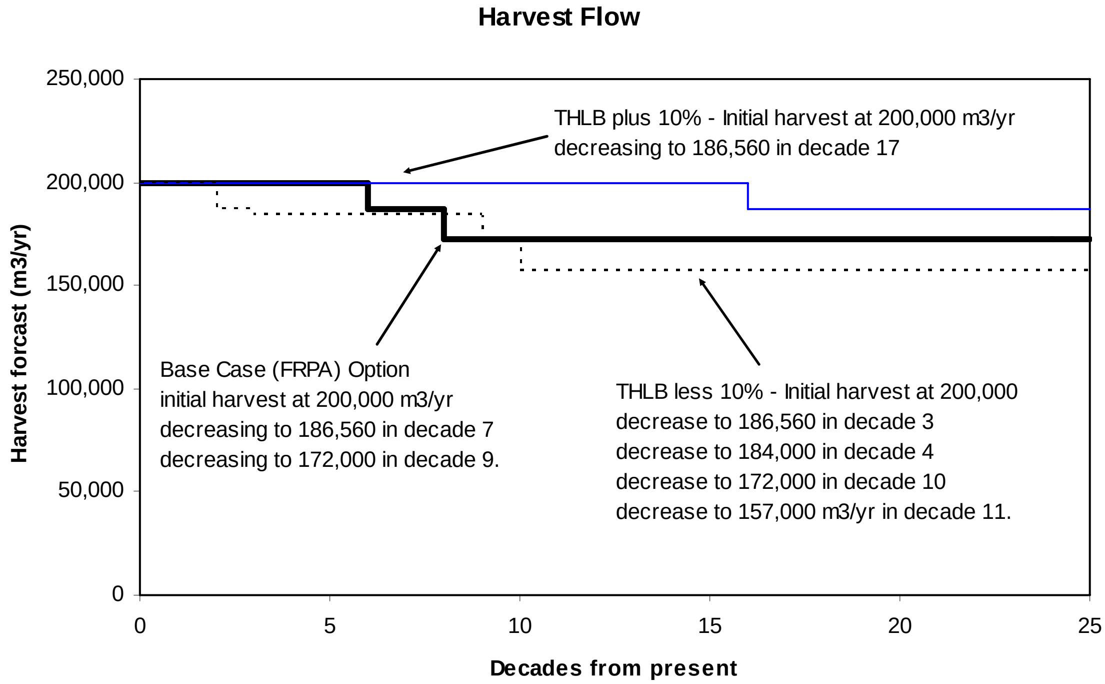


Figure 42. Timber harvesting land base increased and decreased by 10%

Results

Run	Short Term	Mid Term	Long Term
Timber Harvesting Land Base + 10%	The Base Case Option harvest level of 200,000 m3/yr is now maintained for 16 decades.	Higher than base case by 16%.	Increase in the long term harvest level of 8.5% to 186,560 m3/yr.
Timber Harvesting Land Base - 10%	The Base Case Option harvest level of 200,000 m3/yr is maintained for only 3 decades.	Lower than base case by 8.7%.	Decrease in the long term harvest level of 8.7% to 157,000 m3/yr.

The impacts are on both the existing natural stands (hence the short term wood supply is reduced) and the managed stands (hence the long term harvest level is impacted). The short term harvest level is either maintained for a longer time period (THLB increased) or reduced to a shorter time period (THLB reduced).

6.2 Yields from Natural and Managed Stands

Stand yields are a critical input into timber supply analysis. The short and mid-term timber supply is heavily influenced by the availability of timber in natural stands that make up the current growing stock. The current standing and mature timber provide all of the timber harvesting opportunities before managed stands come online for harvest. Figure 13 indicated that the harvest of natural stands diminishes very quickly by the 5th decade, at which time managed stands start to become more important to the timber harvest profile.

Uncertainty in timber yields can result from many different factors. Natural stand yields are based on the VDYP yield model, which predicts yields from stand attributes in forest inventory maps. Inaccuracies in the model, in decay estimates, or stand attributes can create uncertainties around actual stand yields.

Managed stand yields are based on the TIPSY growth model, which predicts yields from estimates of site index, and stand attributes such as species, density, and expected gains from planting stock grown from select seed. The over or under estimation of any of these factors can lead to uncertainties in the yields of these future stands.

Methodology

Run	How was it Analyzed?
Natural Stands + 10%	The yield associated with each natural stand analysis unit was increased by 10%.
Natural Stands - 10%	The yield associated with each natural stand analysis unit was decreased by 10%.
Managed Stands + 10%	The yield associated with each existing managed and future managed stand analysis unit was increased by 10%.
Managed Stands - 10%	The yield associated with each existing managed and future managed stand analysis unit was decreased by 10%.

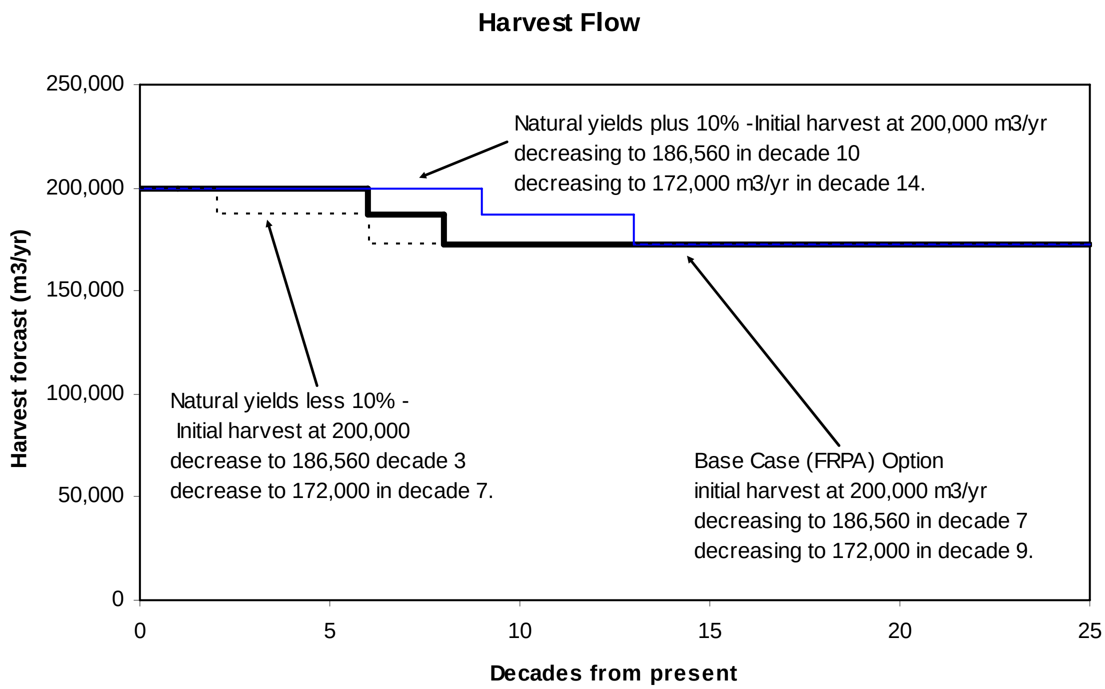


Figure 43. Natural stand yields increased and decreased by 10%

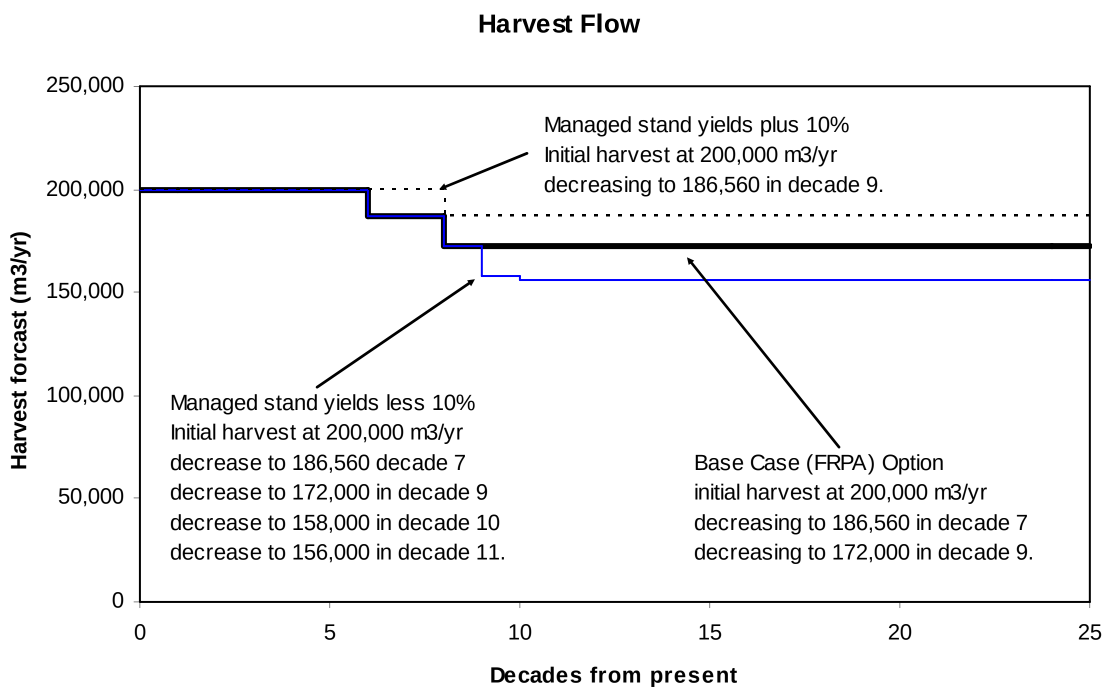


Figure 44. Managed stand yields increased and decreased by 10%

Results

Run	Short Term	Mid Term	Long Term
Natural Stands +10%	The Base Case Option harvest level of 200,000 m3/yr is maintained for 9 decades.	Base Case harvest level of 185,560 m3/yr is extended to decade 13.	No change.
Natural Stands -10%	The Base Case Option harvest level of 200,000 m3/yr is maintained for 2 decades.	Base Case harvest level of 185,560 m3/yr is shortened to decade 6.	No change.
Managed Stands +10%	The Base Case Option harvest level of 200,000 m3/yr is extended to decade 8 (from 6).	Higher than base case by 8.5%	Increase in the long term harvest level of 8.5% to 186,560 m3/yr.
Managed Stands -10%	No change.	Lower than base case by 9.3%	Decrease in the long term harvest level of 9.3% to 172,000 m3/yr.

6.3 Minimum Harvest Ages

Uncertainty around the age that stands become merchantable for harvest is linked to both our ability to predict the future growth of stands and our ability to understand future conditions that will define merchantability (markets / products). The large majority of minimum harvest ages used in the base case scenario were based on achieving 95% of the stands maximum mean annual increment (MAI). This age almost always delivered the minimum stand and log requirements (vol/ha, avg dbh) but these economic criteria occasionally did push the harvest ages higher. It is important to note that minimum harvest ages are only meant to approximate the time when a stand first becomes merchantable, and that harvesting can and does occur well beyond these ages in the model.

The use of minimum harvest ages associated with maximum MAI's tends to optimize long term harvest levels, but also allowing stands to be harvested at the min harvest age set, provides flexibility in the transition from short term to long term harvest levels. The transition from short to midterm harvest levels in the TFL is heavily influenced by when managed stand volumes become available in significant quantities. It is unknown if there are more appropriate minimum harvest ages than what those used in the base case, so sensitivity runs have been completed to explore the impact of both higher and lower ages.

Methodology

Run	How was it Analyzed?
Min Harvest Ages decreased by 10yr	Minimum harvest ages for each AU were decreased by 10 years.
Min Harvest Ages increased by 10yr	Minimum harvest ages for each AU were increased by 10 years.
Min Harvest Ages based on mai	Minimum harvest ages were based only on achieving 95% of maximum m.a.i.
Min Harvest Ages based in minimum volume	Minimum harvest ages were based only on achieving the minimum volume rule (150 m3/ha, or 120m3/ha for Pl on slopes <45%).

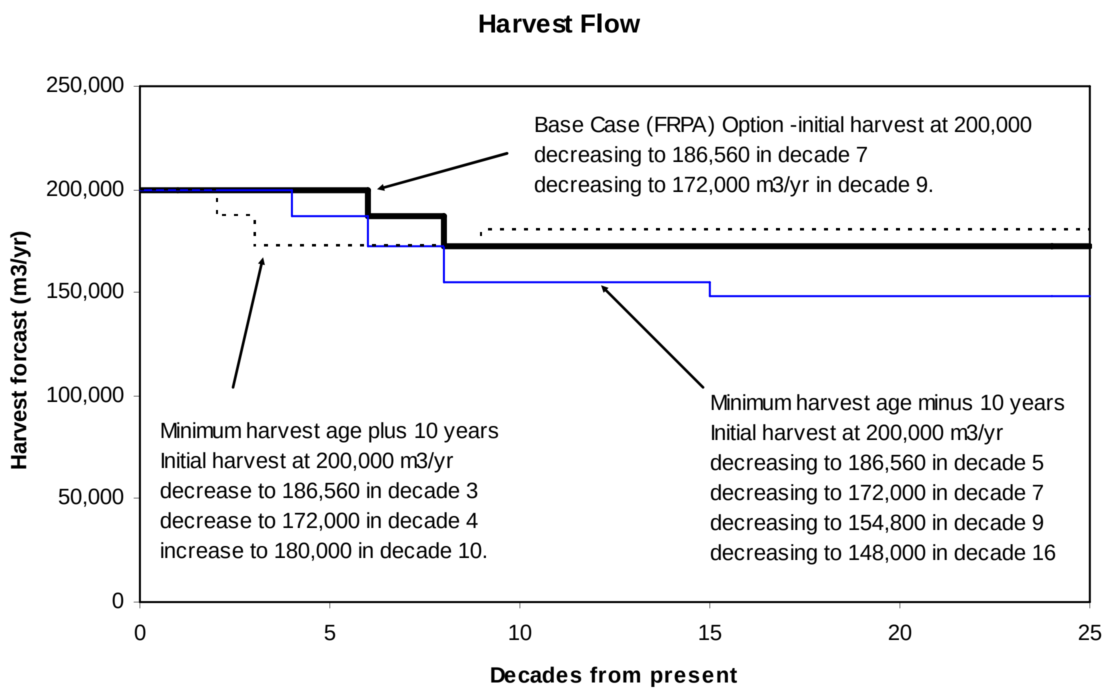


Figure 45. Minimum harvest ages increased and decreased by 10 years

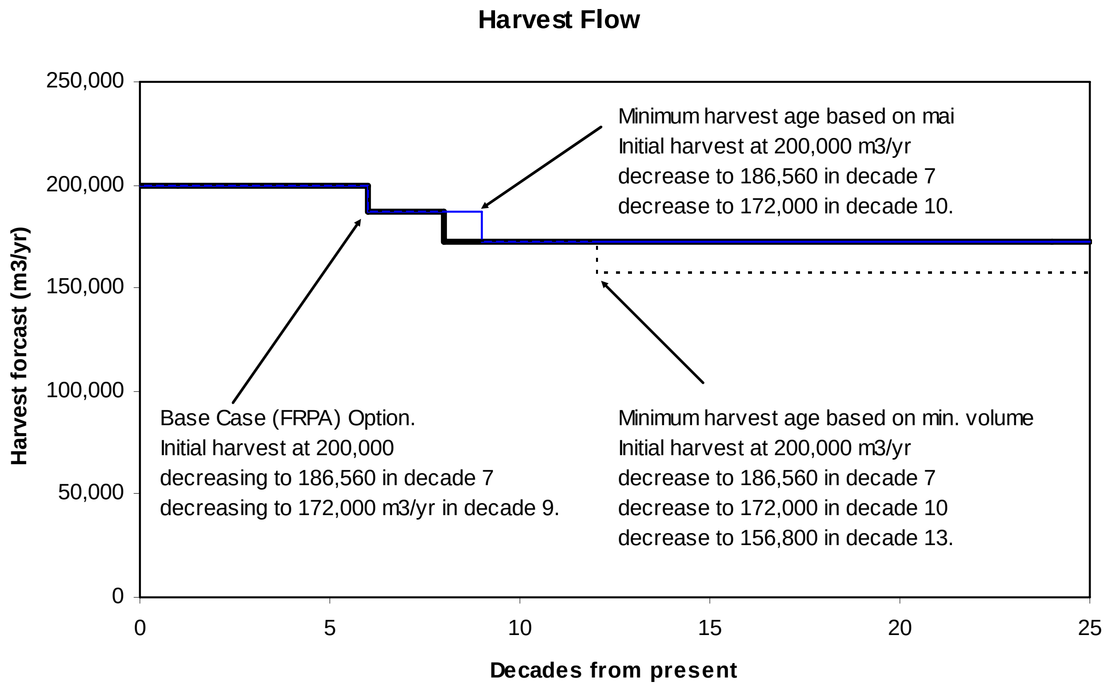


Figure 46. Minimum harvest ages based on mean annual increment and minimum volume

Results

Run	Short Term	Mid Term	Long Term
Min Harvest Ages decreased by 10yr	The Base Case Option harvest level of 200,000 m3/yr is maintained for 4 decades (from 6)	Lower than base case by 10.5%.	Decrease in the long term harvest level of 14% to 148,000 m3/yr.
Min Harvest Ages increased by 10yr	The Base Case Option harvest level of 200,000 m3/yr is maintained for 2 decades (from 6).	Higher than base case by 4.7%.	Decrease/Increase in the long term harvest level of 4.7% to 180,000 m3/yr.
Min Harvest Ages based on 95% of max mai	No change.	Very small, extend the base case harvest level of 186,560 to decade 9 (from 8).	No change.
Min Harvest Ages based in minimum volumes	No change	No change.	Decrease in the long term harvest level of 8.8% to 156,800 m3/yr.

The base case forecast is sensitive to both increases and decreases in minimum harvest ages. Increased harvest ages reduce the availability of stands in the midterm but then increases the long term harvest level because stands are harvested closer to culmination age.

Decreases in the minimum harvest age theoretically result in additional flexibility in the transition from short to mid term harvest levels because more managed stand volume is available earlier. However, the harvest priorities (such as pine versus other species) cause the model to choose stands much earlier than their culmination of mean annual increment (CMAI). This movement away from CMAI is so significant that it results in a significant decrease in both the mid- and long-term harvest level. In turn, this requires a reduction in the harvest in early decades (starting in decade 5) to accommodate a gradual reduction in harvest level from the initial harvest to the mid- and long-term harvest.

Basing minimum harvest ages on minimum volume criteria resulted in a reduction in minimum harvest ages for many analysis units (the majority were originally based on mai.) These younger ages resulted in further movement away from culmination ages and a subsequent decrease in the long-term harvest level.

Basing minimum harvest ages on 95% of MAI alone resulted in no significant change because most analysis units were originally based on this criterion.

6.4 Harvest Priorities

Harvest priorities help to establish the order in which stands will be scheduled for harvest by the model. The goal is to have the model harvest stands in a manner that is consistent with current management, such as MPB susceptible and attacked lodgepole pine. The harvest priorities used in MP9 are listed in Table 6 in order of highest to least priority.

Table 6. Harvest priorities assigned in the base case.

Priority	Rationale
Cable harvest blocks	Harvest cable ground and enforce a harvest profile during the 20 Year Plan (first two decades)
Twenty year Plan blocks	Harvest areas that TFL staff considered most likely to be harvested within the next 20 years.
Analysis Units	Harvest pine-leading (for MPB control) and partial cut stands (to catch the earliest opportunity for the next stand entry)
Oldest first	Capture high volume stands

This sensitivity looked at the effect of removing the priorities on cable blocks and species (Pl and partial cutting). This sensitivity has the net effect of increasing the emphasis on the oldest-first priority.

<u>Methodology</u>

Run	How was it Analyzed?
No cable block harvest priority, and no stand type harvest priority.	Apply only the Twenty Year Plan block priority, and then the oldest first priority.
Same as above, establish a non-declining, even flow harvest level.	Same as above. Determine the non-declining even flow harvest level rather than starting at the base case starting level of 200,000 m3/yr.

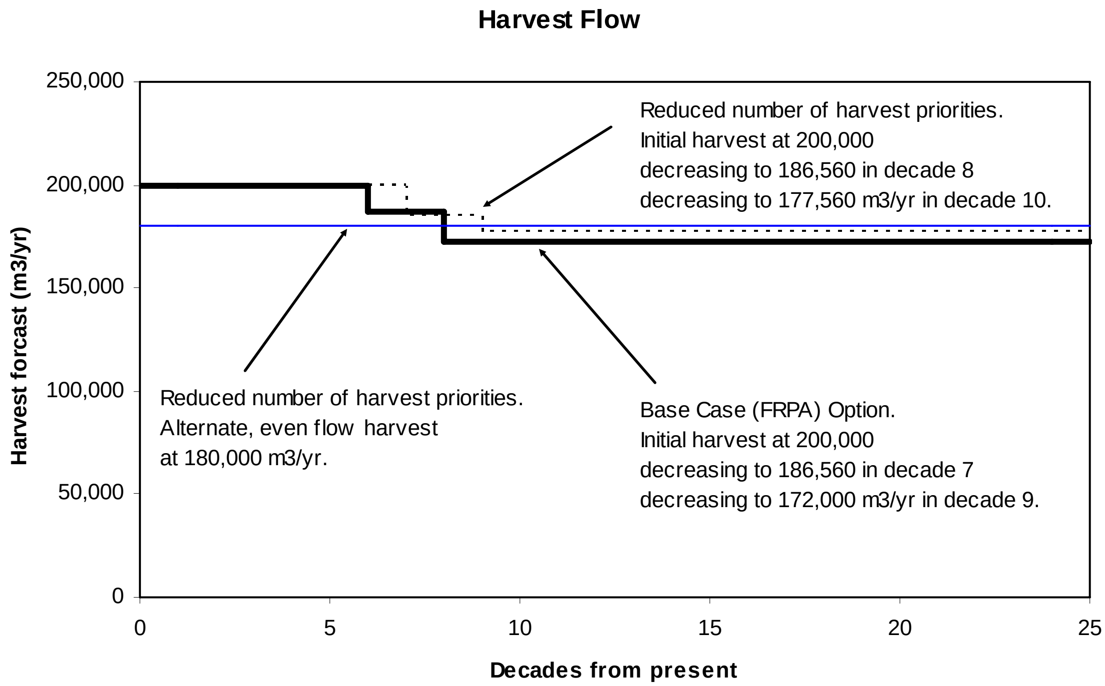


Figure 47. Alternative Harvest Flows Based on Fewer Harvest Priorities

Results

Run	Short Term	Mid Term	Long Term
Reduced number of harvest priorities. No cable block harvest priority, and no stand type harvest priority.	The Base Case Option harvest level of 200,000 m3/yr is maintained for 1 more decade.	Extend the base case mid term harvest of 186,560 m3/yr by one more decade.	Increase in the long term harvest level of 3.2% to 177,560 m3/yr.
Same as above, establish a non-declining, even flow harvest level.	Harvest flow of 180,000 m3/yr is 4% above base case non-declining even flow.	Harvest flow of 180,000 m3/yr is 4% above base case non-declining even flow.	Harvest flow of 180,000 m3/yr is 4% above base case non-declining even flow.

An increased harvest priority on oldest first extends the short-term harvest level by one decade. The long-term harvest level is increased 3.2% above the base case long-term harvest level. This indicates that the pine and cable priorities limit the models ability to turn over old stands and ensure harvesting occurs at or near culmination ages. The introduction of these operational realities has ensured that the base case flow is more consistent with what can be achieved on the ground.

6.5 Regeneration Delays

Regeneration delay is the length of time between timber harvesting and stand re-establishment. Regeneration delays can influence harvest forecasts by impacting the length of time that it takes to meet green-up requirements and/or minimum harvest ages. The trend in the TFL has been that regeneration delays are getting shorter as the licensee regenerate sites quickly after harvest and relies less on natural regeneration. In the base case, most stands have been modeled with a 2 year regeneration delay. This sensitivity examines the risk of stands taking longer than 2 years, on average, to establish in the TFL.

Methodology

Run	How was it Analyzed?
Increased regeneration delay.	Analysis units in the base case were changed from a 2 year regeneration delay to 4 years.
Decreased regeneration delay.	Analysis units in the base case were changed from a 2 year regeneration delay to a 1 year regeneration delay.

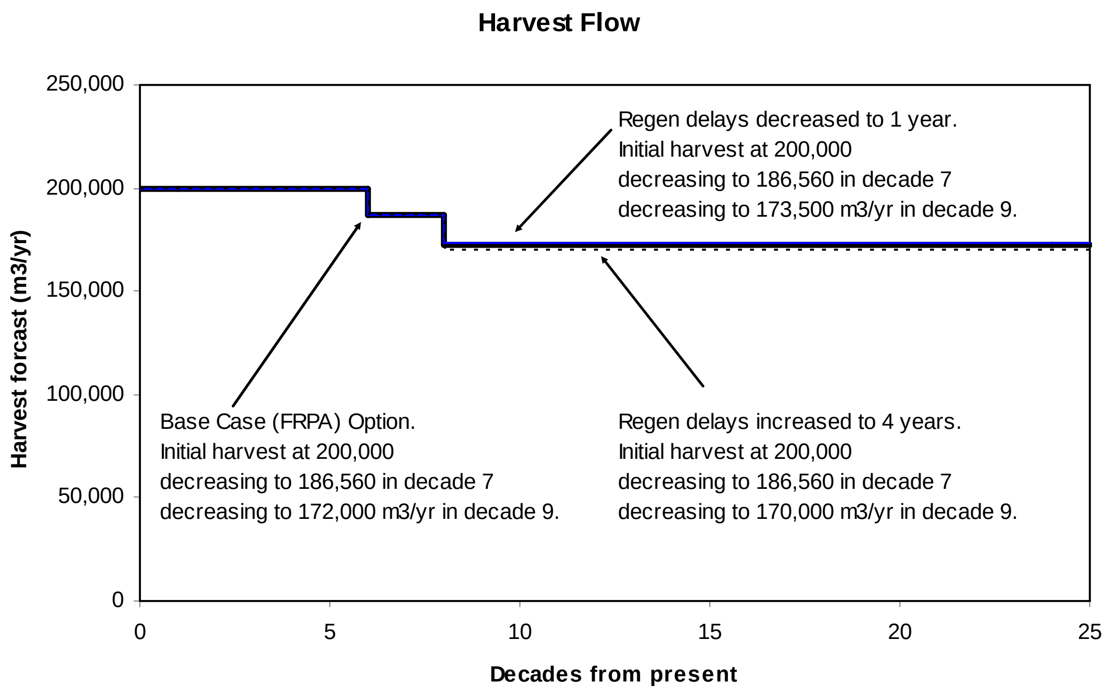


Figure 48. Changes in regeneration delays

Results

Run	Short Term	Mid Term	Long Term
Increased regeneration delay.	No change.	No change.	Decrease in the long term harvest level of 1.2% to 170,000 m3/yr.
Decreased regeneration delay.	No change.	No change.	Increase in the long term harvest level of 0.9% to 173,500 m3/yr.

The impact of either increasing (by 2 years) or decreasing (by 1 year) has no impact on short or midterm flow and very small impacts to long term harvest levels.

6.6 Gains from Select Seed and SIBEC site index adjustment

1) Use of select seed - As required by legislation, the TFL uses the best genetic quality seed and vegetative material available for regeneration. The use of select seed from tree breeding programs increases expected future volume yields. TIPSY yields for future managed stands were adjusted in the base case relative to past and current use of select seed (existing managed stands: Lw-1.1%, Pl 0.2%, Sx-1.9% and future

managed stands: Fd-14%, Lw-16%, Pl-7.1%, Sx-25.2%). Ongoing breeding programs in seed orchards are expected to continue to improve the quality of this select seed and deliver even higher gains than the seed planted today. The genetic gain sensitivity shown below examines the impact of removing all gains associated with class A seed from both the existing and future managed stands. This run demonstrates the risks associated with under-performance of select seed.

2) Managed Stand Site Productivity - The SIBEC site index adjustment factors significantly increased the site index of the landbase. This has the effect of increasing the yields for managed stands, and in turn reducing the time to reach minimum volume and diameter thresholds. The SIBEC sensitivity demonstrates the gains achieved when basing the managed stand yield curves on site indices that are based on SIBEC adjustments.

Methodology

Run	How was it Analyzed?
No SIBEC site index adjustment	All site index gains from the use of SIBEC site index adjustments were removed from the base case yield tables (TIPSY curves). Minimum harvest ages were adjusted to align with the new curves.
No gains from select seed	All gains from the use of select seed were removed from the base case yield tables. Minimum harvest ages were adjusted to align with the new curves.

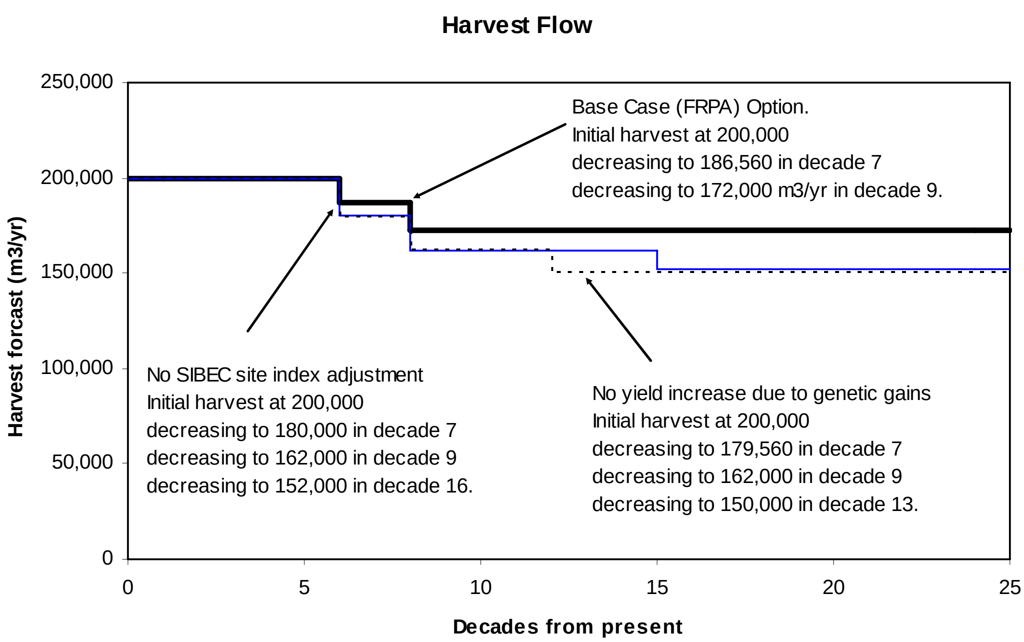


Figure 49. Harvest forecasts after removing SIBEC and GW gains

Results

Run	Short Term	Mid Term	Long Term
No gains from select seed	No change.	Lower than base case by 13%.	Decrease in the long term harvest level of 12.8% to 150,000 m3/yr.
No SIBEC site index adjustment	No change.	Lower than base case by 13%.	Decrease in the long term harvest level of 11.6% to 152,000 m3/yr.

When genetic gains are removed from yield tables, there is less volume available from managed stands in the mid and long term. Removal of the base case's projected genetic gains results in a 12.8% decrease in long-term harvest level.

When SIBEC site index adjustments are removed, the yield tables are reduced and there is less volume available from managed stands in the mid and long term. Removal of the base case's SIBEC adjusted site index factors results in a 11.6% decrease in long-term harvest level.

Both of these factors influence future managed stand yields, hence they do not effect the short term harvest flow which is largely influenced by the availability of natural stands.

7.0 SFMP (FSC) Option

Tembec's approach to forest management on the TFL is consistent with their Sustainable Forest Management Plan (SFMP) and the Forest Stewardship Council (FSC) certification standard. This management scenario reflects Tembec's desired management regime for the TFL. Implementation of Tembec's current vision of FSC certification practices is described in their SFMP. This scenario attempts to illustrate the timber supply impacts of these practices.

The effect of applying this management scenario is that the THLB for the SFMP (FSC) Option is 5,212 ha smaller (10.2 %) than the landbase in the Base Case (FRPA) Option. The reduction is primarily due to larger netdowns for riparian, rare/uncommon ecosystems and High Conservation Value Forests (HCVF's).

The SFMP Option also applied the full old seral targets in low BEO areas starting in the first rotation, and additional visual quality objectives around key recreation lakes. These differences can act to reduce the volume available of short and mid-term wood.

Methodology

Run	How was it Analyzed?
SFMP (FSC) Option	New THLB netdowns based on FSC riparian criteria, rare / uncommon ecosystems and High Conservation Value Forests were applied. Low BEO areas had full old seral targets applied for the entire planning horizon (spatial OGMAs representing full targets were applied for the first 80 yrs and then % constraints were used.). Additional areas of VQO's were also applied around key recreation lakes. For more details on implementation, see section 11.1 in the data package. Three harvest flows were examined: two with different initial harvest levels, and the non-declining even flow harvest level.

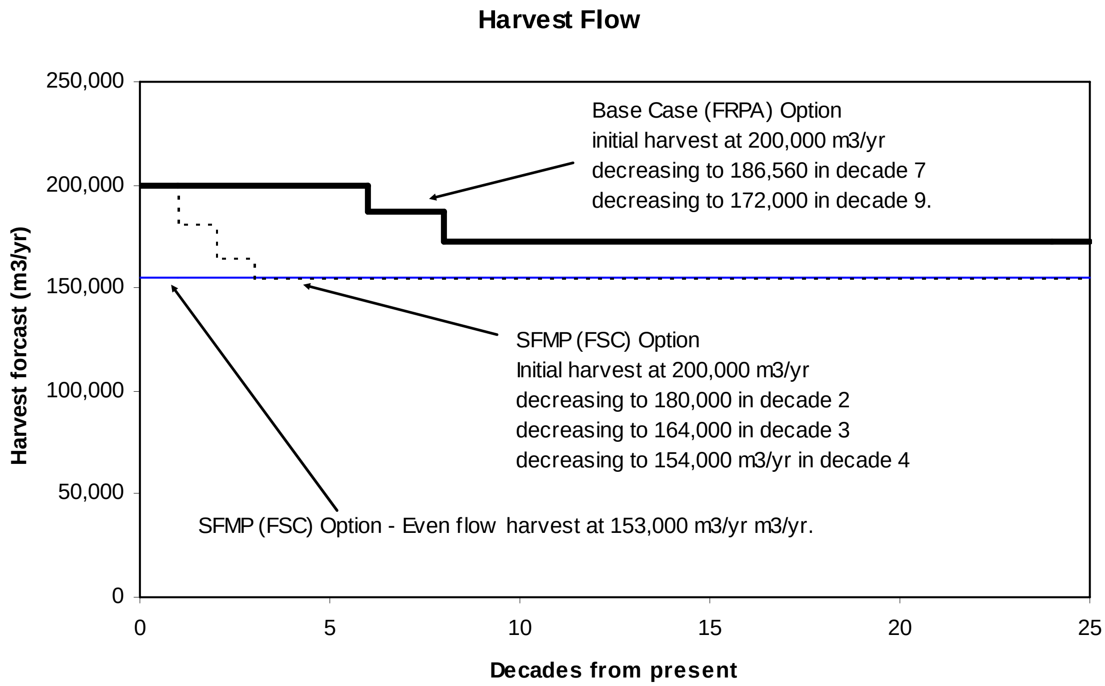


Figure 50. SFMP (FSC) Option harvest flows – 200 k m3/yr initial harvest

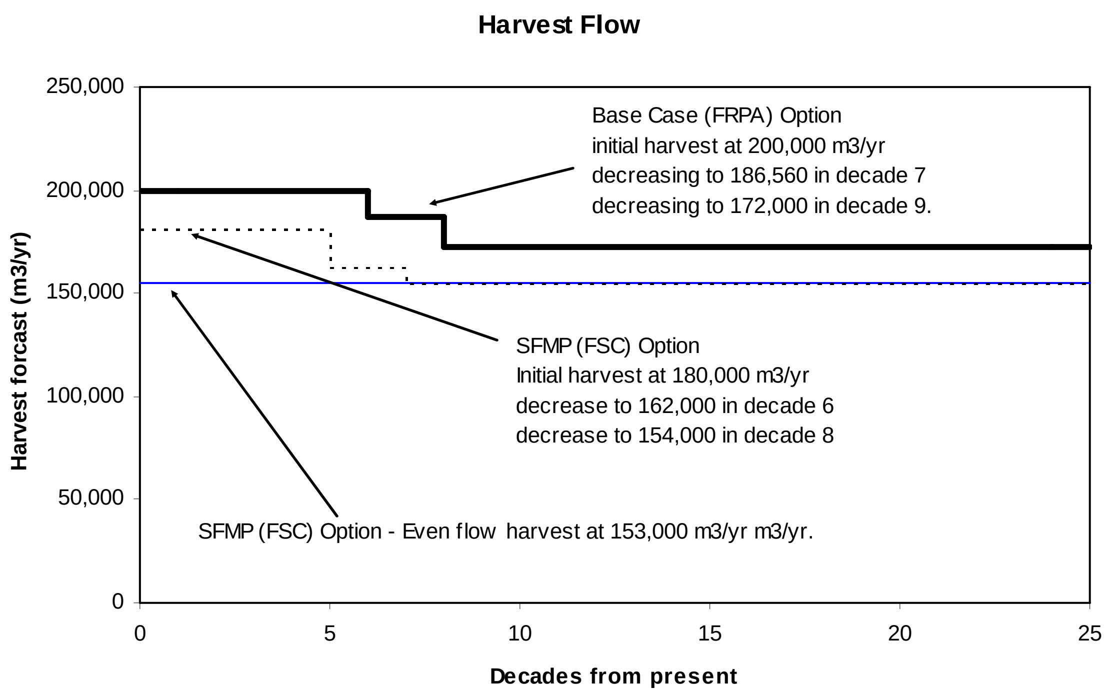


Figure 51 SFMP (FSC) Option harvest flows – 180 k m3/yr initial harvest

Results

Run	Short Term	Mid Term	Long Term

SFMP Option Initial harvest at 200,000 m3/yr	The Base Case Option harvest level of 200,000 m3/yr is maintained for only 1 decade before decreasing 10% each decade to reach a long term harvest flow of 154,000 m3/yr (10.5% below the base case).	Lower than base case by 17.5% (at decade 8).	Decrease in the long term harvest level of 10.5% to 154,000 m3/yr.
SFMP Option Initial harvest at 180,000 m3/yr	The Base Case Option harvest level of 180,000 m3/yr is maintained for only 5 decades before decreasing 10% to 162,000, then decreases to 154,00 m3/yr in decade 8 (10.5% below the base case).	Lower than base case by 17.5% (at decade 8).	Decrease in the long term harvest level of 10.5% to 154,000 m3/yr.
SFMP Option Non-declining, even flow harvest	The SFMP Option even-flow harvest level is 153,000 m3/yr (11.6% below the base case non-declining even harvest flow.)	Lower than base case by 11.6%.	Lower than base case by 11.6%.

The SFMP Option has a reduced harvest flow due to the smaller THLB (10%) and the increased area impacted by OGMA in the short and midterm. The long term flow is very similar to the -10% THLB sensitivity, while the short term flow is far worse. The lockup of the additional OGMA area in the short and midterm, combined with the smaller THLB significantly reduced available mature timber in the short term.

Lowering the initial harvest rate to 180k allows a more uniform harvest flow during decades 2 through 7 (Figure 51).

The harvest characteristics such as growing stock (Figure 52), average harvest age (Figure 53), average harvest volume (Figure 54) and harvest area (Figure 55) for the SFMP Option with an initial harvest rate of 200 k m3/year are provided below. These charts display many of the same characteristics as the Base Case Option harvest characteristics.

Note that:

- the growing stock volumes are lower than the Base Case (FRPA) growing stock volumes because the SFMP (FSC) Option has a smaller THLB,
- the spike in harvest age in decade 9 is due to freeing up the OGMAs after the first rotation. This spike is more pronounced in the SFMP Option than in the base case, due to greater OGMA areas.
- the increase in the NHLB (and decrease in THLB) is evident in the age class distribution graph (Figure 56)

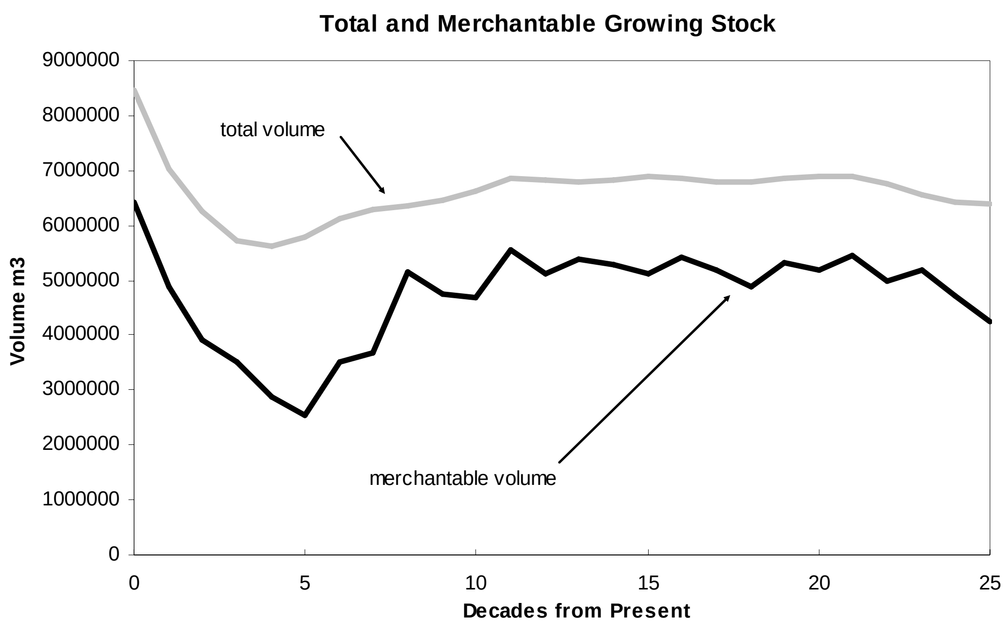


Figure 52. TFL 14 SFMP Option harvest forecast – THLB growing stock

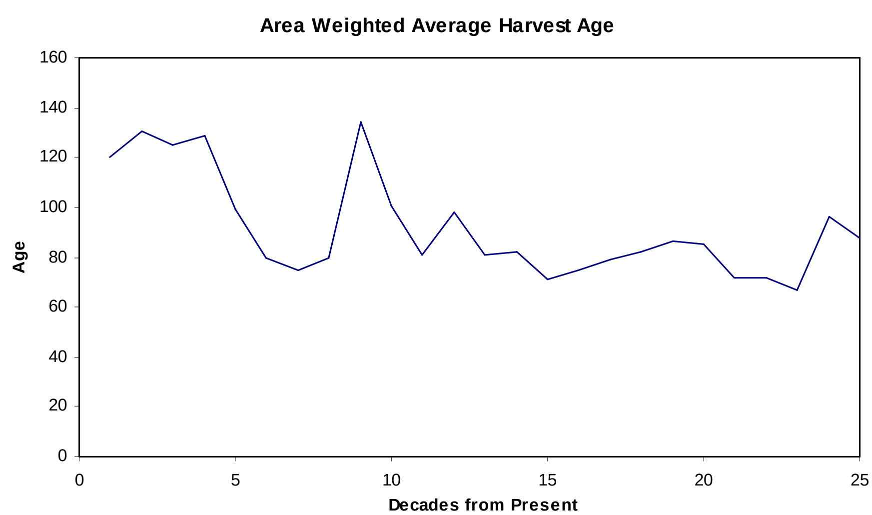


Figure 53. TFL 14 SFMP Option harvest forecast - average harvest age

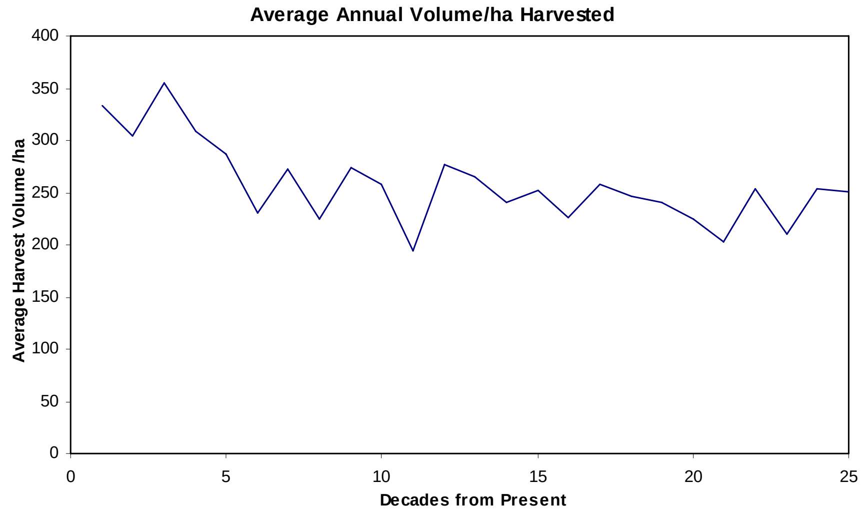


Figure 54. TFL 14 SFMP Option harvest forecast - average harvest volume

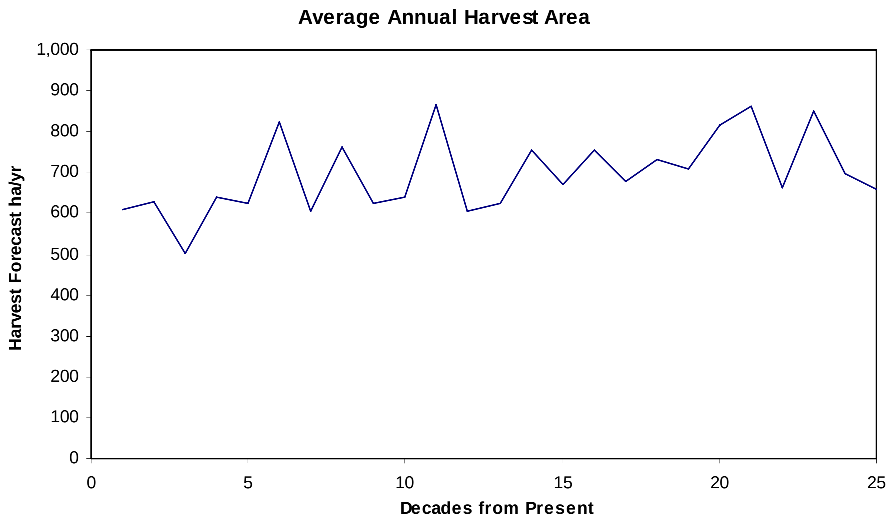


Figure 55. TFL14 SFMP Option harvest forecast - harvest area

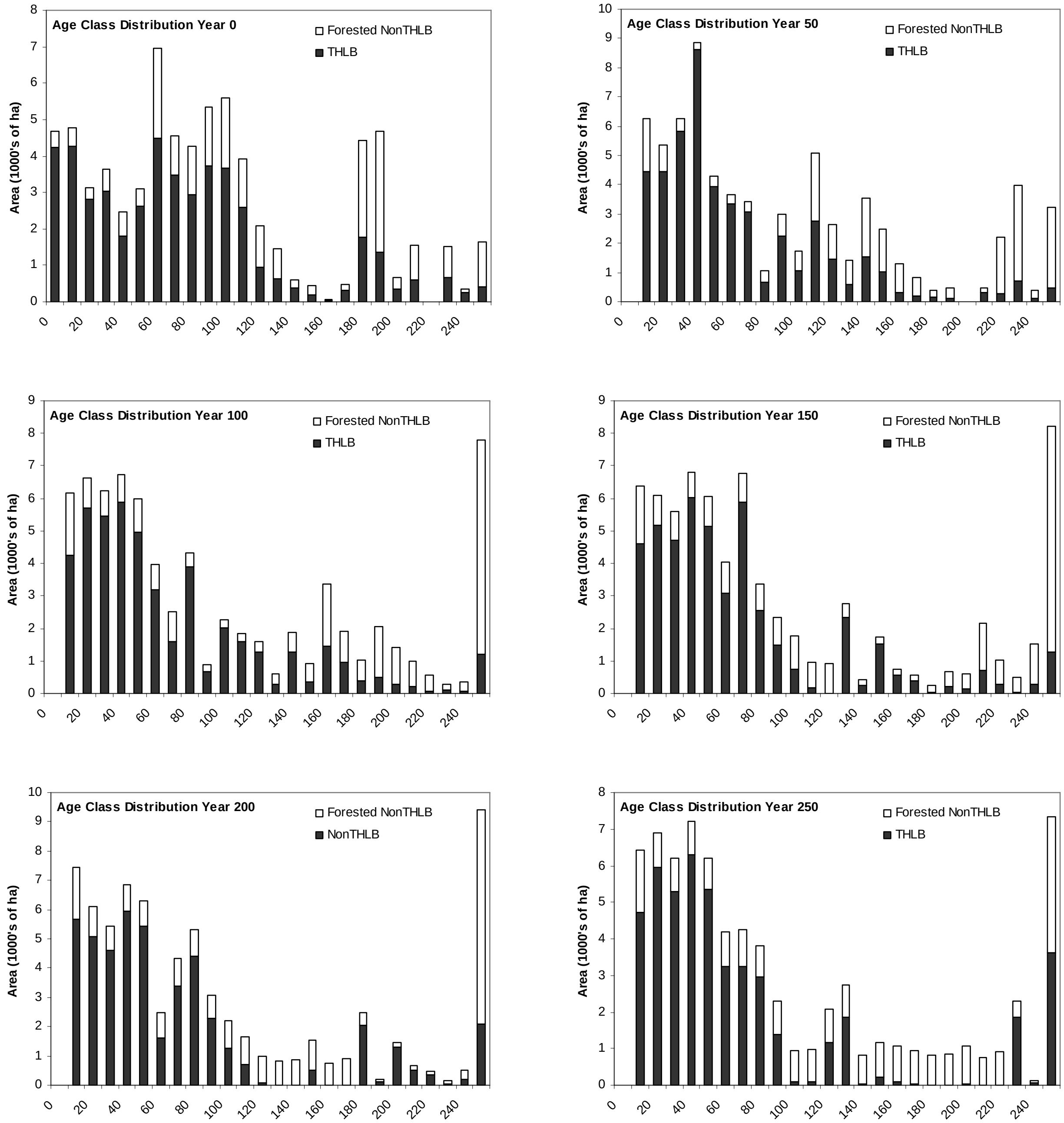


Figure 56. TFL 14 SFMP Option harvest forecast – age class distribution

8.0 Mountain Pine Beetle Option

The base case analysis includes a high harvest priority on young pine stands in order to emulate current practices around mountain pine beetle issues in the TFL. Current practices are attempting to control beetle populations and salvage mortality where it occurs. MPB populations are expanding quickly throughout the province and could cause significantly mortality if they are not held in check by management practices and/or environmental factors. This management scenario is designed to explore the implications of a large outbreak occurring and causing significant mortality in the TFL. The outbreak is assumed to kill 92% of the susceptible pine volume in stands with >40% Pl in the TFL over the next 15 years.

Methodology

Run	How was it Analyzed?
Mountain Pine Beetle Outbreak	Pine stands are attacked and killed by a catastrophic MPB infestation that starts in year 1. The majority of the MPB-attacked pine volume on the THLB is salvaged. Harvest levels over the first 15 years of the planning horizon are increased to accommodate the salvage. Salvaged stands are planted and regenerate to Managed stands. Non-salvaged stands are killed and regenerate back to natural stands after a 10 year regeneration delay.

Modeling was simplified to these steps

- Determine the volume of susceptible pine within the THLB in stands >= 60 years old that have over 40% pine. Assume 92% of this volume will be attacked and killed by MPB (4.4 million m3). Divide that further into three 5-year periods with mortality of: period 1=25%, 2=40%, 3=27%.
- Estimate the pine volume that is killed within the THLB that will not be salvaged because it has too little pine (0.33 million m3)
- Estimate the pine volume killed within the NHLB that will not be salvaged (1.5 million m3)
- Assign stand polygons into their strata (THLB salvaged, THLB not-salvaged, and NHLB) based on a priority order of: (a) stands must be over 60 years old, a higher priority was assigned to stands with (b) higher pine percentage (%), and (c) higher pine volume (m3).
- Increase the harvest rate for a period of 15 years to capture the volume within ‘salvageable’ stands. This worked out to approximately 304,000 m3/yr after some trial-and-error accounting for the growth of stands during periods 1 and 2.
- Implement the beetle salvage and mortality as a fixed schedule (harvest or succession), within the first 15 years. Constraints remain on but do not impede fixed schedule treatments.
- Model the remainder of the planning horizon interactively to determine the harvest flow.
- All non timber constraints were left in place and limit harvest starting in year 20.

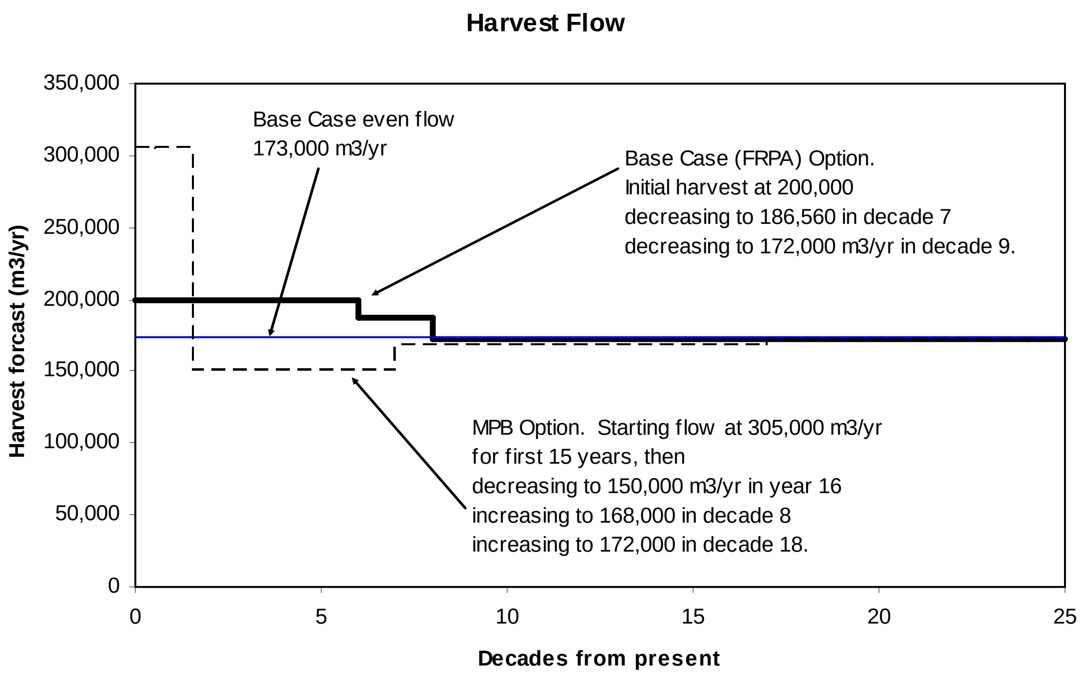


Figure 57. Mountain Pine Beetle Option harvest flows

Results

Run	Short Term	Mid Term	Long Term
Mountain Pine Beetle Outbreak	The Base Case Option harvest level of 200,000 m3/yr is increased by 52.5% for 15 years, then decreased to 150,000 m3/yr (33% below base case) until decade 7.	Lower than base case in the early mid-term by 33%, in the late mid-term by 24.3%.	No change (in the far long-term.)

The result is a very large increase in short term harvest levels to salvage the MPB-attacked stands on the THLB, followed by a decrease in harvest level below the current AAC (33% lower than the base case harvest flow). The harvest flow eventually recovers and matches the base case harvest flow in decade 18.

9.0 Summary and Recommendations

This analysis report presents a base case harvest flow with a stable short-term timber supply. Given the inputs and assumptions in the base case, the initial harvest of 200,000 m3/yr can be maintained for 6 decades before declining in decade 7 to 186,560 m3/yr, and then again in decade 9 to 172,000 m3/yr where it remains for the long term. These harvest levels are above the current AAC by 25%, 16.6%, and 7.5% respectively.

These harvest flows are higher than predicted in the last analysis, largely because the forest cover requirements have been significantly reduced (for example biodiversity requirements for mature forest are no longer required), and the yield curves for managed stands have increased. For example, yield curve curves are significantly increased due to the increased volume gains from selected seed use.

In order to assess the impacts of potential changes to modeling assumptions, and gain further understanding of the dynamics at work in the base case forecast, a series of sensitivity analyses were completed and are summarized below along with the results of the two management optional scenarios (FSC-SFMP, MPB).

Table 7. Summary of Sensitivity Analysis Results

Run	% Change to Harvest Forecast Decade			
	1	2-3	4-8	9-25
Timber harvesting land base increased by 10%	-	-	2.8%	12.1%
Timber harvesting land base decreased by 10%	-	-3.4%	-5.5%	-7.3%
Natural Stand yield increased by 10%	-	-	2.8%	2.9%
Natural Stand yield decreased by 10%	-	-3.4%	-7.1%	-
Managed stand yield decreased by 10%	-	-	-	-8.7%
Managed stand yield increased by 10%	-	-	2.8%	2.9%
Min Harvest Ages increased by 10yrs	-	-3.4%	-11.6%	4.4%
Min Harvest Ages decreased by 10yrs	-	-	-5.8%	-12.3%
Min Harvest Ages based only on mai criteria.	-	-	-	0.5%
Min Harvest Ages based only on min. volume	-	-	-	-6.8%
No species priority harvest – initial 200k m3/yr	-	-	1.3%	3.5%
Reduced Regeneration Delay	-	-	-	0.9%
Increased Regeneration Delay	-	-	-	-1.2%
No SIBEC site index adjustment	-	-	-1.3%	-9.2%
No Gains from Select Seed	-	-	-1.4%	-11.1%
SFMP (FSC) Option – initial 200k m3/yr harvest	-	-14.0%	-20.9%	-10.5%
SFMP (FSC) Option – initial 180k m3/yr harvest	-10.0%	-10.0%	-13.9%	-10.5%
Mountain Pine Beetle Outbreak	52.0%	-5.5%	-21.1%	-1.2%

Table 8 Comparison of non-declining, even-flow harvest levels

Scenario	Non-declining even flow (m3/yr)	Percent of Base Case Harvest
Base Case (FRPA) Option	173,000	-
Base Case – more oldest-first priority	180,000	+4%
SFMP (FSC) Option	153,000	-10%

Base case sensitivity analyses revealed that the short-term harvest level is very stable. No sensitivity analyses resulted in a drop in the first decade's harvest level, although numerous factors influenced the duration the initial harvest level could be maintained. The mid- and long-term harvest levels were sensitive to numerous assumptions as described below.

Uncertainties that altered the near-term harvest level (decades 2-3) were:

- changes to the size of the timber harvesting land base,
- changes to existing natural stand yields, and
- increases in minimum harvest ages (time it takes regenerated stands to become merchantable).

Uncertainties that altered the long-term harvest level by at least 3% were:

- changes to the size of the timber harvesting land base,
- changes to future managed stand yields,
- changes to minimum harvest ages (length of time it takes regenerated stands to become merchantable),
- the amount of select seed used and its genetic worth,
- SIBEC site index adjustments.

The Tembec SFMP (FSC) scenario resulted in a reduction in timber availability throughout the planning horizon because of increased cover constraints and a 10.2% reduction in THLB area. Management consistent with Tembec's SFMP would allow only one decade of harvest at the initial base case level (200k m^3/yr) before stepping down to a long term level 10.5% below that of the base case (154,000 m^3/yr). Other flow options for the SFMP scenario are 1) an initial harvest of 180,000 m^3/yr with significantly lengthened periods between harvest decreases before reaching the long term harvest level in decade 8, or 2) a non declining flow of 153,000 m3/yr.

The MPB scenario shows an increased harvest flow for the first 15 years (305,000 m^3/yr) because it attempting to capture the majority of the impacted Pl volume while it is still viable for sawlog production. The harvest then falls into a midterm trough for 65 year (150,000 m3/yr) before recovering to a long term level of 172,000 m^3/yr. If the initial harvest level had been left at the base case level, the midterm trough would have been worse because more THLB stands would have gone unsalvaged and had longer regeneration delays.

Tembec's preferred management option is reflected in their SFMP and is consistent with FSC certification standards. As implementation of the TFL 14 SFMP is quite recent (1-2 yrs), it was not used as the base case but it does represent current management intent on the TFL. As such, Tembec believes the new AAC for the TFL should be set based on the SFMP scenario results.

Improving upon the base information and assumptions used in this analysis will allow the next timber supply analysis to provide for improved estimates of harvest flow. Some recommendations for future work are:

- Update the stream classifications based on any ground data collected since the stream inventory was completed. This will improve the stream classifications and, in turn, confirm the FSC-based riparian netdowns. The FSC riparian netdowns are the single largest difference in netdowns between the base case and the SFMP Option.

- Confirm, on logged blocks, that the silviculture information that is feeding the forest cover database is being properly represented in the forest cover database. This will help to identify partial cut stands in the inventory, and allow better representation in the next analysis.

- Improve the estimate of area lost to roads, trails and landings (RTLs). The estimate used in this analysis (5%) is lower than values that have been assumed in the adjacent TSAs. This was a concern to government staff. While our estimate is supported by a much more complete road database than within the adjacent TSAs, improvements can be made in determining the disturbed width, and the percentage yield reduction for the disturbed width for each class of road or trail.

Appendix A – Acronyms

AAC	Allowable Annual Cut
Analysis	Timber Supply Analysis
AU	Analysis Unit
BCTS	BC Timber Sales (Formerly Small Business Forest Enterprise Program)
BEC	Biogeoclimatic Ecosystem Classification
BEO	Biodiversity Emphasis Options
BGB	Biodiversity Guidebook
BL	Balsam Fir
CF	Chief Forester
CFLB	Crown Forested Land base
CORE	Commission on Resources and Environment
CW	Western Red Cedar
DBH	Diameter at breast height (1.3m)
DEO	Designated Environment Official
DFO	Department of Fisheries and Oceans
DM	District Manager
ESA	Environmentally Sensitive Area
FD	Douglas Fir
FES	Forest Ecosystem Specialist
FIP/FC1	Old Forest Cover Digital Files
FMER	Fire Maintained Ecosystem Restoration
FIZ	Forest Inventory Zone
FPC	Forest Practices Code
FRBC	Forest Renewal British Columbia
FSSIM	Forest Service Simulation Model
GIS	Geographic Information System
HLPO	Higher Level Plan Order
HW	Western Hemlock
IWAPS	Interior Watershed Assessment Procedure System
KBLUP-IS	Kootenay Boundary Land Use Plan – Implementation Strategy
KBHLPO	Kootenay Boundary Higher Level Plan Order
LA	Alpine Larch
LRMP	Local Resource Management Plan
LTHL	Long Term Harvest Level
LU	Landscape Unit
LW	Western Larch

MoF	Ministry of Forests
MSRM	Ministry of Sustainable Resource Management
MSY	Maximum Sustained Yield
MSYT	Managed Stand Yield Tables
MWLAP	Ministry of Water, Land and Air Protection
NCC	Non-Commercial Cover
NDT	Natural Disturbance Type
NP	Non Productive
NRL	Non-Recoverable Losses
NSR	Not Satisfactorily Restocked
NSYT	Natural Stand Yield Tables
OAF	Operational Adjustment Factor
OGMA	Old-Growth Management Areas
PA	Whitebark Pine
PEM	Predictive Ecosystem Mapping
PL	Lodgepole Pine
PSP	Permanent Sample Plot
PSYU	Public Sustained Yield Unit
PW	White Pine
PY	Ponderosa Pine (tree species) or person years (economics)
RIC	Resources Inventory Commission
RM	Regional Manager
RMZ	Riparian Management Zone
ROS	Recreation Opportunity Spectrum
RTEB	Resource Tenures and Engineering Branch
THLB	Timber Harvesting Land base
TIPSY	Table Interpolation Program for Stand Yields (growth and yield model)
TFL	Tree Fam Licence
TSA	Timber Supply Area
TSR	Timber Supply Review
UREP	Use, Recreation, and Enjoyment of Public
VDYP	Variable Density Yield Predictor (growth and yield model)
VEG Ht	Visually Effective Greenup Hieght
VQO	Visual Quality Objective

Appendix B – Data Inputs and Modeling Assumptions

Changes from the April 25, 2007 Data Package v2.0 (Accepted on May 8, 2007)

- Harvest zone added (priority harvest) on cable with maximum cable harvest to approximate 15% cable during decade 1 and 20% cable harvest during decade 2.
- The partial cut analysis units were split into a series of analysis units, based on the stands present age. This prevented a stand from being entered repeatedly each successive period (generally 10 years) instead of the intended entry each 30 years.