Southern Interior Growth and Yield Co-operative

Growth and Yield Issues Related to TSR (Kamloops Forest Region)

Prepared for the SIGY Co-op by

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Preface

This report by Cortex Consultants is intended to serve as the initial foundation for the ongoing development and maintenance of a living document. This document will eventually provide a centralized overview of the status of growth and yield with respect to timber supply for each of the management units in the southern interior. In preparing this document, Cortex was charged with reviewing and compiling information from published timber supply rationales, supplemented with information gleaned from interviews with key players. SIGY will use this report as the basis for continued development over the next several months. As SIGY's Manager, I will pick up where Cortex left off. I will bring the overview up-to-date by identifying recent growth and yield work completed (or underway) since the last determination in each management unit. This work will help me gain greater familiarity with local issues and contribute to the strategic plans of SIGY's member organizations.

The Southern Interior Growth and Yield (SIGY) Co-operative was established under the BC Co op Act in 1999. SIGY currently has 21 members, 20 forest licensees plus the combined resource ministries of the Crown. A true public-private partnership, SIGY's mission is to facilitate and help coordinate the advancement of growth and yield information in support of timber supply in the context of sustainable forest management. SIGY undertakes strategic planning, facilitation, education and communication in support of its mission.

SIGY members support a more integrated, strategic approach to identification and prioritization of growth and yield needs and investments among licensees and ministries. SIGY has been charged with supporting existing strategic initiatives and facilitating the establishment of others where needed. One of SIGY's important contributions in this area is developing and maintaining a summary overview of the growth and yield status of each management unit as it relates to timber supply. This overview is intended to support, not replace, the strategic plans of individual management units. The overview is also meant to serve as a communication tool providing members with a consolidated summary of growth and yield status in the various management units and a better understanding of growth and yield in the context of timber supply.

Member comments, requests for copies, and continued contributions to the information contained in this report should be directed to me. This report will be maintained as a living document accessible to all members.

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1.0 Introduction

Timber Supply Review

In British Columbia, the Provincial Chief Forester determines an Allowable Annual Cut (AAC) for each Timber Supply Area (TSA) and Tree Farm Licence (TFL) every 5 years. The Timber Supply Review (TSR) is the process used by the Ministry of Forests since 1992 to prepare the information on which those determinations are based. Section 8 of the *Forest Act* defines the mandate of the TSR and the many types and sources of information that the Chief Forester is required to consider when determining AACs. A key source of information is the quantification of timber supply through timber supply analysis.

The main objective of the timber supply analysis in TSR is to quantify the short- and long-term timber supply resulting from current forest management and forest practices. The TSR also identifies where improved information is required for future determinations of AAC.

The process used for timber supply analysis is very similar on TSAs and TFLs, the fundamental differences being who carries out the timber supply analysis, and the context in which it is done. For TSAs the timber supply analysis is carried out by the Ministry of Forests, in a process established solely for the purpose of determining AAC. In the case of TFLs the analysis is carried out by the licensee (or a contractor retained by the licensee), as part of the process of preparing the draft Management Plan for the TFL. The approval of the Management Plan by the Chief Forester is also the determination of the AAC.

Southern Interior Growth and Yield Cooperative

The Southern Interior Growth and Yield (SIGY) Co-operative was formed by licensees and the Ministry of Forests to undertake research and extension activities that support maintaining or increasing the AAC in management units of the southern interior portion of the province, which includes the Cariboo, Kamloops, and Nelson Forest Regions. One of SIGY's important contributions in this area is developing and maintaining a summary overview of the growth and yield status of each management unit as it relates to timber supply.

Purpose of this Report

SIGY commissioned the preparation of this report to guide its own business planning. This overview is intended to support, not replace, the strategic plans of individual management units. It is also meant to serve as a communication tool providing SIGY members with a consolidated summary of growth and yield status in the various management units and a better understanding of growth and yield in the context of timber supply.

This report identifies, for each management unit of the southern interior, the types of growth and yield studies that would provide AAC benefits. The report describes the different types of growth and yield information used in TSR timber supply analyses, issues related to their preparation and use, and the relative impact each could have on the AAC in each management unit. Part 2 of this report provides an overview to timber supply and the factors that determine it. Part 3 provides a summary of growth and yield factors and information related to the TSR for each management unit in the Cariboo, Kamloops, and Nelson Forest Regions of the province. Appendix 1 lists all of the management units of the Southern Interior. Appendix 2 contains a glossary of terms related to growth and yield and TSR.

3.0 Growth and Yield Issues in Each Management Unit

This section presents the main findings of this study—the most important growth and yield issues for each management unit. The findings are based on reports from a variety of sources, and from interviews of knowledgeable people around the province.

For each of the Forest Regions of the southern interior (Cariboo, Kamloops, and Nelson), a "report card" is presented for each management unit in the Region, summarizing the important growth and yield issues for the unit.

The criteria used to determine the relative importance of each growth and yield issue or factor in each management unit were:

1. Is there evidence of an issue related to a growth and yield factor? For instance, is there evidence that site index is incorrectly estimated?
2. Is the timber supply forecast *directly* sensitive in the short-term to the growth and yield issue (does sensitivity analysis show a direct relationship between the growth and yield issue and short-term timber supply)?
3. Is the timber supply forecast *indirectly* sensitive in the short-term to the growth and yield issue (e.g., is the growth and yield factor an important parameter for other applications that affect the timber supply forecast, or does the factor affect another parameter, such as green-up age, to which timber supply is sensitive)?
4. Is the growth and yield factor important for use in development of dynamic models of nontimber values, especially habitat?

Note that this study is focused on timber supply sensitivity. Growth and yield projects may be important for many different reasons, but the scope of this study is restricted to importance with respect to effects on timber supply forecasts.

3.1 Kamloops Forest Region

Kamloops Forest Region includes four TSAs and five TFLs. There are three IFPAs in this region—Adams Lake, Merritt, and Okanagan:

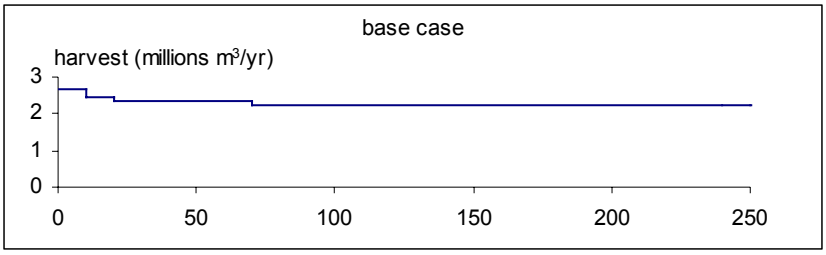
• Kamloops TSA (includes Adams Lake IFPA)	• TFL 15 (Weyerhaeuser)
• Lillooet TSA	• TFL 18 (Slocan)
• Merritt TSA (includes Merritt IFPA)	• TFL 33 (Federated Co-operatives)
• Okanagan TSA (includes Okanagan IFPA)	• TFL 35 (Weyerhaeuser)
•	• TFL 49 (Riverside Forest Products)

Kamloops TSA (includes Adams Lake IFPA)

Forest Region/District: Kamloops and Clearwater Forest Districts, Kamloops Region

Documents reviewed: AAC Rationale (2001), TSR 2 Timber Supply Analysis Report (2001), draft Type 1 Silviculture Workshop (2001), Inventory Audit (1996, 1997), Potential Site Index Estimates for the Major Commercial Tree Species in the Adams Lake IFPA Area Final Report (2001).

Base case forecast:



Initial harvest level consists of:

- Conventional stands—2 361 900 m^3/yr
- Cedar/hemlock partition—200 000 m^3/yr (decade 1 only)
- PA16 partition—86 000 m^3/yr (decades 1-2 only)

Land Base Description	
Total TSA Area (ha)	2 666 375 ha
Total productive forest area (ha)	1 409 110 ha
Current THLB area (ha)	1 040 860 ha
% Operable	74%
Ecological representation	BG, PP, IDF, ICH, MS, SBS, SBPS, ESSF, AT
Species composition (% THLB)	Pli (30.7%), Fdi wet (18.0%), Fdi dry (15.9%), Sx (18.5%), B (9.1%), CH (7.0%).
Age-class distribution	About two-thirds of stands in the THLB are older than minimum harvestable age.
Other comments	Adams Lake IFPA is in Kamloops TSA.
Defining Merchantability	
Method of determining	
Sensitivity	
Site Productivity	Area-weighted average site index for the THLB is 13.3 m.
Species	
Method	OGSI
Findings (change in average SI value)	Adjustment increased the average site index for Kamloops TSA From 15.5 to 16.6 m. For only stands older than 140 yr, the average SI changes from 13.3 to 17.6 m (a 24% increase).
Sensitivity	Significant: LTHL increased by 11%, STHL increased by 5%
Eco-mapping status	
Recent strategy and projects	

Inventory

Audit date:	1996, 1997 (Clearwater and Kamloops Forest Districts, respectively)
Findings	Inventory audits showed no significant differences between the audit volumes and inventory volumes in the two districts. Differences were 13 m^3/ha (-4.3%) in Clearwater and 4 m^3/ha (+2.2%) in Kamloops Forest District.
Base case adjustment	n/a
Sensitivity	n/a

Utilization Standards

	Min dbh (cm)	Max stump height (m)	Min top dib (cm)
Lodgepole pine	12.5	30	10
Cedar older than 140 yr	17.5	30	15
Other coniferous species	17.5	30	10
PA 16 coniferous	7.5	30	8
PA 16	12.5	30	10

Minimum Harvestable Age	80 – 140 yr
Method for determining	90% of age of culmination of MAI
Sensitivity	About 66% of the existing forest is older than MHA. Changing MHA mainly affected when second-growth stands become available for harvesting. Modest mid-term sensitivity; no short- or long-term sensitivity.

Green-up Age/ Requirement	
Method for determining	
Sensitivity	No short-term effect of changing either green-up requirement or age, moderate mid- and long-term effects of changing either green-up age or requirements

Visual Quality	
Method for determining	
Sensitivity	

Old-Growth Age/ Requirement	
Method for determining	
Sensitivity	

Regeneration Delay	2 or 3 yr, depending on analysis unit
Method for determining	Current performance as estimated by Forest District.
Sensitivity	

Managed Stand Yield Tables	Existing stands younger than 25 yr (established since 1974) were considered to be managed.
Yield model used	TIPSY
Issues?	
Sensitivity	Increasing/decreasing regenerated-stand yields has a proportional effect on long-term harvest level (e.g., 10% increase in yields increases LTHL by 10%), There was no effect on short-term harvest level

OAFs	
OAF1	15%
OAF2	5%
Sensitivity	

Selection Silviculture	
Silvicultural emphasis	
First-entry cutting intensity (%)	40%
Return interval (yr)	30 yr
Future entries cutting intensity (%)	30%
Yield model used	VDYP
Incremental Silviculture	
Treatments used in the MU	
How represented in TS analysis?	

Comments:

The Type 1 Silviculture Strategy Workshop (October 2001) identified a number of studies needed for planning both timber supply and silvicultural treatments:

1. confirm stocking on old burned areas.
2. establish locally applicable OGSI adjustments.
3. establish appropriate DWB factors. There is considerable uncertainty over appropriate decay, waste and breakage (DWB) factors for several forest types, in particular older stands in the ICH and ESSF BEC zones. Breakage rates on steeper ground are believed to be much higher than on gentler ground harvested in previous years and on which current DWB factors were likely generated. Operational (realized) volumes for some types have been as much as 50% below those predicted.
4. quantify the impacts of root rots on second growth stands.
5. localize estimates of OAF 1 (area based reductions) and, if possible, OAF2 (losses which increase over time.

Assessment

In Kamloops TSA, improving estimates of site productivity is the single most important growth and yield issue, for the following reasons:

- Based on provincial, but not local, studies of site index values, site index estimates, particularly for older stands, appear to be significantly underestimated. Applying provincial OGSI adjustments increased the average site index for Kamloops TSA From 15.5 to 16.6 m, and for stands older than 140 years, the average SI changes from 13.3 to 17.3 m, a 30% increase (reported in the Timber Supply Analysis Report). In the Adams Lake IFPA, applying the site index adjustment (SIA) procedure increased the weighted average site index (termed potential site index or PSI) on the IFPA by 5.5 m.
- The timber supply forecast is sensitive to site index changes in both the short- and long-term. The short-term forecast was moderately sensitive to applying provincial OGSI adjustments and adjusting minimum harvestable ages accordingly. This is an indirect sensitivity, because site index affects yield estimates, which are also used to determine minimum harvestable age.

- Definition of the THLB is sensitive to estimates of site productivity, but is also complicated by the challenges of doing so in complex stands (see below).

Modeling selection harvesting of dry-belt fir stands is an important issue in Kamloops TSA, which has implications for growth and yield. Timberline (1995) reported that selection silvicultural systems were applied in the dry-belt fir zone, which comprises about 16% of the THLB, a significant amount. Yet, selection management is problematic in TSR for a few reasons. First, it is applied in complex stands, which are inherently problematic in the forest inventory, and for which estimating site index is awkward. A large part of the inventory problems with complex stands is related to the inventory estimates of site index. Second, VDYP and TIPSY are not preferred models for projecting yields for selection management, but Prognosis has not yet been well calibrated for use in Kamloops TSA.

Therefore, in Kamloops TSA, emphasis for growth and yield work should be on:

1. Improving estimates of site index for even-aged stands and uneven-aged stands, although different methods may be needed. Whether OGSI type studies or another approach such as SIA would be appropriate is an important issue, and has implications for decisions regarding the importance of predictive ecosystem mapping (PEM) which may be needed for SIA for instance.

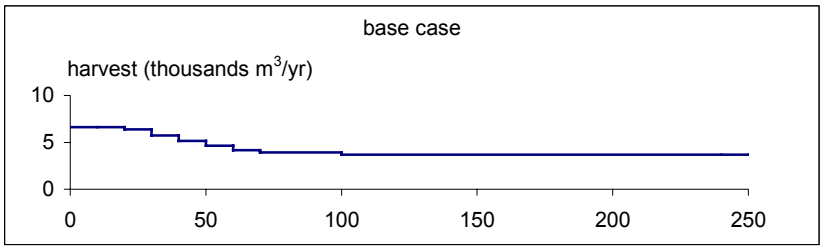
2. Calibrating PrognosisBC for producing TSR yield tables for Kamloops TSA.

Lillooet TSA

Forest District/Region: Lillooet Forest District, Kamloops Forest Region

Documents reviewed: TSR Timber Supply Analysis Report (2001), AAC Rationale (2002), Type 1 Silviculture Strategy (Cortex 2000), Inventory Audit (1997).

Base case forecast: Harvest forecast shows deep decline down to LTHL beginning in 3 decades.



Land base description	
Current AAC (m^3/yr)	636 000 m^3/yr (excluding woodlots)
Total TSA Area (ha)	1 124 000 ha
Total productive forest area (ha)	505 933 ha
Current THLB area (ha)	296 311 ha
% Operable	58.6%
Ecological representation	BEC zones occurring here: BG, PP, IDF, CWH, MS, ESSF, and AT
Species composition (% THLB)	Pli (41.5%), Fdi wet site (30.9%), Fdi dry site (9.6%), S/B/C/H (17.9%), deciduous PA 16 (0.1%)
Age-class distribution	76% of the stands in the THLB are older than minimum harvestable age
Other comments	
Defining merchantability	
Method of determining	Low timber growing potential exclusions based on site index for Fdi (SI <8.6 m), S/B/C (SI<7.5 m), and Pli (SI<9.6 m). Problem forest type exclusions based on combinations of age, height, and stocking. Deciduous stands not in PA 16. Coniferous stands classified as residual stocking.
Sensitivity	n/a
Site Productivity	
Species	All species
Method	OGSI; no local data available, provincial adjustment applied.
Findings (change in average SI value)	OGSI adjustment increased the average site index for the entire TSA by 1.7 m (14%). For stands older than 140 yr, the increase was about 4.2. m (37%).
Sensitivity	No short-term sensitivity. Harvest level increased beginning decade 6. LTHL increased by 32%.
Eco-mapping status	
Recent Strategy and Projects	

Inventory Audit Results	Inventory was done 1988-1990.
Audit date:	1997
Findings	Audit report states that stand volumes in total mature and operable components of forest may be underestimated across all species, mainly due to bias in VDYP, because of the coast-interior transitional nature of much of the area in this unit. Site index for immature stands is acceptably accurate. The TSR timber supply analysis report says that subsequent analysis showed that standing volume is underestimated across the TSA by 12%, but on only the THLB portion of the land base there was no difference between the inventory and ground-based estimates of stand volumes. Volumes in the non-timber harvesting land base were underestimated by 40% in the inventory.
Sensitivity	If existing-stand volumes are reduced by 10%, the decline to LTHL begins two decades earlier and is steeper (LTHL is reached four decades earlier). Increasing existing-stand volumes increased mid-term harvest levels proportionally. There is no long-term effect from changing existing-stand volumes in these ways.

Utilization Standards

	Min dbh (cm)	Max stump height (m)	Min top dib (cm)
Lodgepole pine	12.5	30	10
All other conifers	17.5	30	10

Minimum Harvestable Age	
Method for determining	Existing stands—either 80 or 100 yr Managed stands—regional standard, 90% of age of CMAI
Sensitivity	Changing the MHA (increase or decrease) had significant inverse impacts (about 10%) on the medium term harvest level, and small (3-4%) impacts on the LTHL.
Green-up Age/ Requirement	Green-up age varies from 19 to 28 years in Lillooet TSA.
Method for determining	Years to reach specified heights.
Sensitivity	Changing maximum allowable disturbance in adjacency constraints from representing a 3-pass (33%) system to a 5-pass (20%) system, causes a significant short-term reduction in harvest level—the first decade harvest level drops 6.7%. Changing the green-up age had little effect.
Visual Quality	Green-up age varies from 19 to 28 years in Lillooet TSA.
Method for determining	Years to reach specified green-up heights (3, 4, or 5 m depending on VAC). See p. 95 of TSR timber supply analysis report.
Sensitivity	No short-term sensitivity to changing visually effective green-up requirements. Small (1-2%) mid- and long-term effects.
Old-growth Age/ Requirement	
Method for determining	
Sensitivity	
Regeneration Delay	3 or 4 years
Method for determining	
Sensitivity	Not tested in TSR
Managed Stand Yield Tables	
Yield model used	TIPSY
Issues?	Site index, OAFs for stand voids, root disease, waste and breakage.
Sensitivity	No short-term or mid-term effect on timber supply. Proportional change in LTHL

	(10% change in yields causes 10% change in LTHL).
OAFs	
OAF1	15%
OAF2	5%
Sensitivity	Not tested directly; however, the harvest forecast is not sensitive in short- or mid-term to adjusting managed stand yield tables.
Selection Silviculture	Historically about 27% of the harvest in Lillooet TSA has been under non-clearcut silviculture systems (9%seed tree, 4%shelterwood, and 14% selection)
Silvicultural emphasis	40%
First-entry cutting intensity (%)	30 yr
Return interval (yr)	30%
Future entries cutting intensity (%)	Modeling yields from stands managed under selection silviculture may be an issue, and if it is emphasis should be placed on calibrating PrognosisBC for use in this TSA. But it should not be considered high priority until the issue of determining site productivity under uneven-aged management has been sorted out.
Incremental Silviculture	
Treatments used in the MU	
How represented in TS analysis?	

Comments:

Assessment

According to the TSR timber supply analysis report, application of provincial OGSI adjustments increased the average site index for Lillooet TSA from 12.5 to 14.2 m, or about 14%, and for stands older than 140 years, from 11.4 to 15.6 m, or about 37%. Timber supply sensitivity analysis showed that these differences increased harvest levels after decade 5 by up to 32%. However, there is no local OGSI data, and sensitivity analysis showed no short-term sensitivity to the OGSI adjustments.

Site index adjustment could be expected to affect managed stand yield tables, green-up age, and minimum harvestable ages. TSR sensitivity analysis showed no short-term sensitivity to any of these three factors.

Modeling yields from stands managed under partial-cutting systems may be an issue, and if it is, emphasis should be placed on calibrating PrognosisBC for use in this TSA. But it should not be considered high priority until the issue of quantifying site productivity under uneven-aged management has been addressed.

In summary, no growth and yield studies appear to be high priority with respect to short-term timber supply in Lillooet TSA.

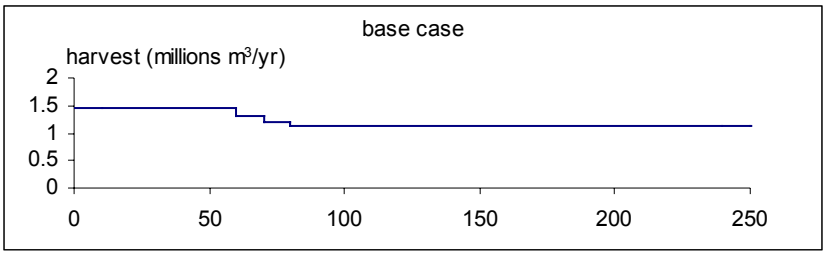
Merritt TSA (includes Merritt IFPA)

Forest District/Region: Merritt Forest District, Kamloops Forest Region

Documents reviewed: TSR Timber Supply Analysis Report (2001), AAC Rationale (2002), Type 1 Silviculture Strategy (2000), Inventory Audit (1998).

Other reports of interest:

Base case forecast:



Land base description	
Current AAC (m^3/yr)	1 508 050 ^{m3}/yr
	(1 195 550 m^3 conventional stands, 312,500 m^3 small-diameter Pli stands.)
Total TSA Area (ha)	1 130 064 ha
Total productive forest area (ha)	811 398 ha
Current THLB area (ha)	660 326 ha
% Operable	81.4%
Ecological representation (% THLB)	IDF (41%), MS (36%), ESSF (21%), PP (1%), AT (0.4%), CWH (0.2%), BG
Species composition (%THLB)	Pli (56%), Fdi dry (15%), Pli smallwood (14%), S (6%), B (5%), Fdi wet (4%)
Age-class distribution	About 60% of the stands in the THLB are older than minimum harvestable age. About 12% are younger than 20 yr, 61% are between 21 and 140 yr, 26% are older than 140 yr (including 4% over 250).
Other comments	The effects of beetle damage and salvage could outweigh everything else in this management unit.
Defining Merchantability	
Method of determining	
Sensitivity	
Site Productivity	
Species	All
Method	Sensitivity analysis was used to test the effect of applying OGSI site index adjustments. Results of the OGSI paired plot and veteran trees studies were applied to all stands older than 140 yr, all species. Not in base case.
Findings (change in average SI value)	Potential for large increases in SI if results of applying the general OGSI methods are valid, however no local data was available.
Sensitivity	No short-term sensitivity; delays falldown by 11 decades in mid-term, and increases harvest level 15% in long-term.
	Study by J.S. Thrower and Assoc. shows partially cut stands of Fdi are not suitable for using height growth and site index to estimate site productivity
Eco-mapping status	

Recent Strategy and Projects

Inventory Audit Results

Audit date: 1998

Findings Audit showed that the inventory is acceptably accurate for the mature component, and mature operable components of the inventory. However the estimate of site index for the immature component may significantly underestimate site productivity.

Base case adjustment

Sensitivity

Smallwood Pine Productivity

Method In sensitivity analysis, SIBEC was used to derive new estimates of site index for 93 500 ha of smallwood (repressed) pine stands.

Findings The average site index of the repressed pine stands was increased from 11.7 m in the base case to 16.4 m. This 4.7 m increase in site index increased the LTHL by about 8%.

Utilization Standards

	Min dbh (cm)	Max stump height (m)	Min top dib (cm)
Lodgepole pine	12.5	30	10
All other species	17.5	30	10

Estimates of recovery from stands of small pine ("smallwood" stands) average about 25% higher than modelled in base case

Chief Forester estimated an increase in harvest level of about 62 500 m^3/yr from smallwood land base in short- and medium-term.

On the conventional land base, licensees are logging to higher utilization standards than modelled in base case, resulting in total estimated increases (upward pressures) of 42 750 m^3/yr in short- and medium-terms.

Minimum harvestable age

Method for determining Existing stands – either minimum volume/ha, or default if age at minimum volume is "unacceptably" low.

Managed stands—

Stand Types	Minimum volume (m^3/ha)	Default age (yr)
Existing stands–pine	150	80
Existing stands–other conifer	150	100
Managed stands	90% of age of CMAI	—
Selection management stands	—	120

Sensitivity No short-term effect; small medium- and long-term effects.

Green-up age / requirement

Method for determining

Sensitivity

Visual Quality

Method for determining

Sensitivity

Old-growth age / requirement

Method for determining

Sensitivity	
Regeneration delay	2 or 3 yr
Method for determining	
Sensitivity	
Managed Stand Yield Tables	
Yield model used	TIPSY
Issues?	
Sensitivity	
OAFs	
OAF1	15%
OAF2	5%
Sensitivity	
Selection Silviculture	Selection management applies to about 15% of the THLB (TSAR p. 52)
Silvicultural emphasis	
First-entry cutting intensity (%)	25%
Return interval (yr)	30 yr
Future entries cutting intensity (%)	25%
\Yield model used:	VDYP for existing and future stands
Incremental Silviculture	
Treatments used in the MU	
How represented in TS analysis?	

Comments:

The abundance of timber older than minimum harvestable age makes for a resilient timber supply in Merritt TSA. The pre-uplift harvest level in Merritt TSA can be maintained for 6 decades, followed by a decline of 9% per decade to the LTHL. There is very little short-term harvest sensitivity to changes in data or assumptions. Further there are significant opportunities for increasing mid- and long-term harvest levels, and in particular through applying new estimates of site index to old-growth stands and to smallwood (repressed) pine types.

Site index projects are already under way in Merritt. They should be completed and their results applied as appropriate.

Local data should be collected to improve confidence in the magnitude of site productivity adjustments for the Merritt TSA.

Collect data on which derivation of localized OAFs can be based.

Smallwood—monitor and track operations in smallwood, and clarify definition and administration of these stands

Management of Douglas-fir stands—Douglas-fir stands to which selection management is applied cover about 100 000 ha (15% of the THLB), may have high wildlife values, and present management challenges. Excluding harvesting from these would not affect short-term timber supply, and would reduce mid-term timber supply by only 3.4. Management of these stands should be carefully examined and monitored for timber supply and non-timber values.

Assessment

There is no short-term sensitivity to any of the factors tested in the TSR timber supply analysis report for Merritt TSA.

Application of the results of OGSI research suggest that long-term timber supply could be as much as 20 percent higher than in the base case forecast, but no local data is available to support this suggestion. In addition, there is evidence from district staff that site productivity in smallwood stands may be seriously underestimated.

For Merritt TSA, the highest priority growth and yield issue is collection of local data to support improving estimates of site productivity.

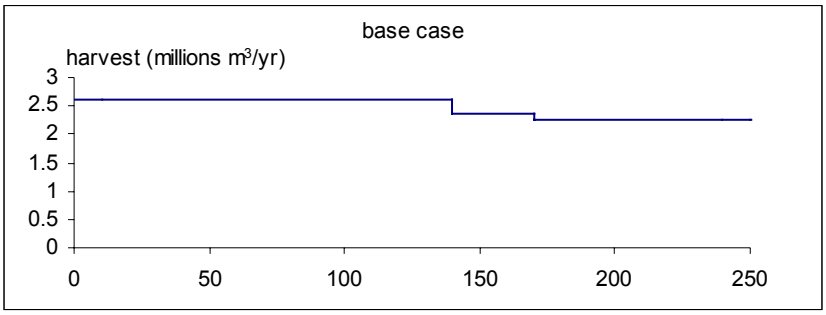
Okanagan TSA (includes Okanagan IFPA)

Forest District/Region: Salmon Arm, Vernon, and Penticton Districts, Kamloops Region

Documents reviewed: AAC Rationale (2001), TSR Timber Supply Analysis Report (2000), Type 1 Silviculture Strategy (2000), Inventory Audit (1997).

Other reports of interest:

Base case forecast:



Land base description	
Current AAC (m^3/yr)	2 655 000 m^3/yr (including a partition of 80 000 for small-scale salvage)
Total TSA Area (ha)	2 246713 ha
Total productive forest area (ha)	1 441 931 ha
Current THLB area (ha)	1 057 755 ha
% Operable	73.4%
Ecological representation (% PFLB)	ESSF (33%), ICH (25%), IDF (22%), MS (18%), PP (1%), AT (1%)
Species composition	Pli (34.1%), Fdi (29.5%), S (14.4%), B (11.6%), C (5.6%), H (4.7%)
Age-class distribution	About 59% of the stands in the THLB are older than minimum harvestable age.
	25% of stands are younger than 21 yr, 31% are between 21 and 100 yr, 24% are between 101 and 250 yr, and 20% are older than 250 yr.
Other comments	Community watersheds cover 20% of the timber harvesting land base.
Defining Merchantability	
Method of determining	Low timber growing potential —site index limit
	Problem forest types—combinations of species, site index, age, height, volume
Sensitivity	
Site Productivity	No local site productivity study data is available for Okanagan TSA.
Species	Sensitivity analysis was used to test adjusting SI of stands older than 140 yr, which comprise about 35% of the THLB.
Method	Applied provincial OGSI method; since no local data available.
Findings (change in average SI value)	Weighted average increase in SI = 5.01 m (40%), however there is good reason to think that this overestimates the adjustment actually needed. There is less than 1 m difference in SI between older stands and intermediate-aged stands in Okanagan TSA, which might indicate the SI of the older stands might not be underestimated significantly
Sensitivity	22% increase in LTHL
Eco-mapping status	

Recent Strategy & Projects

Inventory Audit Results

Audit date: 1997

Findings No statistically significant problems with volume estimates.

District staff trying to organize funding to re-inventory this TSA.

Base case adjustment

Sensitivity

Utilization Standards Based on licence requirements and current performance

	Min dbh (cm)	Max stump height (m)	Min top dib (cm)
Pine	12.5	30	10
Cedar	17.5	30	15
All others	17.5	30	10

Minimum Harvestable Age

Method for determining Not explained.

Species group	Minimum harvestable age (yr)
Lodgepole pine	80
All other species	100

Sensitivity

Green-up Age/ Requirement

Method for determining

Sensitivity None.

Visual Quality

Method for determining

Sensitivity

Old-growth Age/ Requirement

Method for determining

Sensitivity No short-, mid-, or long-term effect. Small effect in early long-term.

Regeneration Delay

Method for determining

Sensitivity

Managed Stand Yield Tables

Yield model used VDYP, TIPSY; plus, VDYP used for managed-stand yields for selection system

Issues?

Sensitivity

OAFs	**Pli, dry belt Fdi and B**	**B, S on G-M sites**	**Cw, Hw, wet belt Fdi**
OAF1	15%	20%	20-33%
OAF2	5%	0%	14-20%

Sensitivity Mid- and long-term increase of about 7% (p.22 of Rationale) to 10% (p.28 TSAR).

Selection Silviculture	Applied to 48000 ha of dry-belt Douglas-fir.
Silvicultural emphasis	
First-entry cutting intensity (%)	33%
Return interval (yr)	30 yr
Future entries cutting intensity (%)	33%
Incremental Silviculture	
Treatments used in the MU	
How represented in TS analysis?	

Comments:

The AAC Rationale (2001) directs district staff, among other things to:

- pursue funding for a new forest inventory, and
- work with licensee staff to collect improved site productivity data for stands in the TSA

In addition, modeling root-rot impacts is a concern. Current approaches using OAF2s may result in more volume than VDYP at 100 years, and less volume at 200 years.

Assessment

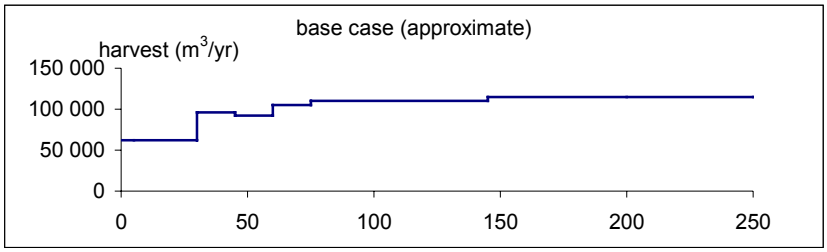
The timber supply forecast for Okanagan TSA is very robust, meaning that it is not sensitive to changes in data or assumptions. None of the parameters tested in sensitivity analysis affected the short-term timber supply. No growth and yield projects are high priority for this TSA.

TFL 15 (Weyerhaeuser)

District/Region: Penticton Forest District, Kamloops Forest Region

Documents reviewed: AAC Rationale (1999), Type 1 Silviculture Strategy (Weyerhaeuser 2001)

Base case forecast:



Land Base Description		
Current AAC (1999)	70 000 m^3/yr	
Total TFL Area (ha)	48 449 ha	
Total productive forest area (ha)	45 375 ha	
Current THLB area (ha)	36 655 ha	
% Operable	81%	
Ecological representation	MS (46%), IDF (38%), ESSF (14%), PP (2%)	
	Over 11 000 ha are classified as dry-belt stands.	
Species composition	Lodgepole pine (60%), larch (20%), ponderosa pine (7%), spruce (6%), Douglas-fir (5%), and balsam (2%).	
Age-class distribution	About 38% of the THLB stands are younger than 60 yr, and 41% are between 61 and 140 yr. About 21% of THLB stands are older than 140 yr, including 2% older than 250 yr.	
Other comments		
Defining Merchantability		
Method of determining		
Sensitivity		
Site Productivity		
Species	Pli	Other spp< 30 yr old
Method	SI was adjusted using local data from growth intercept studies.	assign SI from silviculture records
Findings (change in average SI value)	Study suggested that average SI for lodgepole pine stands on TFL 15 should be 19 m, 6 metres higher than average indicated by the inventory	
Sensitivity	Long-term sensitivity, but no short-term effect	
Eco-mapping status		
Recent strategy and projects	SIA project in progress?	

Inventory Audit Results

Audit date: 1996

Findings Volumes in coniferous stands older than 60 yr are overestimated by 18%.

Weyerhaeuser contends that the audit should not be applied because of issues associated with the compilation of audit volumes.

Sensitivity Medium-term timber supply is highly sensitive to decreases in volumes for existing stands; Chief Forester concluded that the short- and medium-term timber supply may be severely overestimated compared to the base case forecast if the audit is accurate.

Chief Forester encouraged the licensee to refine the forest cover inventory using a VRI Phase 2 sampling plan

Utilization Standards

Decay, Waste and Breakage FIZ D loss factors were used for decay, waste and breakage

	Min dbh (cm)	Max stump height (m)	Min top dib (cm)
Spruce, balsam	17.5	25*	10
Lodgepole pine	12.5	25*	10
Other species	17.5	30	10

* Normal utilization standards are for a 30 cm stump. To represent the shorter stump, yield tables were increased by 1%.

Minimum Harvestable Age

Method for determining Minimum stand volume criteria assigned by licensee (Weyerhaeuser incorrectly used gross volume rather than merchantable volume for determining MHA, so they most likely underestimated MHA)

Sensitivity Increasing MHA has a negative impact on timber supply beginning decade 2; very sensitive in medium term

Green-up Age/ Requirement 3m / max 30% disturbance in General Management, Stocking Class 4, and Wildlife Management Zones.

Method for determining 3 m height required in general management areas

Sensitivity Highly sensitive in short-term to increasing green-up age/height.

Highly sensitive in short- and medium-term to changing the maximum permitted percent disturbance. The Chief Forester noted in the AAC Rationale that the existing distribution of harvested areas on the TFL limits flexibility of future harvesting opportunities in the short- and medium-terms.

Visual Quality 5008 ha of the THLB was visually sensitive

Method for determining BCFS procedures for determining allowable disturbance were used. Green-up height of 4.5 m was required in visually sensitive areas

Sensitivity Increasing green-up height to 6 m had no impact on the base case forecast.

Old-growth age/ requirement

Method for determining Low biodiversity emphasis option of draft Landscape Unit Plan.

Sensitivity Licensee tested an alternative scenario based on applying the Okanagan IRM Timber Harvesting Guidelines, which require that 10% of the productive forest be maintained in an old-growth condition. A non-declining harvest level of 86 000 m^3/yr could be maintained for about four decades before rising to a LTHL of 120 000 m^3/yr.

Regeneration Delay

Method for determining

Sensitivity

Managed Stand Yield Tables	
Yield model used	TIPSY
Issues?	
Sensitivity	Very sensitive in medium- and long-term
OAFs	
OAF1	10%
OAF2	5%
Sensitivity	
Comment:	Need to investigate effects of mistletoe to determine whether 10% OAF1 is adequate.
Selection Silviculture	Selection management is rarely used because of forest health issues.
Silvicultural emphasis	
First-entry cutting intensity (%)	
Return interval (yr)	
Future entries cutting intensity (%)	
Incremental Silviculture	
Treatments used in the MU	
How represented in TS analysis?	

Comments:

This licensee is currently completing a site index adjustment project.

Medium-term timber supply is highly sensitive to decreases in existing volumes, which imparts significance to the inventory audit results.

Weyerhaeuser OK Falls helped establish two commercial thinning trials near Princeton, B.C. These plots were established in 1997, and have not yet been re-measured.

Many stands harvested on TFL 15 are Pl-leading that regenerate to Pl after harvesting to densities that may exceed 20 000 stems/ha and higher. MoF policy states that where they contain more than 10 000 countable trees per hectare at time of free-growing, these areas must be spaced by the licensee to a much lower target density. The target density, which was set by the MoF, is generally about 1200 – 1800 stems/ha in the OK Falls area. A higher target density of 2400 trees/ha was recently approved for all of Weyerhaeuser's operating area in the Penticton District. (J.S. Thrower & Associates Ltd., 2000).

Assessment

The timber supply forecast on TFL 15 is very sensitive in the short-term to changes in the existing inventory volumes, and the inventory audit (1996) showed that volumes are significantly over-estimated (18%) in stands older than 60 yr. Sorting out the reasons for this finding is probably the most important issue in this management unit.

The short-term forecast is sensitive to green-up constraints. However the current green-up age is based on a green-up height of 3 m, which is not excessive and does not leave much room for

significant changes to green-up age. Investments in refining green-up age are unlikely to provide much leverage on timber supply.

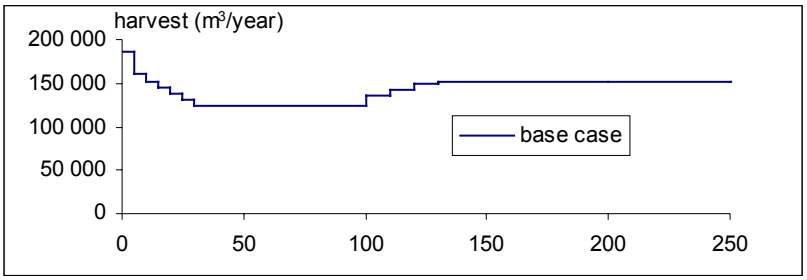
TFL 18 (Slocan Forest Products)

Forest District/Region: Clearwater Forest District, Kamloops Forest Region

Documents reviewed: AAC Rationale (2000), Inventory Audit (1997)

Other reports of interest:

Base case forecast:



Land Base Description	
Current AAC (m^3/yr)	177 650 m^3/yr
Total TFL Area (ha)	74 622 ha
Total productive forest area (ha)	68 700 ha (approx)
Current THLB area (ha)	
% Operable	
Ecological representation	SBS (40%), ESSF (44%), ICH (16%)
Species composition	Se, Sw, Pli, Bl, Fdi, Hw, Cw
Age-class distribution	
Other comments	
Defining Merchantability	(e.g., for land base net-down)
Method of determining Sensitivity	
Site Productivity	No adjustment made in base case
Species	
Method	General provincial OGSI adjustments were applied to all stands older than 140 years.
Findings (change in average SI value)	Not stated in rationale.
Sensitivity	Increased LTHL by 11%; no change in short-term or medium-term harvest. In his decision, Chief Forester concluded that underestimating site index may cause future yields and LTHL to be underestimated by up to 11%.
Eco-mapping status	TEM Project underway (or possibly complete?)
Recent strategy and projects	

Inventory Audit Results	Inventory completed 1992
Audit date:	1997
Findings	No significant differences between ground-based and audit volume estimates of mature stands (older than 60 yr); site index assignments were acceptable; the non-forest classification in the 1992 re-inventory did not meet provincial standards, but this had no effect on THLB.
Sensitivity	

Utilization Standards

DWB FIZ G, special cruise #318

	Min dbh (cm)	Max stump height (m)	Min top dib (cm)
Lodgepole pine	12.5	30	10
All other species	17.5	30	10

Minimum Harvestable Age

Method for determining Age at which specified minimum height or volume are achieved

Analysis Unit	Minimum volume (m^3/ha)	Minimum height (m)
Pine	120	
All others	150	

MHA ranged from 80 to 150 yr

Sensitivity Reducing MHA by 10% increases mid-term timber supply by 6%.

Increasing MHA by 10% reduces mid-term timber supply by 9%.

Green-Up Age/ Requirement	Timber supply analysis done by Hugh Hamilton with their FSOS model.
Method for determining	Spatially explicit analysis using automated blocking; G-U height/age = 3m/15 yr.
Sensitivity	Increasing green-up age from 15 to 20 yr reduced short-term harvest by 19%.
	Decreasing green-up age to 10 yr increased short-term harvest by 6%.
Visual Quality	VQOs have not been established for TFL 18.
Method for determining	Chief forester felt that the allowable disturbance could be higher and that the short- and medium-term harvest may be underestimated because of this.
	Chief forester directs licensee and district and regional staff to review the recommended VQOs.
Sensitivity	
Old-Growth Age/ Requirement	
Method for determining	
Sensitivity	
Regeneration Delay	2 yr
Method for determining	Current practice.
Sensitivity	None tested.
Managed Stand Yield Tables	(for all existing stands younger than 40 yr, except residual balsam stands)
Yield model used	TIPSY
Issues?	None
Sensitivity	Proportionate sensitivity of LTHL to changing MSYT by 10%.

OAFs		Sx, Fdi	Pli	All other spp
	OAF1	15%	15%	15%
	OAF2	15%	14%	5%
	Sensitivity	None tested; however, the MSYT sensitivity shows an effect on LTHL..		
Selection Silviculture				
	Silvicultural emphasis			
	First-entry cutting intensity (%)			
	Return interval (yr)			
	Future entries cutting intensity (%)			
Incremental Silviculture				
	Treatments used in the MU	Genetic gain		
	How represented in TS analysis?	Assumed 9% gain for interior spruce, % gain for Pli, Fdi, Lw, and Pw.		

Comments:

Timber supply forecast in this management unit declines sharply beginning in year 6, and is very sensitive to changes in the land base. Important growth and yield issues are related to defining the timber harvesting land base and yields:

- growth and yield of residual balsam stands,
- criteria used to identify areas of low site and problem forest types,
- defining OAFs, and
- defining minimum harvestable age.

Assessment

There is potential for interaction of a number of elements mentioned in the AAC Rationale to affect short-term timber supply in TFL 18:

1. site indices may be underestimated significantly
2. short-term harvest level is sensitive to green-up age and allowable disturbance percent
2. mid-term harvest level is sensitive to reducing minimum harvestable age.

No local data on site productivity has been collected. If site indices are proven (through local studies) to be underestimated, green-up age and minimum harvest age would also be affected, which could have a significant effect on the short- and mid-term harvest levels.

Therefore the highest priority for growth and yield studies for TFL 18 is to undertake work to improve estimates of site productivity.

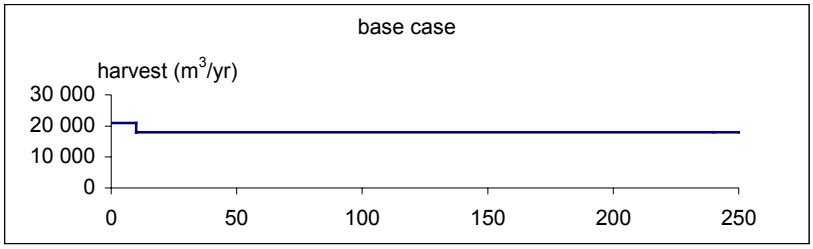
TFL 33 (Federated Co-operatives)

Forest District/Region Salmon Arm Forest District, Kamloops Forest Region

Documents reviewed: AAC Rationale (2000), Type 1 Silviculture Strategy (2001), Inventory Audit (1995).

Other reports of interest:

Base case forecast:



Land Base Description	
Current AAC (m^3/yr)	21 000 m^3/yr
Total TFL Area (ha)	8365 ha
Total productive forest area (ha)	7678 ha
Current THLB area (ha)	6979 ha
% Operable	91%
Ecological representation	ICH (66%), ESSF (33%)
Species composition	Fdi, Cw, Hw, Se, B, Pli
Age-class distribution	About 28% of the THLB is younger than 40 yr.
Other comments	
Defining Merchantability	
Method of determining	Low timber growing potential sites were defined as being unable to produce at least 200 m^3/ha by age 160 yr. These sites were mapped to a minimum site index value, which was used to identify "low site" hectares. Problem forest types on this TFL are mainly those with significant amounts of birch or aspen.
Findings	101 ha of low site identified 150 ha deciduous identified
Sensitivity	
Site Productivity	No adjustments were made in the base case because only data for Pli and S, which would be applicable to only 99 ha of stands older than 140 yr on TFL 33, were available for the region.
Species	
Method	
Findings (change in average SI value)	
Sensitivity	
Eco-mapping status	

Recent Strategy and Projects	Licensee recognized in MP #8 that site index assignments need review.		
Inventory Audit Results	Inventoried in 1981, updated in 1998		
Audit date:	1995		
Findings	There was no significant difference between the inventory estimate of mean volume/ha and the audit estimate.		
Base case adjustment			
Sensitivity			
Utilization Standards			
	Min dbh (cm)	Max stump height (m)	Min top dib (cm)
Lodgepole pine	12.5	30	10
All others	17.5	30	10
Minimum Harvestable Age			
Method for determining	Age of MAI culmination		
Sensitivity	Not sensitive		
Green-Up Age/ Requirement	In IRM zone: 3 m green-up height was applied, with a 35% maximum limit		
Method for determining	retention VQO zone: max 1%< 6m (22 yr)		
	partial retention VQO zone: max 10% < 5 m (20-23 yr)		
	modification VQO zone: max 21% <5 m (23-25 yr)		
Sensitivity	The base case was very constrained by visual constraints, and timber supply was very sensitive to it; District staff recommended that current practices (e.g., layout, cutblock size) warrant allowing more disturbed area in VQO zones.		
Visual Quality	76% of the THLB is visually sensitive.		
Method for determining	Visual quality requirements and green-up ages are the single most important issue affecting timber supply on TFL 33.		
Sensitivity			
Old-Growth Age/ Requirement			
Method for determining			
Sensitivity			
Regeneration Delay			
Method for determining			
Sensitivity			
Managed Stand Yield Tables			
Yield model used	TIPSY		
Issues?			
Sensitivity			
OAFs	Chief Forester noted that the licensee has not accounted for root rot in the ICH, which is likely to be prevalent. The licensee was asked to estimate losses.		
OAF1	15%		
OAF2	5%		
Sensitivity	Licensee feels that the managed-stand OAFs are too high based on a series of plots that measured gaps.		

Selection Silviculture	Small patches (<7 ha cuts) and single-tree systems used.			
Silvicultural emphasis	type 1	type 2	type 3	type 4
First-entry cutting intensity (%)				
Return interval (yr)				
Future entries cutting intensity (%)				
Incremental Silviculture				
Treatments used in the MU	Genetic gain			
How represented in TS analysis?	S 4%, Pli 6%, Lw 3%, Fdi 0%			

Comments:

Visual quality requirements and green-up ages are the single most important issues affecting timber supply on TFL 33.

The Chief Forester asked the licensee to investigate and provide estimates of endemic losses to root rots, particularly in stands of the ICH. As well, the licensee expressed concern that the OAFs being used (15%, 5%) were unnecessarily high. These issues should be pursued.

Assessment

The key timber supply issue in TFL 33 is related to visual quality objectives and the manner in which current practices are represented in the timber supply analysis model. Timber supply in this management unit is very sensitive in the short term to visual quality objectives (green-up age and allowable disturbance percent). The allowable disturbance constraints that were used in the timber supply analysis were felt to be more restrictive than required to represent current practice, because the licensee has been employing visual landscape design techniques and small cutblocks for almost 10 years, permitting more disturbed area in practice than would otherwise be allowed.

Determining the appropriate allowable disturbance percent is outside the scope of this assessment, but is clearly important. But the sensitivity of the forecast to green-up age begs the question of ensuring that the green-up age used accurately represents the time needed for stands to reach green-up height.

Since no local data have been collected for adjusting site index estimates[1], and site index is an important factor in projecting stand height, it is recommended that growth and yield efforts be focused on site index estimation.

There is also some uncertainty about whether the OAF1 used in the analysis is appropriate given the likelihood of problems with root rot. This issue is unlikely to affect short-term harvest levels, but is nonetheless important in the mid-term and long-term for this management unit.

[1] The only local data currently available are for pine and spruce, which comprise very little of the mature THLB.

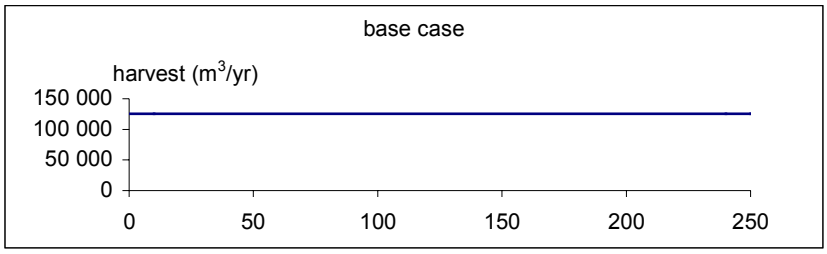
TFL 35 (Weyerhaeuser)

Forest District/Region Kamloops Forest District, Kamloops Forest Region

Documents reviewed: AAC Rationale (2001), Inventory Audit (1995)

Other reports of interest:

Base case forecast:



Land Base Description

Current AAC (m^3/yr)	125 600 m^3/yr
Total TFL Area (ha)	36 564 ha
Total productive forest area (ha)	35 400
Current THLB area (ha)	31 172 ha
% Operable	88%
Ecological representation	MS, ICH, IDF, ESSF
Species composition	Pli, Se, Bl, Fdi
Age-class distribution	
Other comments	

Defining Merchantability

Method of determining

TEM (1999) resulted in 456 ha (0.7% of THLB) being classified as low productivity, 216 of which were netted out after other reductions.

Marginally merchantable stands (2393 ha) were defined using stand attributes of species, age, and height:

Species	age (yr)	Height (m)
non-pine leading	> 100 yr	< 19.5 m
pine-leading	> 80 yr	< 19.5 m

pine stands that have been disturbed or have low stocking and /or small trees.

Site Productivity	
Species	The base case includes new estimates of site index for Pli, S, Bl, Fdi.
Method	SIA done by J.S. Thrower and Assoc. New site index estimates for Pli, S, and Bl were based on tree heights and ages from 64 randomly selected points. Estimates for Fdi were based on BCFS species conversion formulas applied to adjusted estimates for pine and spruce.
Findings (change in average SI value)	Thrower noted that the adjusted site indices for spruce may be slightly over-estimated. Chief Forester felt that the impact of any overestimate is likely to be small.
Sensitivity	Sensitivity analysis showed very small sensitivity to increasing SI, but a 3-metre reduction in SI caused a 6.4% reduction in timber supply.
Eco-mapping status	TEM was completed in 1999. It is currently being enhanced and upgraded.
Recent Strategy and Projects	
Inventory Audit Results	Inventory was done in 1978, and updated to Dec 31, 1999.
Audit date:	1995
Findings	No difference between inventory mature volumes and sample plots.
Base case adjustment	
Sensitivity	
Utilization Standards	
	Normal utilization standards as defined in TFL agreement were used.
Minimum Harvestable Age	
Method for determining	age at which specified minimum height or volume are achieved

Analysis Unit	Minimum volume (m^3/ha)	Minimum height (m)

Sensitivity	
Green-Up Age/ Requirement	
Method for determining	
Sensitivity	
Visual Quality	
Method for determining	
Sensitivity	
Old-Growth Age/ Requirement	
Method for determining	
Sensitivity	
Regeneration Delay	
Method for determining	
Sensitivity	

Managed Stand Yield Tables					
Yield model used	TIPSY				
Issues?					
Sensitivity					
OAFs	**all species, enhanced mgmt**	**all species, other managed**	**Pli**	**Fdi**	**S**
OAF1	10%	11%			
OAF2			3.2%	3.9%	3.8%
Sensitivity					
Selection Silviculture					
Silvicultural emphasis	type 1	type 2	type 3	type 4	
First-entry cutting intensity (%)					
Return interval (yr)					
Future entries cutting intensity (%)					
Incremental Silviculture					
Treatments used in the MU	"enhanced management program" — higher stocking levels, immediate site preparation, significantly improved planting stock, increased use of mixed-species planting				
How represented in TS analysis?	mixed species planting was not reflected in base case, and may increase time (relative to planting pure pine) to green-up, FTG, and minimum harvest age, reducing mid-term timber supply				

Comments:

In this management unit there is some question about the extent to which low site productivity area contributes to the THLB.

More confidence is needed in new site index estimates for high elevation areas and spruce generally.

Operational adjustment factors need review and substantiation with empirical data.

Assessment

The timber supply analysis used new (adjusted) site index estimates derived by J. S. Thrower and Associates. Sensitivity analysis showed strong long-term sensitivity to decreasing site indices, but very little sensitivity to increasing them. In the AAC Rationale, the Deputy Chief Forester expressed confidence that any error in the site indices was of smaller magnitude than that tested in the sensitivity analysis, and that the effect was not short-term at any rate. Further work on improving site index estimates should be considered low priority.

Weyerhaeuser's recent use of mixed-species regeneration strategy may have mid-term timber supply implications (longer green-up period), but it may improve performance in other areas such as visual quality and habitat values. It is important that the development of these managed mixed-species stands be monitored and measured.

The Deputy Chief Forester also mentioned the uncertainty about the OAFs used in the timber supply analysis, and directed the licensee to collect empirical data in support of the OAFs for the next TSR analysis.

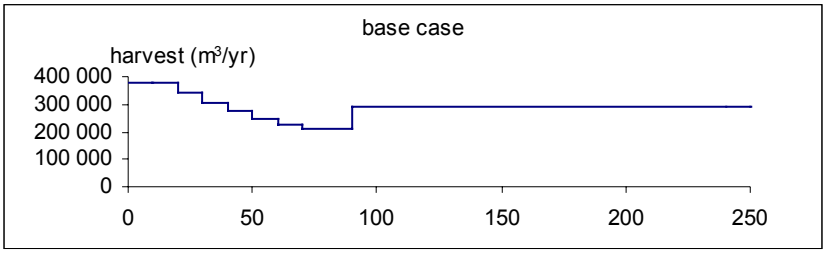
TFL 49 (Riverside Forest Products)

Forest District/Region: Vernon and Penticton Forest Districts, Kamloops Forest Region

Documents reviewed: AAC Rationale (December, 1998), Sustainable Harvest RMP (2000-2005)

Other reports of interest:

Base case forecast:



Land Base Description	
Current AAC (m^3/yr)	380 000 m^3/yr
Total TFL Area (ha)	143 760 ha
Total productive forest area (ha)	135 424 ha
Current THLB area (ha)	125 022 ha
% Operable	92.3%
Ecological representation	PP, IDF, ICH, MS, ESSF
Species composition	Pli (43%), Fdi (29%), S (15%), B (13%)
Age-class distribution	25% younger than 60, 47% between 60 and 140, 26% older than 140, with 2% older than 250.
Other comments	
Defining Merchantability	
Method of determining	Non-merchantable stands (deciduous, low volume, low productivity) were defined using a combination of leading species, site index or volume limits, diameter class and age.
Sensitivity	
Site Productivity	The licensee intends to adjust site indices in blocks A and C, as has already been done in block B
Species	
Method	The licensee used ecosystem site association data to adjust old growth site indices for stands older than 140 yr in block B. In sensitivity analysis, provincial OGSI adjustments were applied to blocks A and C.
Findings (change in average SI value)	
Sensitivity	OGSI adjustments in blocks A and C showed that medium-term and long-term timber supply may be underestimated by 23% and 12% respectively
Eco-mapping status	Ecosystem classification of Block B had been done, and was planned for Blocks A and C.
Recent Strategy & Projects	

Inventory Audit Results

VRI Phase I inventory was completed in 1996.

Audit date:

VRI Phase II sampling was used to assess the accuracy of the inventory.

Findings

Existing mature stand volumes may be underestimated by up to 15%, which would allow initial harvest level to be maintained for an additional two decades.

Sensitivity

Utilization Standards

Licensee normally cuts to a 20 cm stump height, rather than 30 cm.

	Min dbh (cm)	Max stump height (m)	Min top dib (cm)
Lodgepole pine	12.5	30	10
All others	17.5	30	10

Decay, Waste, and Breakage

Okanagan special cruise factors #187 for Fdi, Cw, and Hw.

FIZ D was used for all other species.

Minimum Harvestable Age

Method for determining

Age of MAI culmination

Stand type	Minimum Harvestable Age (yr)
Existing stands	70 – 140 yr
Managed stands	50 – 140 yr

Sensitivity

Mid-term timber supply increased significantly when MHA was reduced by 10%.

Green-up Age/ Requirement

Method for determining

Used 3 m in IRM zone

Sensitivity

Visual Quality

Method for determining

Sensitivity

Old-growth Age/ Requirement

Method for determining

Sensitivity

Regeneration Delay

Method for determining

Current practice—4 yr for Fdi, Pli; 3 yr for all other species

Sensitivity

Managed Stand Yield Tables

Yield model used

TIPSY

Issues?

1. Species composition of regenerated stands modelled differs from current practice

2. Root disease – Root rot can be severe in ICH and IDF BEC zones. Research Branch staff estimate that future yields may be 20 to 30 percent below those projected with TIPSY.

Sensitivity

1. up to six percent reduction in long-term timber supply

2. up to seven percent reduction in long-term timber supply

OAFs				
OAF1	10%			
OAF2	5%			
Sensitivity				
Selection Silviculture	Partial cutting is used to produce 5% of volume harvested annually.			
Silvicultural emphasis	type 1	type 2	type 3	type 4
First-entry cutting intensity (%)				
Return interval (yr)				
Future entries cutting intensity (%)				
Sensitivity	Licensee simulated using partial cutting systems in a sensitivity analysis, and found a 5% reduction in long-term timber supply, with no impact in short- and medium-term.			
Incremental Silviculture				
Treatments used in the MU	Genetic improvement.			
How represented in TS analysis?	Increase site index by 2% for spruce and pine planted 1992-1997, and by 5.5% for improved pine planted after 1998.			

Comments:

Chief Forester encouraged the licensee to undertake ecosystem mapping as the basis for assigning new estimates of site productivity in blocks A and C.

Applying OGSI adjustments increased mid-term timber supply by 23%

Minimum harvestable ages were based on culmination of MAI. Reducing minimum harvestable age by 10 years significantly increased mid-term timber supply.

OAF1 of 10% needs substantiation.

Assessment

The harvest level forecast for TFL 49 declines after the second decade by 10% per decade until decade 8. The lowest harvest level in the forecast is in decades 8 and 9, after which it increases to the LTHL. I infer that timber scarcity in the mid-term is limiting harvest levels in decade 3. According to the AAC Rationale, stands currently between 40 and 70 years old represent only six percent of the timber harvesting land base and limit the available timber supply of TLF 49 in the medium term (p.2). Applying OGSI adjustments increased mid-term timber supply by 23% (p.16). Minimum harvestable ages were based on culmination of MAI. Reducing minimum harvestable age by 10 years significantly increased mid-term timber supply (p. 18).

Increasing mid-term harvest levels would allow maintaining the initial harvest level longer because of an allowable cut effect.

Therefore, the highest priority growth and yield issues are applying site index adjustments, and refining estimates of minimum harvestable age.

Appendix 1 Management units of the Southern Interior

Cariboo Forest Region	Kamloops Forest Region	Nelson Forest Region
100 Mile House TSA (Lignum IFPA)	Kamloops TSA (Adams Lake IFPA)	Arrow TSA (Arrow IFPA)
Quesnel TSA	Lillooet TSA	Boundary TSA
Williams Lake TSA (Lignum IFPA)	Merritt TSA (Merritt IFPA)	Cranbrook TSA
TFL 5 (Weldwood)	Okanagan TSA (Okanagan IFPA)	Golden TSA
TFL 52 (West Fraser)	TFL 15 (Weyerhaeuser)	Invermere TSA
	TFL 18 (Slocan)	Kootenay
	TFL 33 (Federated Co-ops)	Revelstoke TSA
	TFL 35 (Weyerhaeuser)	TFL 8 (Pope & Talbot)
	TFL 49 (Riverside)	TFL 3 (Slocan)
		TFL 14 (Tembec)
		TFL 23 (Pope and Talbot)
		TFL 55 (Louisiana-Pacific)
		TFL 56 (Revelstoke Community Forest)

Appendix 2 Glossary

Allometry	The growth of part of an organism relative to the entire organism; the measurement and study of such growth.
Allowable annual cut (AAC)	The rate of timber harvesting permitted each year from a specified area of land. The chief forester sets AACs for timber supply areas (TSAs) and tree farm licences (TFLs) in accordance with Section 8 of the Forest Act.
Analysis unit	A grouping of forest types for use in timber supply analysis. Usually based on some combination of species composition, site productivity, silvicultural regime, and or geographic location.
BEC method	See SIBEC method.
(of estimating site index)	
Direct methods (of estimating site index)	Any of the site index estimation methods that require tree measurements.
Destructive sampling	Sampling that requires falling and sectioning trees.
FSSIM	The Forest Service Simulator, a timber supply analysis model developed by the MOF Timber Supply Branch for use in TSR.
Growth intercept method (of estimating site index)	A direct method of estimating site index from the height and age of carefully selected site trees. The growth intercept (GI) method uses 5-year height growth above DBH. Site index is then obtained from a look-up table. This method is best used on stands that have between 3 and 30 years growth above breast height. (See also BEC method and site index curve method.)
Growth and yield model	A model that predicts growth over time and the resulting yields at various points in time.
Harvest schedule	A schedule of hectares to be harvested by time period (e.g., decade), specifying treatment type, area, and amount of harvesting and regeneration treatments to be implemented throughout the planning horizon.
Height-age models	Models that estimate height as a function of site index and age (and are commonly used to estimate site index from height and age).
Indirect methods (of estimating site index)	Any of the site index estimation methods that do not require direct tree measurements. Mainly SIBEC and SIA.
Managed-stand yield table	A yield table representing the yields from managed stands, for use in timber supply analysis.
Meta-model	A model derived from the output of another model.
MGM	Mixedwood Growth Model—– An individual-tree, distance independent model for boreal mixedwoods being developed by the University of Alberta. Northern licensees and the ministries have assisted development work in BC.
Natural-stand yield table	A yield table representing the yields from naturally established (usually existing) stands, for use in timber supply analysis.
Operational Adjustment Factors (OAF) for TASS/TIPSY	For timber supply analysis, adjustments are required to reduce TIPSY (TASS) yields to reflect expectations under normal, sub-optimal field conditions. Unadjusted TASS (TIPSY) yields are intentionally set to reflect operational “potential” under ideal field conditions, i.e., with complete stocking and minimal growth losses from insects, diseases, brush competition, etc. Refer to TIPSY’s HELP files.
OASIS	OASIS is the operational adjustment to site index study piloted on the Bulkley TSA. A non-spatial technique for applying SIBEC estimates, it does not require PEM or TEM.
OGSI	Old-Growth Site Index (OGSI) refers to data collection procedures for paired plots, and relocation and remeasurement of logged temporary sample plots. The OGSI procedure is used to adjust the site index value assigned to post-harvest regenerated stands based on estimates from the preceding old-growth stand. OGSI adjustments are derived from pairs of site index plots established in old-growth stands and adjacent second-growth stands of the same inherent productivity, hence the name “paired plot”.
Paired Plot	OGSI adjustments are derived from pairs of site index plots established in old-growth stands and adjacent second-growth stands of the same inherent productivity.
PEM	Predictive Ecosystem Mapping – one of two mapping methods used in BC to provide

	spatial linkage of SIBEC/SIA to the inventory in timber supply analysis. Also see TEM.
PrognosisBC	The BC version of the Forest Vegetation Simulator (FVS). It is an individual-tree, distance independent model intended for application in multi-spp and/or uneven-age conditions, including partial cutting, in the southern interior.
Sensitivity analysis	A modeling technique used to explore a problem by testing the sensitivity of the solution to changes in inputs. In timber supply analysis it involves changing the value of a model parameter (e.g., minimum harvestable age), and then measuring the effect of that change on the harvest forecast.
SIA	A three-phase procedure for obtaining site index estimates, involving preliminary estimates, field-sample based "actual" estimates, and statistical adjustment of the preliminary estimates.
SIBEC	Site index-biogeoclimatic ecosystem classification. SIBEC is a method to predict site index using site series of the biogeoclimatic ecosystem classification. This method is intended for use in very young stands, very old stands, and stands not suitable for other methods. (See also growth intercept method and site index curve method.)
Site index	A measure of forest site productivity expressed as the average height of *top height* trees of a given species at age 50 years (breast height age).
Site index curve method (of estimating site index)	A site index prediction method that uses the height and age of carefully selected sample trees measured on-site. Site index is then obtained from a look-up table. This method is best used on stands that have between 30 and 140 years growth above breast height. (See also BEC method and growth intercept method.)
Site tree	A tree measured for height and age for use in estimating site index from site index curves.
SORTIE	SORTIE is a light-driven ecological gap model, focused on predicting natural regeneration under various levels of ground and canopy disturbance. Work is underway to develop a version for the northern ICH.
Species conversion table	A table used to predict the site index for one species from the site index measured on a different species on the same site.
SPS	Stand Projection System--an individual-tree, distance independent model in the private domain. Different versions are currently supported by three consulting companies in BC and the USA.
Stand yield model	A model predicting only yield at various points in time. In contrast to a growth and yield model, it lacks actual growth components.
Stem analysis data	The data from destructively sampling trees.
TASS	Tree and Stand Simulator— an individual-tree, distance-dependent model used mainly to produce yield tables for single-species, even-aged managed stands. See TIPSY.
TEM	Terrestrial Ecosystem Mapping– one of two mapping methods used in BC to provide spatial linkage of SIBEC/SIA to the inventory in timber supply analysis. Also see PEM.
Timber supply	The rate at which timber is made available for harvesting over time, measured in m^3/year
Timber supply analysis	A process of exploring the effects of different management scenarios on timber supply.
TIPSY	Table Interpolation Program for Stand Yields– historically, the main source of managed stand yield tables for TSR. TIPSY merely provides convenient access to yield tables produced by TASS.
Tree list	A representative sample list of individual tree measurements describing a particular stand or stand conditions. Tree lists are required input data for models such as PrognosisBC, MGM and SPS.
VAC	Volume over age curve—the simplest form of yield model.
VDYP	Variable Density Yield Prediction model-— a yield model developed for the BC forest inventory. It predicts stand volume from air-photo interpreted inventory attributes. It continues to be the primary source of natural stand yield tables in TSR.
Volume and decay factors	Individual tree volume and decay predictions used to compile plot volume estimates.
Yield curve	A figure showing volume yield per hectare as a function of stand age.
Yield table	A table showing the volume yield per hectare as a function of stand age.