TFL 33
Sicamous Tree Farm License

Incremental Silviculture Strategy (Interim)

-- Final Version 3.0 --

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British Columbia

Ministry of Forests

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Forest Renewal BC

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Preface

About the Interim Strategy

The terms of a service agreement between Forest Renewal BC (FRBC) and the BC Ministry of Forests (MoF) require the MoF to develop, and FRBC to fund, what is essentially an incremental silviculture strategy. This document addresses this contractual requirement.

Incremental silviculture is part of a suite of strategies, which together may influence the future quality and quantity of habitat and timber supply. This strategy document broadly analyzes the full potential range of silviculture activities in order to create a context for an incremental silviculture strategy.

An incremental silviculture strategy should not be confused with the allowable annual cut (AAC) determination process. AAC's are based on actual practice and current information at the time of the determination. This strategy, on the other hand, is about creating a future state of our forests. The degree to which the strategy proves appropriate and is achieved may influence future, but not necessarily present, AAC determinations.

This strategy is founded on readily available information and the knowledge of forestry professionals. It is intended as an interim strategy until a more in-depth analysis-based review is completed. In the case of TFL 33, MP #8 was approved in 2000, and a new AAC was set for the license. Therefore, this interim strategy will be useful in providing background for the development of MP #9.

Acknowledgments

The project is being coordinated through Mr. Ron Newman of the Ministry of Forests, Kamloops Forest Region. Forest Renewal BC is providing funding. The participation of the following representatives at the Federated Co-operatives (FCL) silviculture strategy working session is gratefully acknowledged:

Ministry of Forests	**Federated Co-operatives Ltd.**
Jim Wright – Salmon Arm District	Kevin New
	Jeff Lipsett

The format of this document, and the methodology to be employed in the upcoming working session, are based on previous work completed for the Strathcona TSA by L. P. Atherton & Associates, and Cortex Consultants Inc.

Strategic Summary

General Strategy

Overall, the focus of the silviculture strategy is to increase the proportion of premium peeler and sawlogs, but not at the expense of a reduction in the annual harvest.

Working Targets

Quantity: Maintain the current AAC, and if possible increase it to historic levels.

Quality: Manage existing and future managed stands to increase the proportion of Douglas-fir peeler logs above the current 30%. Preferred species are Douglas-fir, then western redcedar, then western larch, then spruce, then western white pine, then lodgepole pine.

Product Objectives

Quality Class	Species	Characteristics
Premium log (peeler)	Douglas-fir	35 – 45cm logs, knots max 6cm, 8.7 cm core
Poles	Western redcedar	9.1m length, 15.2cm top, 28cm butt. Specific knot, scar, rot, sweep rules.
Sawlog	Douglas-fir, larch, w. redcedar, spruce, lodgepole pine	20.5cm

Major Silvicultural Strategies

Currently Identified

The following points represent some potential silviculture strategies, which have been identified for TFL 33 in the existing management plan (MP #8) and by Federated Co-op staff.

1. Improve plantation yields through the use of genetically improved stock.
2. Optimize selection of species in managed stands.
3. Explore opportunities to achieve product specifications with the highest value.
4. Achieve yield gains through fertilization.
5. Maintain health of all stands through prevention and control.

Possible Additions

The following are additional strategies, which could be explored.

1. Shorten regeneration delay.
2. Accelerate early height growth to reduce green-up period.
3. Reduce minimum harvest ages for managed stands
4. Prune to increase the future supply of premium logs.

Habitat Strategies

1. Maintain forage in mule deer winter range.
2. Provide coarse woody debris in grizzly bear habitat.
3. Provide old forest opportunities (forage and thermal cover) for caribou.

Information Requirements

The following information is vital to confirming or initiating the above strategies:

1. Improve inventory data (species, density, well-spaced stems, treatment history and some measure of performance) for immature stands in order to identify candidate areas for incremental silviculture programs and to provide inputs for managed stand yield tables.
2. Improve productivity estimates for managed stands (TEM/PEM, site index, managed stand yield tables).
3. Verification of operational adjustment factors (OAFs).
4. Verification of genetic gains in managed stands.
5. Development of strategies for growing cedar poles.
6. Confirmation of habitat areas for caribou.
7. Confirmation of old growth management areas.
8. Localize strategies to enhance food supplies other than Douglas-fir for mule deer

Introduction

Description of License

FCL acquired TFL 33 with the purchase of Shuswap Timbers in 1965. The official transfer of quota followed in 1970. As a result of the amalgamation, milling facilities were closed in Sicamous and all volume was subsequently directed to Canoe. TFL 33, although small in comparison to other TFL's in the province, has played an important role in the past 34 years in providing raw material as part of the licensed quota attributable to FCL.

All-weather roaded access to the license was completed in 1973 and harvesting was concentrated at the higher elevations of the license. During the term of M.W.P. #5, attention shifted to the lower elevations where the predominant cut was in first pass. Operations during M.W.P. #6 and MP #7 varied between the lower and upper elevations.

The current TFL 33 management plan (MP #8) was approved and a new AAC was assigned in December 2000. It established a new AAC of 21,000 m3/year for the next five years.

Methodology

This strategy was prepared through the following process:

1. Prior to a district working session, Timberline Forest Inventory Consultants and JS Thrower & Associates prepared a preliminary draft of this document, summarizing available information relevant to a strategy and identifying opportunities to improve the future quantity and quality of timber supply.
2. A district working session was held on February 14, 2001 in Canoe, attended by representatives of the MoF and Federated Coop staff. Bill Kuzmuk of Timberline and Mary Lester of JS Thrower facilitated the session. The objective of the session was to review potential opportunities identified in the draft document along with others that may arise. The outcome of the session will include a silviculture regime table, complete with priorities.
3. The results of the working session have been incorporated into this document along with attendant forecasts of future harvest quantity and quality and of job outcomes.
4. After review by the MoF, MoELP, Little Shuswap and Spallumcheen Indian Bands and the licensee, a completed strategy document will be submitted to the MoF.

Higher Level Goals and Objectives

This section will document higher level goals and objectives relevant to an incremental silviculture strategy for the TFL.

Provincial Goals

Fundamentally, government's goals can be characterized as:

- sustainable use;
- community stability; and
- a strong forest sector. (MoF, 1999a)

Provincial Objectives

Until provincial targets for timber quantity and quality are established, management unit strategies are to consider the following interim provincial strategic objectives (MoF, 2000). Incremental silviculture strategies must also be in keeping with higher level plans under the Forest Practices Code.

Objective 1: Maintain current harvest levels as long as possible without creating disruptive shortfalls in future timber supply.

Objective 2: Create a long term timber supply capable of supporting a steady long term provincial harvest level similar to current levels.

Objective 3: Minimize the interim shortfall in provincial harvest anticipated before a steady long term timber supply is achieved.

Objective 4: Create a long term timber supply, which will enable the timber quality profile of future harvests to be the same or better than the current profile.

It is recognized that not every management unit has the same capability to contribute to these interim objectives. Further, it is recognized that these objectives may not be attainable at current funding levels. Their purpose is to provide general guidance to the application of available funds.

Regional Objectives

The objectives of the regional incremental silviculture strategy are to:

- Ensure a long term sustainable harvest, which approximates the current harvest value and volume levels and that, produces a diversified mix of products necessary to create and maintain sustainable forest employment.
- Balance treatments that enhance growth and yield such as fertilizing, spacing and forest health activities with those that increase the value of the wood such as pruning.
- Utilize incremental silviculture treatments to contribute to sustainable management of non-timber values at the landscape level. (MoF, 1999)

Basic Data

TFL 33 is situated within the Columbia wet-belt on the Western slopes of the Shuswap Mountain Range. The TFL lies immediately to the north of Sicamous adjacent to Shuswap Lake and comprises a total land base of 8,365 hectares. Elevation of the license area is from approximately 347 meters at lake level to approximately 1700m on Queest Mountain and encompasses five Biogeoclimatic Subzones (BGC Subzones) – the ICHmw2, ICHmw3, ICHwk1, ESSFwc2 and the ESSFwcp. Note that ESSFwcp only occurs in the non-productive land base.

The following provide tabular and graphic summarires of the TFL 33 land base.

Land Area

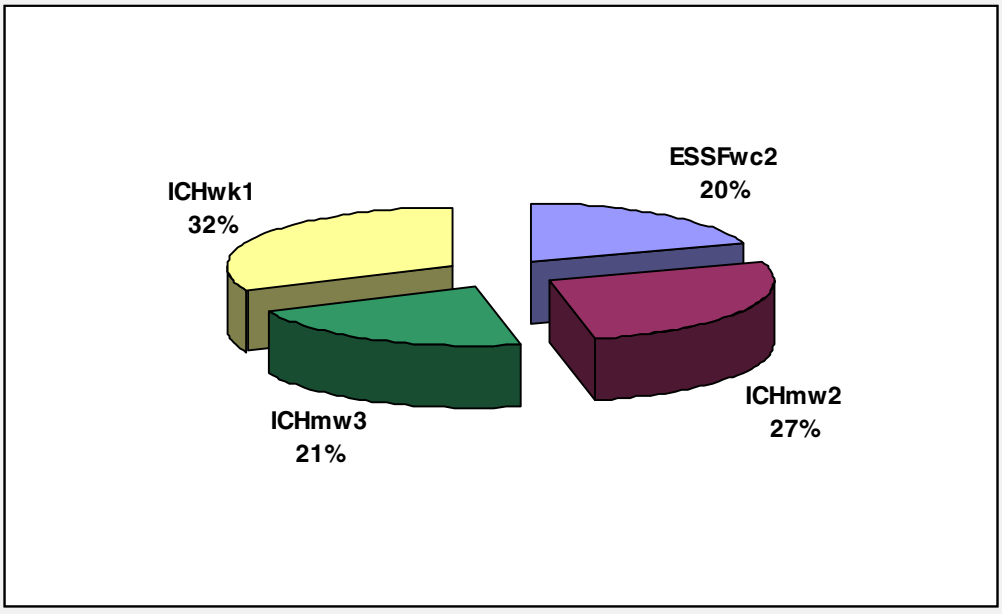
Description	Area (ha)	Area %
Total Area of TSA	8,366	100
Total Productive Crown Forest	7,678	91.8
Current Net THLB	6,979	83.4
Long-term Net THLB	6,788	81.1

Source: TFL 33 MP #8 Information Package report.

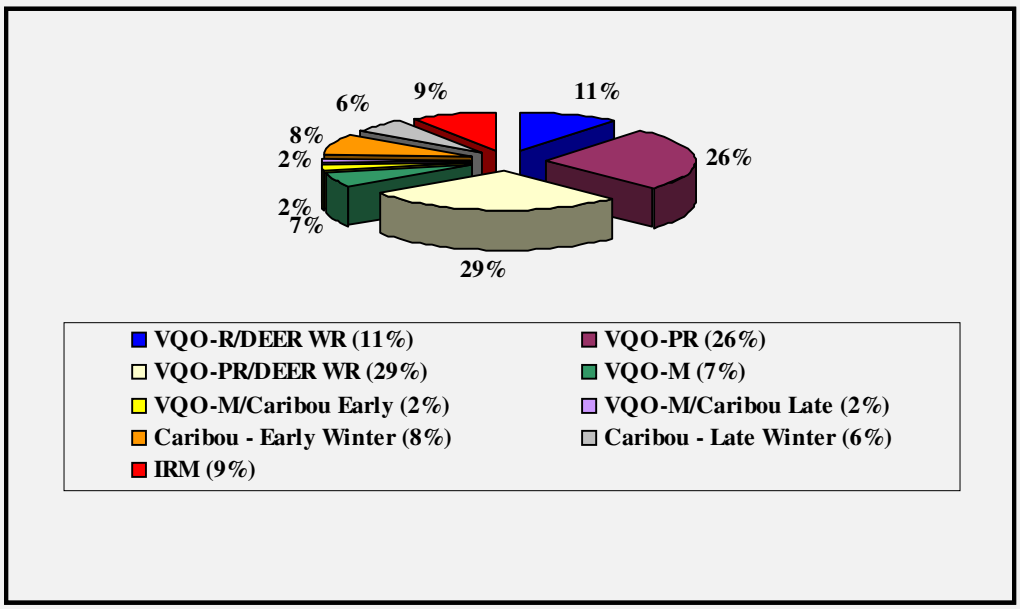
AAC

Licensee	Pre-MP 8	MP 8 [1]	% Change
Fedco	21,050	19,550	-7.1
SBFEP	1,450	1,450	0
Total	22,500	21,000	-6.7

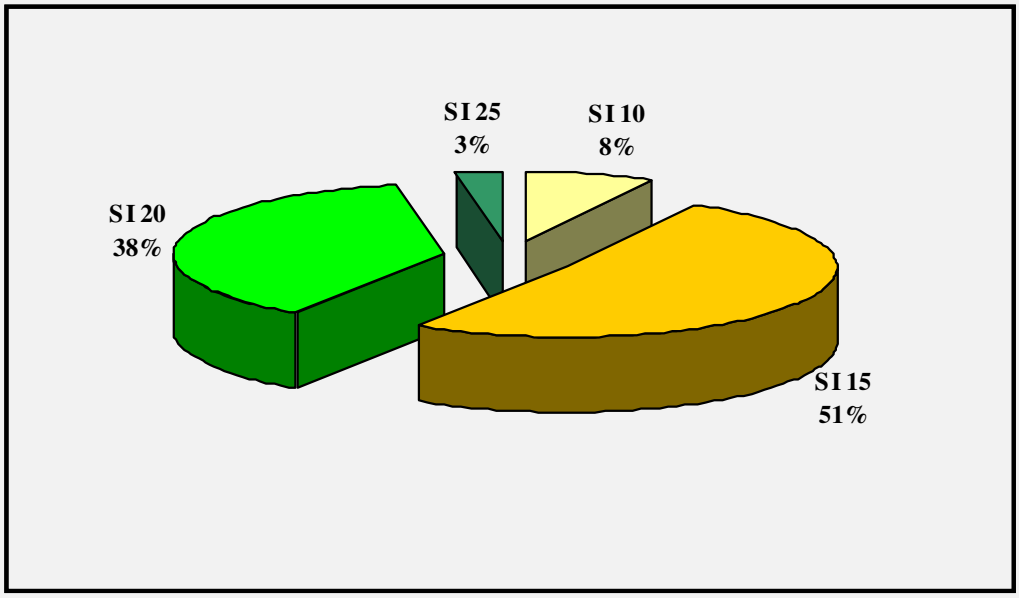
[1] Effective December 21, 2000



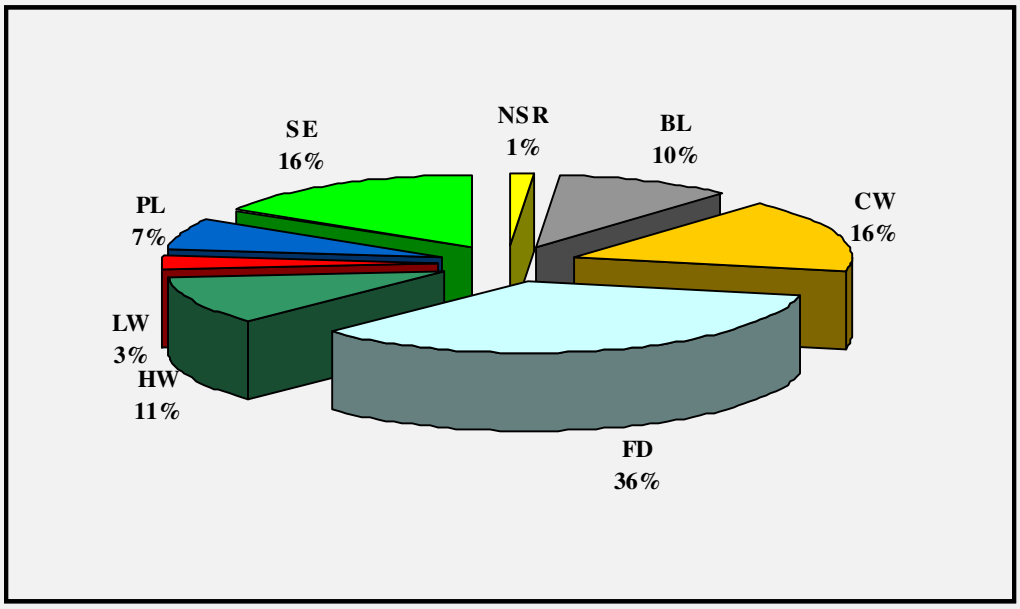
Distribution of BEC Subzones by Productive Forest Area



Distribution of Productive area by Resource Emphasis Area

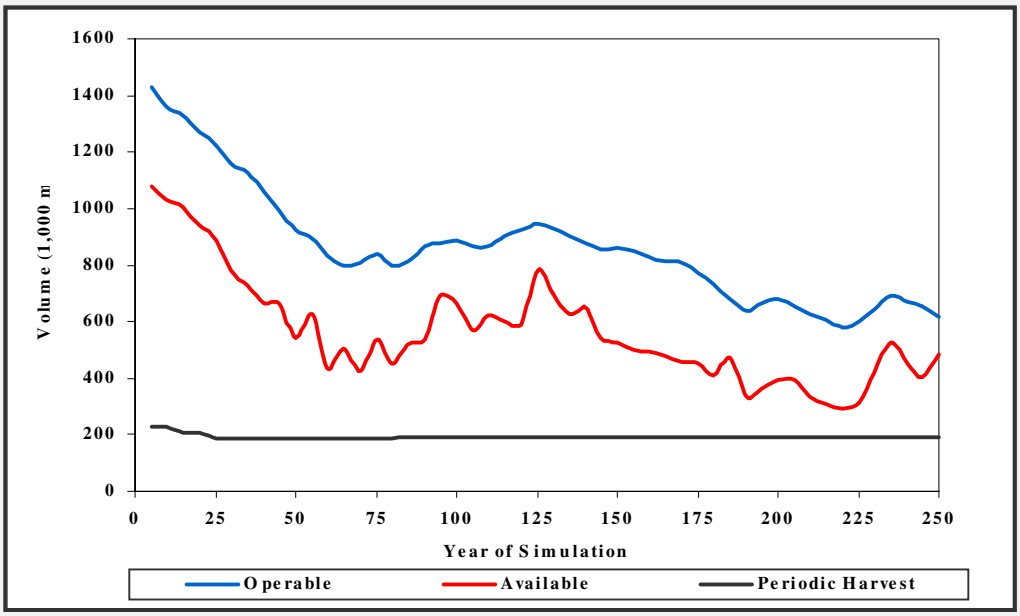


Distribution of productive area by 5-metre site index class

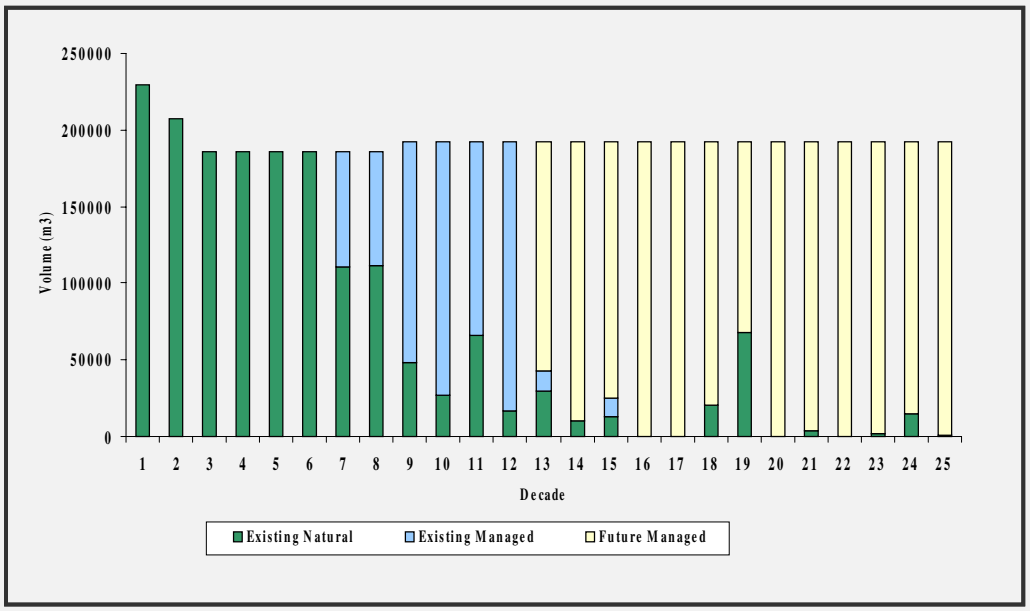


Distribution of net THLB by leading tree species

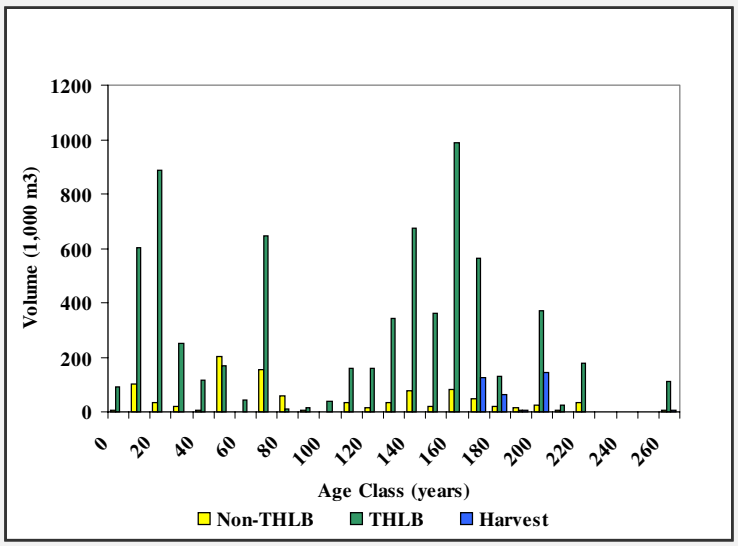
The following graphic summaries are from the MP #8 timber supply analysis report. They are based on results of the LRMP option, which based input assumptions on the Okanagan-Shuswap Land and Resource Management Plan.



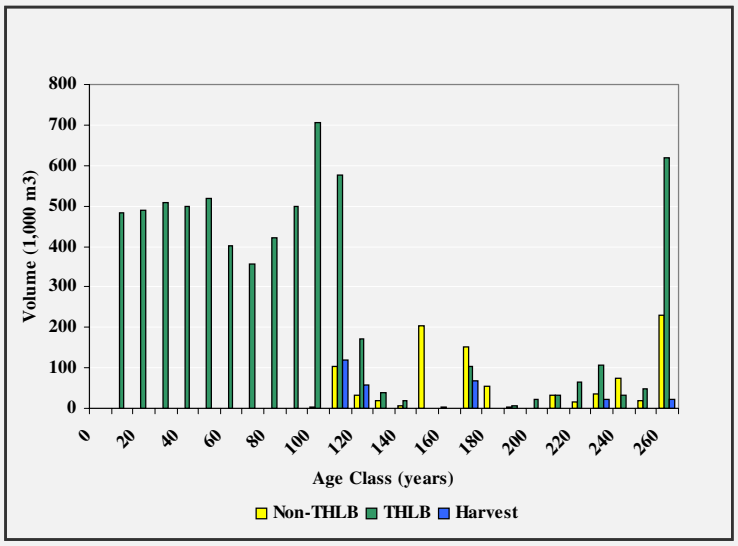
LRMP Harvest and Growing Stock Profile



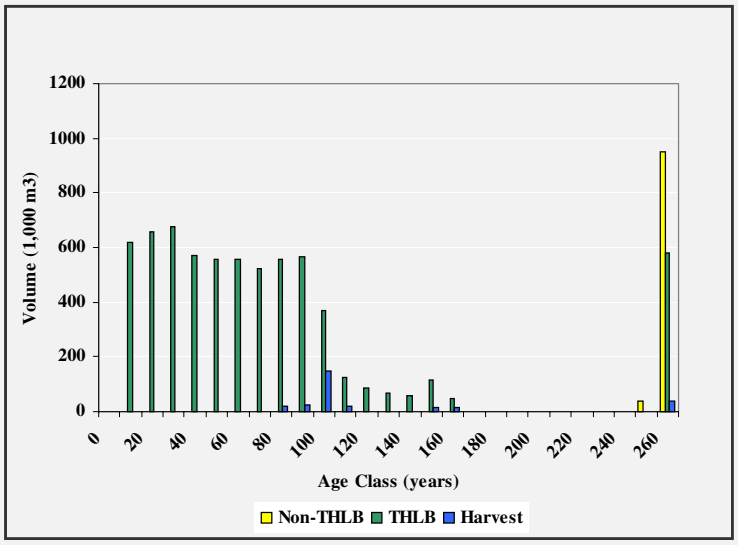
Gross harvest by yield classification



Age class distribution – Simulation Year 1



Age class distribution- Simulation year 100



Age class distribution- Simulation year 250

Issues

Individual Issue Analysis

The following information is primarily from documentation produced for the most recent timber supply analysis for TFL 33 (MP #8). This includes the Information Package and Analysis Report, along with the Chief Forester's AAC Determination Report. Information, which is relevant to an incremental silviculture strategy, is recorded. Key statements are bolded.

Abbreviations: AAC - allowable annual cut; THLB - timber harvesting land base; IHL - initial harvest level; ST – short-term harvest level; MT – mid-term harvest level LTHL - long term harvest level; VQ – visual quality.

Species abbreviations: Fd - Douglas-fir; Hw - western hemlock; Cw - western redcedar; Bl- balsam fir; Pl – lodgepole pine; Lw – western larch; Se – interior spruce.

♦ Harvest Forecast	**Current AAC (December 2000) is 21,000 m^3**, net of a 450 m^3 deduction for non-recoverable losses. Initial harvest level is maintained for one decade and declines 13% in decade 2 to the mid and LTHL of 18,050m3/year. Harvest levels must decline to accommodate VQO forest cover constraints.
♦ Age Class	2% of the THLB is overmature forest (> age 250), 38% is mature (> age 140) and 28% is second growth less than 40 years of age. The transition of harvest from the mature to second growth forest represents a challenge to avoid interruption in timber flow. The rate of harvest from the existing mature forest must be balanced with the rate at which regenerating stands become available for harvest.
♦ Productivity	Existing productivity estimates are considered to be understated, based on studies in similar forest types due to the bias in estimation of old growth site indices. This affects both managed stand volumes and the rate at which managed stands achieve green-up height.
♦ Forest Cover	*IRM (non-VQ) Zones*: 9% of THLB. Base case requirement of at most 35% of THLB permitted to be < 3 m tall (18 years old). *Visual Quality Zones*: 71% of THLB. Base case requirement of at most 10% (retention VQO), 20% (partial retention VQO) and 30% (modification VQO) to be < 5/6 m tall. Sensitivity test: varied by zone Relaxation**: *Insensitive in the LRMP (highly sensitive in the short-term for the AAC Rationale)*** Increasing the maximum disturbance percentages in both VQO and non-VQO zones permitted the IHL to be increased to the previous AAC of 22,500m3/year (maintained for 2 decades). Increase: ***Highly sensitive in the short-term***. Reducing the VQO maximum % forced a significant reduction of the IHL and throughout the 250-year planning horizon. *Green-up*: Green up ages 18 yrs for 3 m (non-VQ) and 20 - 28 yrs for 5 m (VQ). Sensitivity test: -20% Relaxation: MT and LTHL supply increased by < 1%. Increase: N/A
♦ NSR	0 ha of backlog NSR. 93 ha of current NSR (1.3% of THLB) to be regenerated within 2 years.

♦ Quality	152 ha were deducted from the THLB for deciduous species. An additional 101 ha of low productivity and unmerchantable types were also excluded.
♦ Older Forests	All analysis options included old growth requirements based on MoF "45-45-10" approach. Reserve areas from outside TFL 33 were considered in determining old growth requirements. Sensitivity test: Low emphasis biodiversity: Very minor MT and LTHL impacts. Intermediate emphasis biodiversity: **Significant ST** (up to 76%) reduction in ST harvest. MT and LTHL declines were minor.
♦ Minimum Harvest Ages	Base case uses MAI culmination ages as minimum harvest ages (60 – 150 years). Sensitivity test: -10 years: No change in harvest. +10 years: Moderate (4%) decline in MT harvest. Insignificant change in LTHL.
♦ Silvicultural Systems	Most of the THLB is currently managed under a clearcut harvesting system, using small cutblocks with variable levels of retention.
♦ Regeneration	Fd, Lw and Pl leading stands are regenerated to Fd35Pl35Lw30. Cw and Hw leading stands are regenerated to Pl35Fd35Se30. Se and Bl leading stands are regenerated to Se100. All regeneration use the same site index as the existing stand. All future managed stands are assumed to be planted at 1,500 stems per hectare. Base case assumes regen delays of 2 years for all stands. Sensitivity test: 0 years: Minor sensitivity, LTHL increases by 1.4%. 4 years: Moderately sensitive, MT reduced by 11%; LTHL reduced by < 4%.
♦ Estimates of Timber Volumes	VDYP used for existing stand volumes for all stands between ages > 33 years. Sensitivity test: +10%: **Highly sensitive**. The IHL could be maintained for an additional 35 years. -10%: Moderately sensitive. MT harvest reduced by up to 15%. TIPSY used for existing stands less than age 34, and all future regenerated stands. OAF1 – 15%. OAF-2 of 5. There is concern over OAF-2 and whether it addresses potential losses from root-rot. Sensitivity test: +10%: **Highly sensitive**. LTHL is increased by 9%. -10%: **Highly sensitive**. LTHL is reduced by 10%.
Wildlife Issues	The addressed habitat concerns for deer winter range and caribou (early and late winter). Virtually all DWR overlaps VQ areas. Caribou habitat was not modeled in the "AAC Rationale" scenario. It was modeled in all simulation runs associated with the LRMP option. Sensitivity test: No caribou mature & old constraints**: Highly sensitive**. The IHL could be maintained for an additional 15 years. MT and LTHL increased by as much as 6.5%.
Riparian/fish Habitat/WTP	Riparian buffers and WTPs were included in the analysis based on FPC requirements and new inventory information for TFL 33.

Summary of TFL-level Issues by Period

Overall, timber supply is constrained at many points over the 250-year time horizon of the analysis. In the short-term visual quality requirements limit the periodic harvest. Low points in available timber occur at decade 6, which limits timber harvest in the short and mid-terms and at decade 20, affecting long-term timber availability.

Visual quality is the single-most important issue affecting timber supply on TFL 33. Changes to the amount of allowable disturbance have immediate and significant impacts on timber availability. In addition, caribou mature and old forest constraints place limits on the mid and long-term harvest by placing stands in reserve to accommodate habitat requirements.

Since the approval of MP #8 the Okanagan-Shuswap LRMP has been passed by Order in Council. Guidelines in the LRMP indicate that the visual quality constraints assigned in the Base Case and the AAC Rationale scenarios of the timber supply analysis are more restrictive than will be required by the LRMP. This will be addressed through cutblock management and size. In addition, old growth constraints will be addressed through the identification of old growth management areas (OGMA). This will limit the area that is affected by old forest requirements. Both of these LRMP initiatives are expected to improve timber availability on the TFL.

The LRMP also provides management guidelines for caribou. These were modeled in the MP #8 analysis. However, the boundaries for caribou habitat have not been confirmed, but it is expected to be smaller than the areas modeled in the timber supply analysis. Grizzly bear management will focus on the maintenance of coarse woody debris and this can be achieved without having any impact on timber supply or the opportunity to perform silviculture activities.

Short Term (1 - 20 years)

In the AAC Rationale scenario, the IHL (20,950 m3/year) can only be maintained for one decade. In the LRMP option, the higher IHL of 22,500 m3/year is also maintained for one decade. Any factors, which affect timber availability over the first 6 decades, can be expected to impact on short-term harvest levels. Visual quality objectives, existing natural stand yields and caribou habitat have the greatest impact on short-term harvest. Under the rules of the LRMP, there may be additional opportunities for timber on the TFL.

Mid Term (21 - 80 years)

In the timber supply analysis, many factors affecting timber supply during the first 60 years were primarily absorbed by the short-term harvest. This was, by design, to avoid excessive negative impacts on mid-term levels, and conversely to capitalize on short-term opportunities where they existed. As a result, mid-term harvest levels demonstrated relatively low sensitivity to the changes discussed with the exception of visual quality, caribou habitat and natural stand yields.

Long Term (81 + years)

The major impacts on long-term harvest levels were caused by changes in regenerated yield estimates. Increases (or decreases) in long-term timber harvest are proportional to changes in these yield estimates. In addition, caribou habitat constraints affect long-term levels.

Future Issues

Changes to visual quality, caribou habitat, old forest requirements and managed stand volumes (SI50, OAFs, genetic gains) not incorporated into the MP #8 analysis could have future impacts on timber supply. Improving the information associated with these analysis inputs will provide a much clearer picture of the timber supply from TFL 33, as well as the opportunities for silviculture treatments.

Incremental Silviculture History

Year	Juvenile Spacing	Conifer Release	Pruning	Fertilization	Totals	Cumulative Total
1985	0.0	34.0			34.0	34.0
1986	0.0	15.0			15.0	49.0
1987	39.8	11.6			51.4	100.4
1988	81.2	0.0			81.2	181.6
1989	28.1	0.0			28.1	209.7
1990	0.0	0.0			0.0	209.7
1991	0.0	0.0			0.0	209.7
1992	13.8	0.0			13.8	223.5
1993	0.0	0.0			0.0	223.5
1994	27.7	0.0			27.7	251.2
1995	175.4	53.9	67.5	0	296.8	548.0
1996	131.5	0	132.7	0	264.2	812.2
1997	7.3	0	0	245.4	252.7	1,064.9
1998	0	14.7	36.4	0	51.1	1,116.0
1999	0	0	0	0	0	1,116.0
TOTALS	504.8	129.2	236.6	245.4	1,116.0	

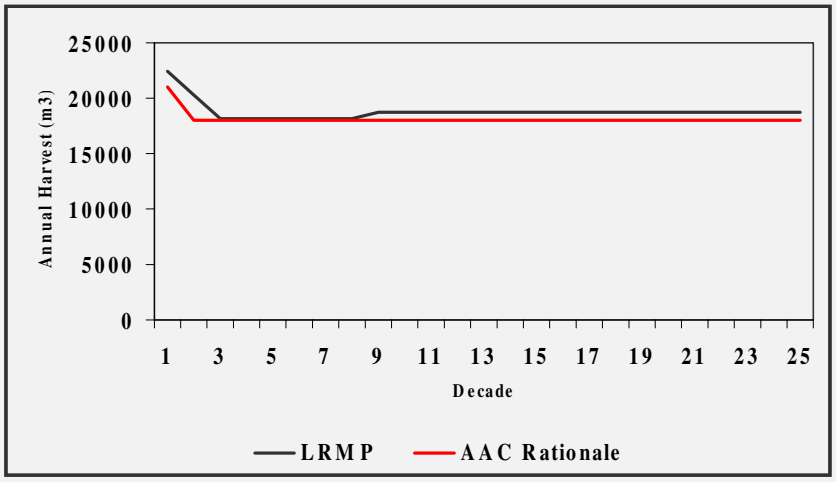
Incremental silviculture work has been funded by FRBC since 1995. Work is currently carried out under a MYA between FRBC and FCL.

Opportunities to Increase Timber Supply

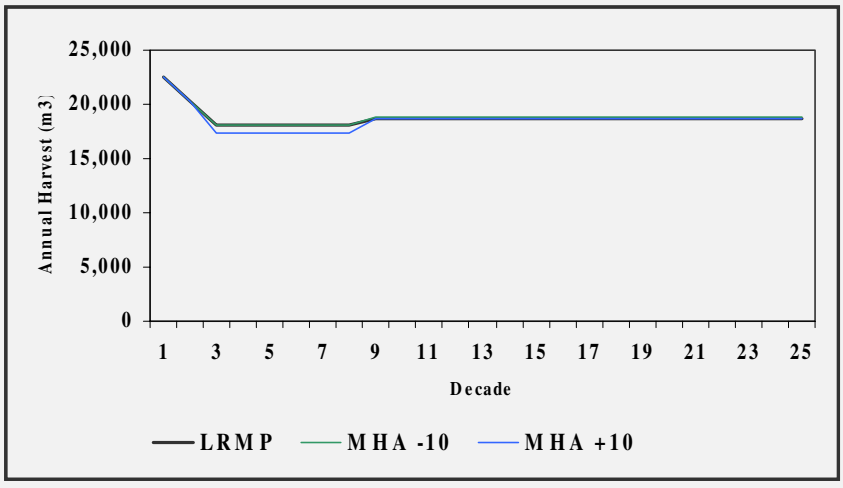
Opportunities Indicated Through MP #8 Sensitivity Analyses

Timber supply analysis modelling in support of planning incremental silviculture has not yet been undertaken. In its absence, sensitivity analyses from the MP #8 analysis report are the best source of information for assessing opportunities for incremental silviculture to increase future timber supply. The following are selected sensitivity analysis results from the MP #8 analysis.

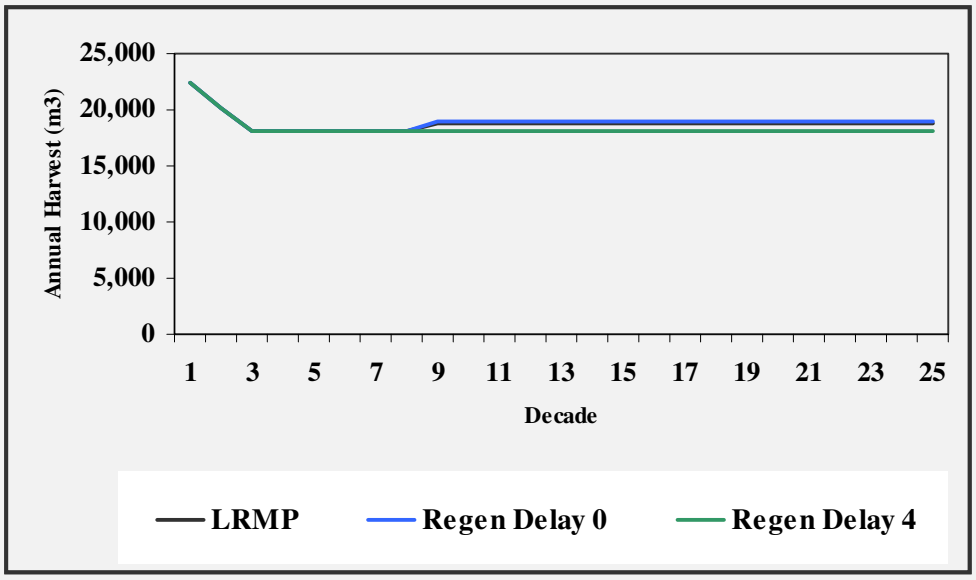
Note that the Base Case harvest from the MP #8 timber supply analysis was not the primary scenario used to determine the current AAC. Additional information submitted to the Chief Forester after the acceptance of the original timber supply analysis report, shown below as "AAC Rationale", became a key element in setting the AAC. Due to the timing of this additional submission, there were no sensitivity analyses conducted for the AAC Rationale scenario. Therefore discussions for the TFL 33 Type I analysis will be based on sensitivity runs from the LRMP option which showed similar trends in timber supply to the AAC Rationale scenario.



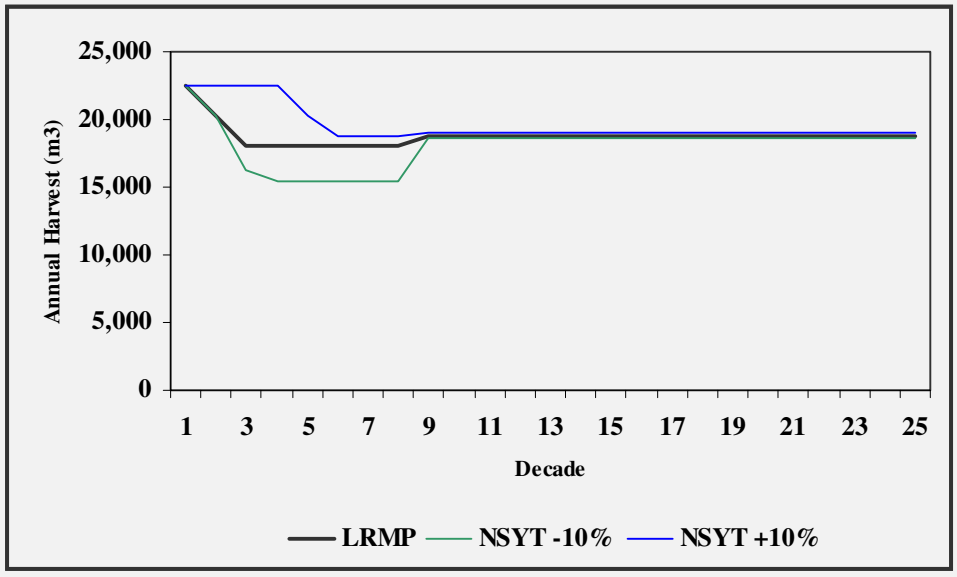
LRMP Option & "AAC Rationale" harvest



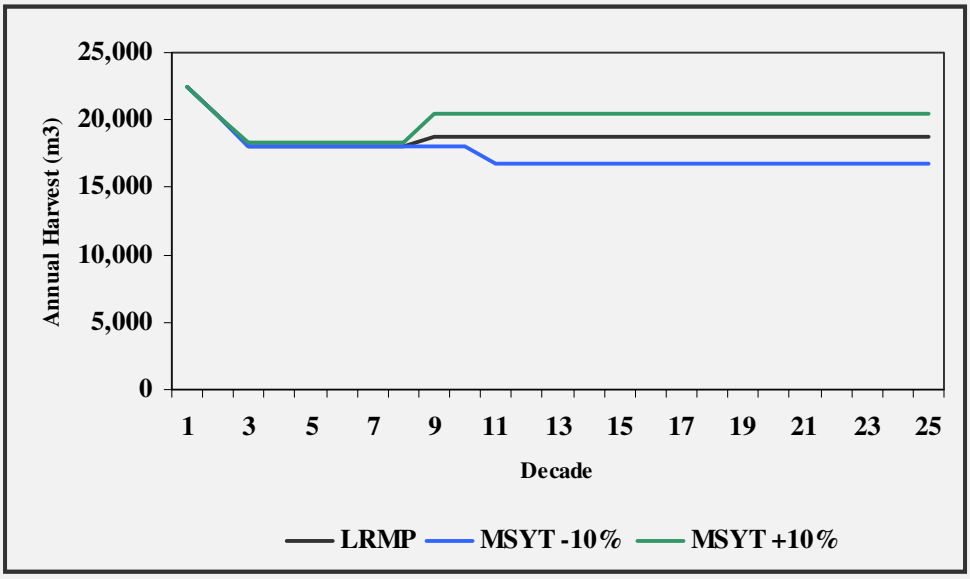
Impact of altering minimum harvest age



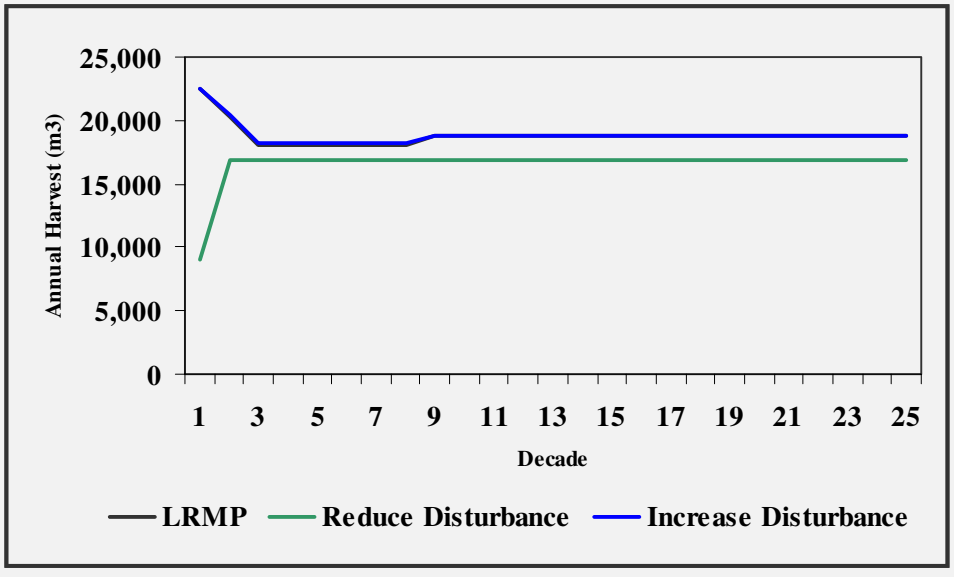
Impact of altering regeneration delay



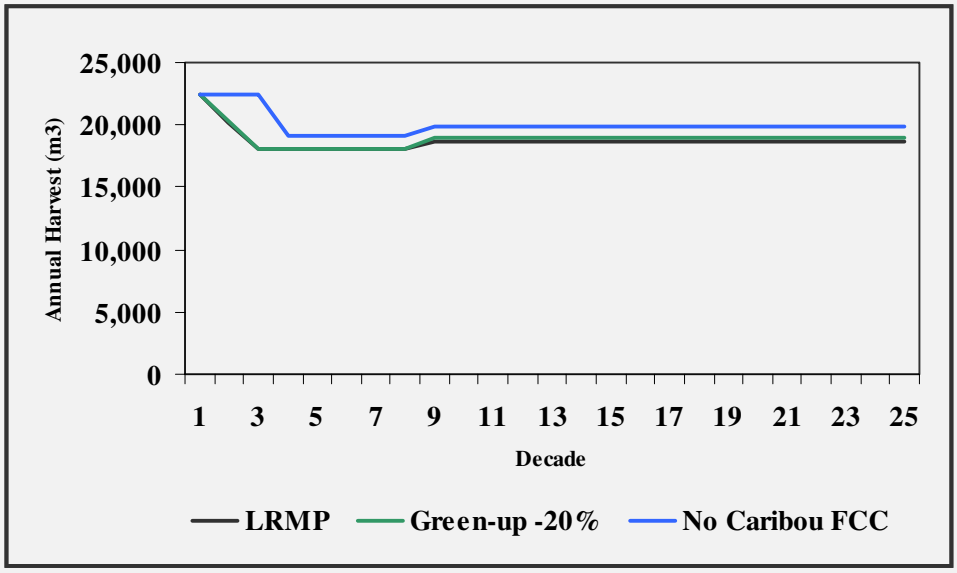
Impact of adjusting existing stand yields ± 10%



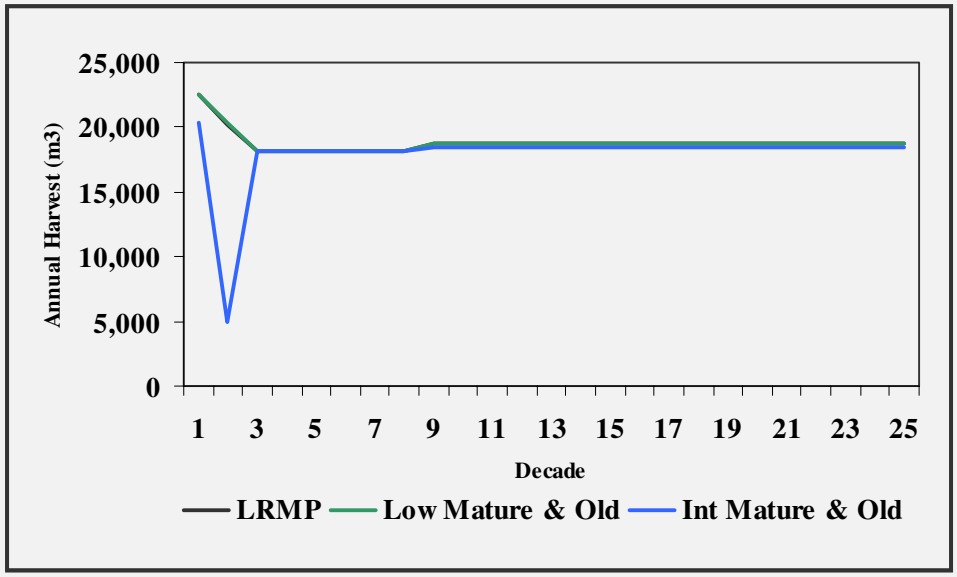
Impact of adjusting managed stand yields ± 10%



Impact of adjusting forest cover disturbance percentage



Impact of adjusting green-up & caribou constraints



Impact of adjusting landscape biodiversity emphasis

Identification of Silviculture Opportunities

Prior to the district working session, information in the previous sections was used to identify a number of silvicultural strategies with the potential to increase future timber supply at the TFL level. These were meant only to initiate discussion during the working session. Each of these was addressed in more detail during the workshop. While an attempt has been made to categorize opportunities according to response time frame, it should be noted that visual quality objectives have the most significant impact on timber supply throughout the 250-year planning horizon.

In addition, several treatment opportunities may not have significant impacts on timber quantity, but are associated with changes in timber quality and/or wildlife habitat availability.

Potential Strategies by Response Time Frame

Immediate impact on quantity (required to sustain current timber flow forecast)

IM 1: Continue to develop alternative harvesting systems in VQ areas to reduce disturbance impact.

IM 2: Confirm OGMA boundaries.

IM 3: Confirm caribou habitat boundaries.

Short Term (1 - 20 yrs) impact on quantity

ST 1: Improve green-up rates (and/or understanding of green-up rates).

ST 2: Re-inventory, especially managed stands.

ST 3: Collect managed stand site productivity estimates.

ST 4: Develop alternative management in caribou areas to reduce old forest impacts

Mid Term (21 - 80 yrs) impact on quantity

MT 1: Improved managed stand yield table estimates, including OAFs and genetic gains.

MT 2: Improved understanding of old forest requirements.

MT 3: Fertilization.

Long Term (81+ yrs) impact on quantity

LT 1: Improve long term yields through genetic improvement program or other treatments.

LT 2: All mid-term programs.

Impact on timber quality

Q 1: Pruning and fertilization of managed Douglas-fir stands.

Q 2: Increase the component of Douglas-fir peeler logs from the current 30%.

Q 3: Increase the component of western redcedar poles.

Impact on wildlife quantity/quality

H 1: Maintain appropriate mature and old forest for caribou.

H 2: Maintain coarse woody debris for grizzly bear.

H 3: Enhance forage species for mule deer.

Available Information Regarding Potential Treatments and Treatable Area

This section summarizes available information directly relevant to the potential treatments for the TFL. Information on immature stands on the TFL is not readily available to determine treatable areas at this time. A managed stand inventory is recommended to provide this background information.

Treatment	Comment	Location	Treatable Area
Pruning	Improve peeler log component. May prune selectively.	Fd leading managed stands	+/- 1,200 ha of Fd good site
Managed stand inventory	Objective is to locate stands suitable for incremental work and to get accurate information on species composition, stand density, height and growth rates. Under performing stands will be identified at this time.	All managed stands	+/- 2,000 ha
Managed stand SI50	Estimates of productivity for managed stands at a site series level.	Entire productive land base	7,678 ha
Verification of OAFs	Improved managed stand yield estimates.	All managed stands	+/-2,000 ha (will eventually affect entire THLB)
Managed Stand Yield Tables	Objective is to more accurately reflect the growth of managed stands in the timber supply analysis. May direct silviculture strategies and product objectives.	All managed stands	2,000 ha of existing 6,979 ha (THLB to address future supply)

Treatment	Comment	Location	Treatable Area
Planting genetically improved stock	Improved seed will be used wherever available for Douglas-fir, larch, spruce and lodgepole pine.	All harvested areas	6,979 ha over long-term (THLB)
Fertilization	Fd/Pl stands, good & medium sites. Hand fertilization may be used where access is good.		Up to 3,600 ha
Cw poles	Need to develop silviculture strategies for growing cedar poles.	Cw leading or as a component of an Fd stand	
Rehab of deciduous	Not at the expense of non-timber interests – they may be important as OGMAs or WTPs.	Deciduous leading	Up to 152 ha
Rehab of low site	Not at the expense of non-timber concerns.	Low SI50	Up to 101 ha
Spacing	Insufficient candidate areas.		N/A
Commercial thinning	Insufficient candidate areas, may jeopardize harvest during mid-term.		N/A

It is important to note that the potential areas listed above are based on the existing inventory and may change with improved managed stand, SI50 and species composition information.

A summary of the treatments and programs listed in the table above are provided below.

Pruning

Stands on TFL 33 are generally managed on fairly long rotations, (averaging 140 years over the 250 year analysis planning horizon) due to visual quality constraints. This fits well with Federated Co-op's product objective of increasing the yield of Douglas-fir peelers from the TFL. Pruning or selective pruning of the largest crop trees can enhance the production of clear wood for peeler logs without jeopardizing the quality of habitat.

Managed Stand Inventory

An improved inventory of managed stands on TFL 33 is a high priority. This would provide inputs for managed stand yield tables (MSYT's) and would also identify enhanced silviculture opportunities on the TFL. This inventory should also provide some measure of growth of these stands against expected site index so that under performing stands may be targeted for rehabilitation.

Site Index Adjustment

A major component of the timber supply information is estimates of site index that adequately represents the expected growth of post-harvest regenerated (PHR) stands. In the TFL area, like most areas in BC, the site index estimates in the inventory under-estimate the expected growth of PHR stands for many of the areas and stand types.

There has been substantial effort by government and industry in recent years to improve site index and yield estimates for PHR stands with the goal of achieving more realistic timber supply modeling and forest-level planning. A site index adjustment project is a high priority for TFL 33, particularly because of the importance of green-up and adjacency in VQO areas.

Operational Adjustment Factors

FCL feels that the operational adjustment factors (OAFs) used in the timber supply analysis for managed stands are too high based on a series of plots that measured gaps in these stands. Survival of plantations is high and few gaps occur. They also feel that because many root disease areas are stumped, future losses to root disease should not be high.

A study to determine realistic OAFs for TFL 33 should be initiated. This may include looking at stands in 40 to 100 year old age classes that were not managed for root disease. Future losses in current harvesting where stumping is done should be less than in these unmanaged stands.

Managed Stand Yield Tables

The purpose of managed stand yield tables (MSYT's) is to predict future wood volumes that will be available from PHR stands. This can lead to the establishment of product objectives; it can direct silviculture investments and can enhance ecologically based forest management. MSYT's will allow the growth and yield of individual stands to be measured and may result in the re-evaluation of product and silviculture regime objectives. This will also allow the growth of stands following harvesting to be more accurately reflected in timber supply analyses.

MSYT's for even-aged stands are based on TIPSY for coniferous species and a pro-rate of TIPSY and VDYP for mixed coniferous/deciduous stands. The inputs required for a TIPSY run are as follows:

- Species composition (from the inventory file);
- Site index (from a SIBEC or other source, not MOF forest cover files);
- Initial stand density (desirable to have some ingress numbers also);
- Stand origin (planted or natural);
- Regeneration delay (needed for documentation for the timber supply analysis);
- Residual thinning density if the stand was spaced (thinning in TIPSY takes place when the stand is at a height of 5 m). This treatment refers only to juvenile spacing, not conifer release, brushing or slashing type treatments; and
- Operational adjustment factors (OAF1 and OAF2) which will be set for the operating area.

Development of MSYTs for TFL 33 is a high priority so that the growth of managed stands can be accurately reflected in the timber supply analysis. Current site index and height growth curves appear to underestimate the growth of these stands. MSYTs will have positive impacts on harvest levels in the short-term by shortening the time to achieve green-up and in the medium and long-term through increases in the estimated productivity of regenerated stands.

Planting Genetically Improved Stock

Genetically improved stock will be planted on TFL 33, as seed is available. TFL 33 is within the Nelson Seed Planning Zone. Estimates of seed availability and gains (volume over the rotation) are shown in the following table. Use of genetically improved stock will reduce the time to green-up, which will have positive impacts on the harvest levels of the TFL in the short-term. Increased yields from regenerated stands will have positive impacts on the long term harvest.

Availability and Gains from Tree Improvement Program

Species	Seed Available:	Estimated Gain
Sx	2001/02	8-12%
Lw	2005/06	70%
Fdi	2008/09	22-25%
Pl Low	2001/02	6%
Pl High	2006/07	16%

In the spring of 2001, Fedco will also be planting some hybrid Coastal/Interior Douglas-fir seedlings from the Kalamalka Research Station. This stock should be established with production seedlots as a silviculture trial so that growth can be monitored and statistically valid results presented in the future.

Fertilization

There are opportunities to fertilize pruned stands to decrease time to achieve green-up and/or to increase the production of clear wood to meet premium log objectives. Current research would recommend fertilization of stands with over 80% Fdi and Pli combined, on good and medium sites older than 20 years. Fertilization should occur at a 9-10 year frequency to fully capture the response to the fertilizer. Studies in the ICH show no extra response to anything but nitrogen. Six-year height data in the ICHmw shows an additional 80 cm height increment (height 11 m at age 25 at time of fertilization)[1].

There is potential for earlier fertilization in Douglas-fir and spruce but little research has been done. Fedco is interested in working with the MoF to establish trials in younger stands with the objective of achieving green-up earlier.

There is also potential for fertilizing stands prior to harvest. Stands would have to be free of disease with high live crown percentages to be suitable for treatment.

Production of Cedar Poles

Cedar has been planted very successfully on TFL 33 on well-drained sites. Tree handling and storage were found to be critical to survival and good growth. Cedar poles are a high value product that can be produced on the TFL and a strategy for producing this crop is a high priority.

[1] Personal communication with Rob Brockley, Kalamalka Research Station, February 1, 2001.

Rehabilitation

There may be some minor opportunities for rehabilitation of broadleaf stands that were partially harvested in the past. However, their contribution to old growth, wildlife tree patches or visual quality must be assessed prior to initiating any projects. If any underperforming stands are identified in the managed stand inventory, these may also be scheduled for rehabilitation. There may also be some minor opportunities for landing rehabilitation to increase the THLB of the TFL.

Juvenile Spacing

All stands on TFL 33 are planted immediately following harvesting. This early density control leaves few opportunities for future spacing programs. In most cases, ingress does occur but these stems are not considered competition to established crop trees. Considering such factors as increased losses to root disease following spacing treatments, concerns about wood quality in spaced stands and potential reductions in volume from spacing, this treatment is given a very low priority in this analysis.

Commercial Thinning

There are few opportunities for commercial thinning on TFL 33. Removal of volume from stands may cause problems with root disease and may also jeopardize mid-term harvest levels.

Potential Timber Quantity Strategies by Response Time Frame

Explanatory notes with respect to the following tables.

Column Number	Note
1	The response time frame is the period in which the anticipated result is expected, not the period in which actions must necessarily commence.
2	Description of treatment.
3	Information obtained from the February 14 workshop, combined with information presented earlier in this document.
4	Anticipated results will be calculated using the timber supply responses indicated by MP #8 sensitivity analyses.

In the AAC rationale, the Chief Forester identified several downward influences on timber supply, dealing primarily with operability mapping, managed stand OAFs and influence of non-TFL lands on old growth. For the purposes of this strategy, however, a status quo is assumed with respect to these. Should any arise, the strategies would serve to mitigate their effects rather than increase timber supply.

In addition, the Chief Forester recognized that management of visually sensitive areas, managed stand site index and "phasing in" old growth requirements could improve timber supply on the TFL.

Potential Timber Quantity Strategies by Response Time Frame

(1) Response Time Frame	(2) Potential Strategy/Action	(3) Discussion / Current Status	(4) Anticipated Result
Immediate	Alternative harvesting in VQ areas	LRMP guidelines differ from approach modeled in AAC Rationale, which provides increased access to timber.	5 – 10%
	OGMA boundaries	Expected to be localized and may overlap with other constrained areas.	Minor change, but provides increased flexibility in harvest planning.
	Caribou habitat area boundaries and management requirements	Expected to have less area of the TFL affected and these areas may overlap with OGMAs.	+/- 10% in short and mid-term.
Short-term (1 – 20 yrs)	Improved green-up estimates	Improved green-up in visually sensitive areas will increase access.	Minor improvement.
	Re-inventory managed stands	Will identify best candidates for treatment.	Improved understanding.
Mid-term (21 – 80 yrs)	New site productivity information	Managed stands are performing better than indicated by yields developed for timber supply analysis.	Mid and long-term harvest is improved by up to 9%.
	Verify OAFs	15% seems too high, and root rot is being addressed by current management practices	Mid and long-term harvest is improved by up to 5%.
	Genetic gains	Improved planting stock is expected to increase future managed stand yields.	Improved mid and long-term harvest.
	New managed stand yields, including revised site productivity, OAFs and genetic gain values.	Managed stands are performing better than indicated by yields developed for timber supply analysis.	Mid and long-term harvest is improved by up to 9%.
	Fertilization	May enhance final yields depending on application frequency.	
Long-term (81 – 250 yrs)	As per mid-term, especially continued genetic gains.		

Opportunities to Improve Timber Quality

The effects of incremental silviculture on the future quality of the timber resource were not analyzed in the MP #8 Timber Supply Analysis. This issue was discussed during the working session.

Product Objectives

During the working session, the topic of product objectives was also discussed. It is clear that many of the silviculture opportunities identified will impact on log quality. As part of the characterization of these opportunities, each treatment was assessed with respect to its probable impact on log quality. These assessments are summarized in the following table.

Code	Impact
+	positive
0	neutral
-	negative

Available Information Regarding Potential Treatments and Impact on Quality

Treatment	Comment / Potential Treatment Regimes	Treatable Area
Pruning	Increase in quality of peeler logs by reduced knot size	Up to 1,200 ha
Fertilization	Increase in amount of clear wood if pruned stands are fertilized	Up to 3,600 ha
Production of Cw poles	Increase output of cedar poles in the long term if a successful strategy is developed and implemented	More information required
Genetically improved stock	Increased growth rates in conjunction with pruning and fertilization should increase the amount of clear wood produced Objective of Douglas-fir orchards is to minimize the losses of wood density Second generation Pl orchards will consider branching characteristics and wood density	6,979 ha (THLB)

The areas listed above are based on the current inventories and understanding of managed stand candidates. These areas might change with updated inventory information.

Potential Timber Quality Strategies by Response Time Frame

Response Time Frame	Potential Strategy/Action	Discussion / Current Status	Anticipated Result
Immediate		No impacts as current harvest will not be from managed stands	0
Short Term (1–20 yrs)		No impacts as current harvest will not be from managed stands	0
Mid Term (21–80 yrs)	Pruning	2 lifts are anticipated on selected crop trees only	+ Increased production of clear wood
	Fertilization of pruned stands	Pruned stands should be given highest priority	+ Increased production of clear wood
	Planting genetically improved stock	Improved seed will be used as available	+ Increased clear wood based on combination of increased growth and pruning and fertilization of improved plantations
	Increase Douglas-fir component in plantations		+ Douglas-fir is the preferred species for FCL.
	Increase production of cedar poles	Need to confirm pole characteristics and management requirements to obtain this product.	+
Long Term (81-250 yrs)	Same as mid term		

First Nations Issues

The Little Shuswap and Spallumcheen First Nations Bands did not attend the workshop but will be given the opportunity to review this draft document. The majority of their traditional use of the TFL area was the foreshore and the major rivers. Terrain limited their access and use of the remainder of the TFL.

Wildlife Species of Particular Interest

The TFL 33 key wildlife species, and their general habitat requirements are:

- Mule deer – maximum 20% < 3 metres and minimum 40% > 20 metres;
- Caribou – maximum 35% < 3 metres, min. 40% > 140 years and 10% > 250 years; and
- Grizzly bear – provide coarse woody debris and address access management requirements.

Opportunities to Improve Habitat Quality/Quantity

The effects of incremental silviculture on the future quality/quantity of wildlife habitat were not analyzed explicitly in the MP #8 Timber Supply Analysis. The issue was discussed during the working session. As with timber quantity/quality, it is possible that many of the silviculture opportunities identified will impact on habitat availability. As part of the characterization of these opportunities, each treatment will be assessed with respect to its probable impact on habitat. These assessments will be summarized in the following table.

Code	Impact
+	positive
0	neutral
-	negative

Available Information Regarding Potential Treatments and Impact on Habitat

Treatment	Impact on old growth	Impact on DWR	Impact on caribou habitat	Impact on grizzly habitat
Alternate VQO	0	+	0	0
OGMA boundaries	+	0	+	0
Improved green-up	+	+	0	0
Caribou boundaries	+	0	+	+
MS inventory	0	0	0	0
SI50 estimates	0	0	0	0
OAFs	0	0	0	0
Genetic gains	0	0	0	0
New MSYTs	0	0	0	0
Fertilization	0	+	0	+
Pruning	0	+	0	+
Fertilization	0	+	0	+
Fd component	0	+	0	0
Cw pole component	0	0	0	0

Incremental Silviculture Strategy

This section synthesizes the preceding background information and analysis into an incremental silviculture strategy for the TFL.

General Strategy

As stated earlier, short and medium term timber supply on TFL 33 is constrained by timber availability at decade 6. Because of the significance of this constraint, opportunities to enhance timber supply prior to this point rely heavily on offsetting the impacts of visual quality objectives. Generally, any strategy, which reduces the impact of visual quality, will improve timber availability prior to decade 6, and throughout the remainder of the planning horizon. Other tactics, which accelerate the development of managed stands, are particularly important in this regard. These tactics impact on timber availability in three positive fashions:

- Reduced time to green-up;
- Reduced minimum harvest ages; and
- Increased yields at rotation.

In addition to visual quality, caribou forest cover requirements (mature and old forest) limit the overall supply by placing older forests in reserve. The absence of stands > 250 years creates this limitation. Therefore, if new caribou areas are defined, or existing areas are reduced, the impact of caribou habitat on timber supply may be reduced. This is especially true if the caribou habitat areas overlap with the OGMAs that are planned for TFL 33.

Quality targets have not been explicitly established for TFL 33. Several of the silviculture tactics identified for improvement of quantity are also expected to have a positive impact on quality. In addition, pruning could be implemented specifically to improve the supply of premium log grades. However, the cost of such a program is substantial, and more explicit definition of quality objectives should be completed prior to undertaking a pruning program.

Strategies to Increase the *Quantity* of Timber

The key strategies for improving the quantity and/or availability of timber as identified at the working session are:

Quantity-1: Incorporate the LRMP guidelines for harvesting in visually sensitive areas.

Quantity-2: Continue to use Class A seed and genetically improved planting stock on all future plantations.

Quantity-3: Minimize stand voids in all future plantations.

Quantity-4: Fertilize appropriate stands.

Quantity-5: Rehabilitation of broadleaf, non-merchantable, low site, and old roads and landings

Strategies to Increase the *Quality* of Timber

The key strategies for improving the quality of timber as identified at the working session are listed below. These are based on the objective of increasing the Douglas-fir premium log component and log size (peeler logs) and increasing the cedar pole component.

Quality-1: Increase the Douglas-fir component within plantations where appropriate.

Quality-2: Increase the cedar pole component on appropriate sites.

Quality-3: Utilize pruning to increase the premium log component within Douglas-fir managed stands. This will reduce the number of knots in the lower (premium) logs.

Quality-4: Utilize fertilization in appropriate stands to maximize the production of mature (clear) wood prior to harvest.

Strategies to Increase the Quantity or *Quality* of Habitat

The key strategies for improving the quality of habitat as identified at the working session are listed below.

Habitat-1: Confirm caribou habitat boundaries within the TFL and continue to maintain mature and old forest within these areas.

Habitat-2: Confirm OGMAs within the TFL, preferably overlapping with areas that have consistent management objectives.

Habitat-3: Increase the forage opportunities for Mule Deer, and continue to plant Douglas-fir within the deer habitat areas.

Habitat-4: Increase/maintain coarse woody debris in appropriate grizzly bear areas and manage access as required.

Summary of Information and Research Needs

Information collection is a major component of the silviculture strategy for TFL 33. It is clear from the workshop that updated information will prove very useful in executing silviculture programs. This information will also provide a better understanding of the future timber supply outlook for the TFL. The key information that should be gathered is listed below.

Info-1: Managed stand inventory to improve silviculture planning and identification of candidate areas for treatment. It will also provide updated information for new managed stand yield estimates.

Info-2: Managed stand site index. This will allow more accurate estimates of managed stand yields and green-up times to be included in planning and timber supply.

Info-3: Verification of OAFs. These need to be confirmed to allow accurate managed stand yield estimates.

Info-4: Updated genetic gains information to be used in revised managed stand yields. In addition monitoring of stands grown from improved seed to ensure that genetic gain estimates are correct.

Info-5: Updated managed stand yield tables based on the information above.

Info-6: Identification of under-performing stands, from the managed stand inventory.

Info-7: Verification of cedar pole characteristics and the management practices to achieve those characteristics.

Info-8: Monitoring programs for tracking the development of managed stands.

Info-9 Research and monitoring programs to allow harvesting while addressing visual quality objectives

Silviculture Treatments and Investment Priorities

The following table summarizes incremental silviculture regimes which are suitable for attaining the above working targets and strategies. Approximate areas that could be treated over the long-term are included for each regime, but these are based on current inventories and may change with the completion of new inventories. A priority ranking is included for each regime.

TFL 33 Treatment Table

Treatment	Strategy	Opportunity Area (ha)	Time Frame for Expected response			Candidate Site and Stand Attributes				Habitat Impact		Direct Silv. Jobs (Person-days per ha)	Direct Cost ($/ha)	Ranking	Impact on premium sawlog prod.	Impact on AAC
			Short (1-20)	Medium (21-80)	Long (81-250)	Site Quality	Stand Types	Species	Ages (Yrs)	Old Growth	Wildlife					
Pruning, first and second lift	Qual-1	1,200			X	G,M	Plantations	Fd, Fd-leading	15+	0	0	4	$800	1	+	0
Fertilization	Quan-4 Qual-4	3,600	X	X	X	G,M	Pruned stands	Min 80% Fdi + Pli	20+	+	+	1	$460	2	+	+
Planting genetically improved stock	Quan-2	6,979	X	X	X	G,M	All harvested areas	As available	0	0	0			1	+	+
Rehabilitation of broadleaf, low sites or landings	Quan-5	253 (max)		X	X	G,M	Broadleaf or Low site (exclusions)		All	-	-			4		+
Production of Cw poles	Qual-2			X	X		Well-drained sites	Cw		0	0			2	+	

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