December 12, 2005

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RE: Supplemental information to support the TFL18 MP10 timber supply analysis

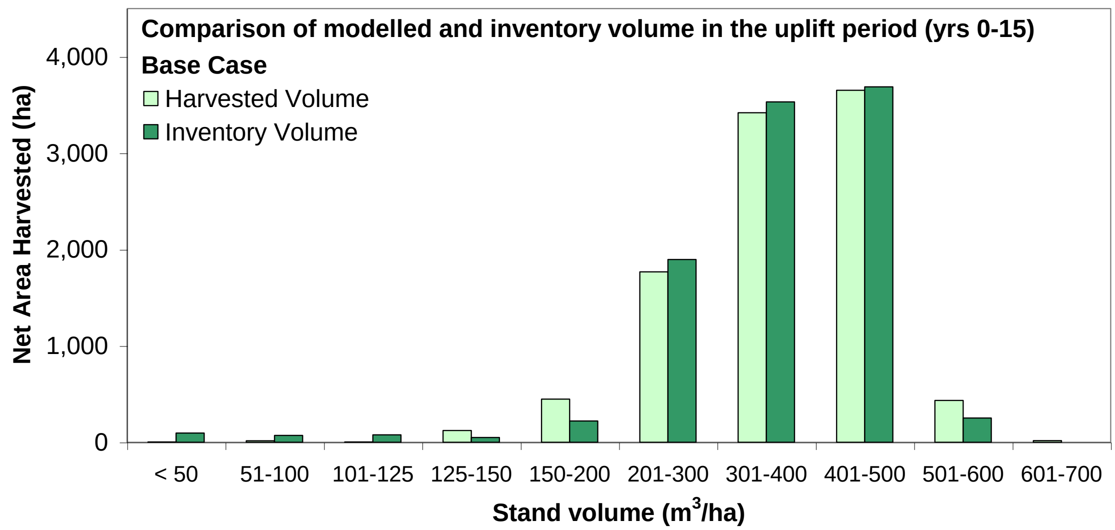
Canfor Vavenby Division and Forest Ecosystem Solutions Ltd. presented the MP10 timber supply analysis to the Deputy Chief Forester of BC and other government staff on November 29, 2005. Several questions were raised during this presentation that required further investigation. This memo provides responses to the issues raised.

The following questions are addressed in this document:

1. Are the higher volumes realistic? Is there an error?
2. What are the reasons for harvest in each period of the short term?
3. How does the incidental harvest change with different short-term harvest levels?
4. What stands are being harvested at low volumes? Why are they being harvested?
5. How much volume comes from stands that are below culmination age?
6. What is the breakdown of the non-recovered losses? I.e. why are they unrecovered?
7. How much of the total volume of pine actually gets harvested in the short term under various scenarios?
8. What are the ECA results for the Canfor Preferred Scenario?
9. Are there any THLB stands that never get harvested? Where do these occur and why are they not harvested?
10. How much of each species is harvested relative to the overall species component of the TFL at any given period?
11. Two percent seems low for the roads reduction. Is this correct?
12. Could we show by graph/map the Pl and Spruce leading stands by susceptibility category?

Question 1: Ron Van Der Zwan expressed concern about the higher end of the stand volumes harvested in the short term. He was concerned about the presence of stands with >500 m³/ha. Are the higher volumes realistic? Is there an error?

The first thing to check is that the profile of harvested volume is reasonably close to the unprojected inventory volumes of the harvested stands (Figure 1). This provides a check for inconsistency between the yield tables and the inventory. The base case harvest profile is similar to the harvest profile, with some slight differences due to aggregation and growth. The harvest profile of the preferred scenario is shifted to lower volumes relative to the inventory volume because of volume losses to beetle. These graphs demonstrate that (1) stands with volumes >500 m³/ha are not a large contribution to the short-term harvest, and (2) if there is an error in the yields for these stands, it is not isolated to the yield tables, but also occurs in the inventory.



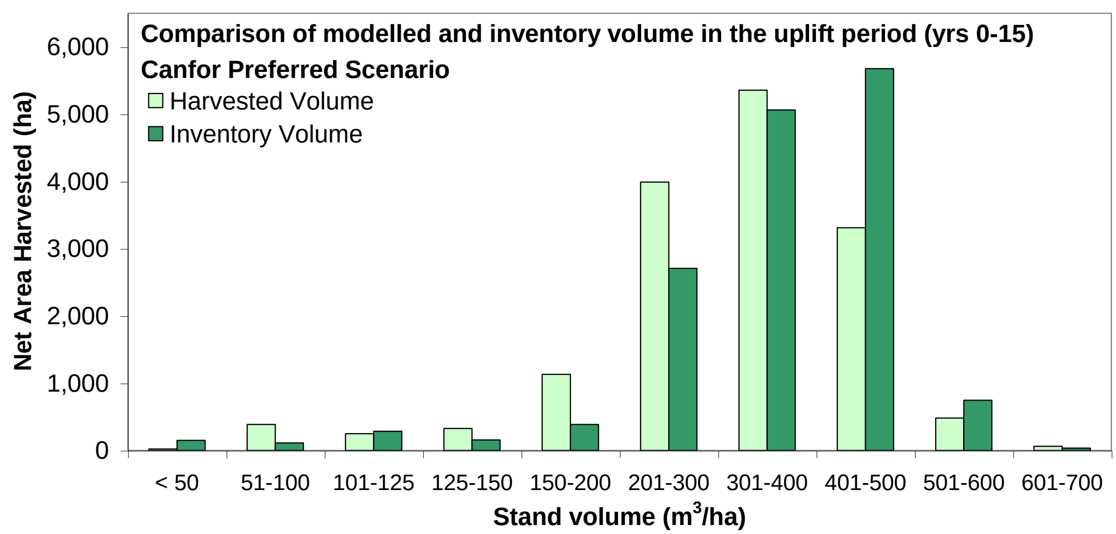


Figure 1: Comparison of modeled and inventory volume of stands harvested in the first 15 years of the MP10 Base Case (top) and the MP10 Canfor Preferred Scenario (bottom).

Given that the modeled volumes and the inventory volumes appear to be consistent on average, the next thing to check is that the cruise data for logged blocks actually show some stands with volumes above 500 m^3/ha. A review of the cruise summaries for seven recent cutting permits found four blocks containing stands with volumes above this threshold (Table 1). Although these results are not a definitive verification of the inventory, they give some confidence that the modeled harvest volumes are reasonable.

Table 1: Cruise summaries for recent Cutting Permits containing stands with merchantable volumes >500 m^3/ha

CP	Cruise Date	Stand #	Spp	Area (ha)	Net Volume (m^3/ha)	# Plots	StDev
243	7-Feb-03	1	S B	29.9	**539**	30	159
244	7-Feb-03	4	S (B)	11.9	**606**	9	296
252	11-Aug-04	2	Pl F	2.9	**505**	7	229
257	20-Jul-05	3	F S	4.9	**705**	4	241

Question 2: What are the reasons for harvest in each period of the short term?

This is a difficult question to answer because of the iterative process used to come up with the Canfor Preferred Scenario. However, Figure 2 provides an indirect way of showing the reasons for harvest, by showing the pine component of stands harvested in the short and medium terms. Stands in dark red, red, and orange represent stands that were targeted for salvage due to a reasonable stand component (>20%) of pine. Stands in yellow and green could be included for two reasons: (1) they were incidentally harvested as part of a larger salvage block; and (2) they were targeted for other objectives such as existing damage by spruce bark beetle and harvesting of existing cutting permits. The first period contains several approved FDP blocks that were designed for purposes other than MPB Salvage. Also, most spruce beetle blocks are harvested during the first five years, creating the larger component of low-pine harvest in this period. MPB salvage is the main priority in the second period, and most of the low-pine harvest in this period is likely incidental. Almost half of the harvest in the third period occurs from low-pine stands, primarily because the pool of medium- and high-pine stands has largely been salvaged at this point. This result indicates that the short-term AAC increase may not need to be carried through to the third period.

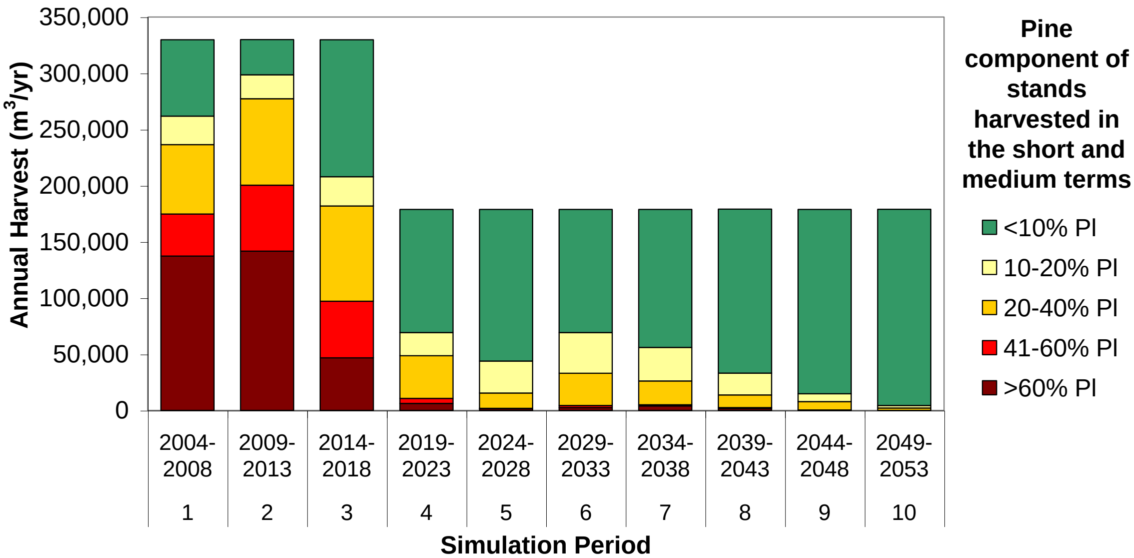


Figure 2: Pine component of stands harvested in the short and medium terms of the Canfor Preferred Scenario.

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Question 3: How does the incidental harvest change with different short term harvest levels?

As stated above, it is difficult to determine which stands are harvested incidentally as part of salvage blocks, and which stands were intentionally prioritized for harvest due to non-MPB management considerations. This means that non-pine volume is not a good absolute measure of incidental harvest. Nevertheless, the volume harvested in intentional non-pine blocks is fixed at all harvest levels, so the *change* in non-pine volume is a good relative measure of incidental harvest for different harvest levels. Harvest of non-pine volume is measured over the first 10 years to avoid inclusion of non-salvage harvests that occur in the third period.

Table 2 shows that a doubling of the short-term harvest level results in a doubling of the incidental (non-pine) harvest. This result indicates that the efficiency of salvage in terms of incidental harvest is fairly constant. Stable incidental harvest combined with less non-recovered losses indicate that higher short-term harvest levels yield greater salvage effectiveness, subject to the assumptions of the analysis.

It is reasonable to believe these numbers overestimate actual incidental harvest, as Canfor is making efforts during development to exclude non-pine stands where practicable. The 20 year plan blocks could not take these measures into account.

Table 2: Average annual non-pine volume harvested in the first ten years of the planning horizon, for a range of alternate harvest levels. The Canfor Preferred Scenario is shown in bold lettering.

Short Term Harvest Level (m^3/yr)	Non-Pl volume (m^3/yr)	% Non-Pl volume
177,000	106,796	60%
207,000	121,688	59%
237,000	135,945	57%
267,000	151,880	57%
297,000	170,249	57%
327,000	**190,098**	**58%**
357,000	207,566	58%

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Question 4: What stands are being harvested at low volumes? Where are they and why are they being harvested?

Stands harvested at less than 200 m3/ha can be considered "low volume." A summary of harvest from these stands in the short term is provided in Table 3. Two thousand ha of low volume stands are harvested over the first 15 years. This represents 6% of the total harvest in this period by volume. The average stand volume at harvest is 146 m^3/ha, but without losses to beetle, the average stand volume at harvest would be 219 m^3/ha. Low-volume stands are primarily located in the ESSF zone, with only 19% in the SBS, likely due to the relative productivity of the latter zone. The majority of the harvest is from pine-leading stands. This summary implies that there are two main reasons for the low-volume harvest: (1) The high proportion of pine in many stands is overriding other harvest priorities; and (2) non-recovered losses in these salvage stands are sending them below the 200 m^3/ha threshold.

Table 3: Summary of harvest from low-volume stands in the short term (years 0-15).

Stands harvested at less than 200 m^3/ha	
Total area harvested in short term (ha)	2,119
Total volume harvested in short term (m^3)	309,432
Total non-recovered losses (m^3)	153,929
Average stand volume (m^3/ha) at harvest	146
Average stand volume without losses (m^3/ha)	219
Proportion of total short term harvest	6%
Proportion with >60% pine (by volume)	67%
Proportion with <10% pine (by volume)	18%
Proportion in ESSF zone	51%
Proportion in ICH zone	30%
Proportion in SBS zone	19%
% Pine leading	74%
% Balsam leading	14%
% Spruce leading	8%

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Question 5: The relative poorest first harvest rule, combined with minimum harvest volume of 125 m3/ha, allows harvesting below culmination. How much volume comes from stands that are below culmination?

Harvest age relative to culmination age over the planning horizon of the Canfor Preferred Scenario is shown in Figure 3. This measure is only provided for managed stands, because culmination age is irrelevant as a harvest criterion for natural stands. The measured used is "harvest age divided by culmination age." For example, a value of 0.5 indicates that the age of harvest is half of the culmination age. A value of 2 indicates harvest at double the culmination age.

Figure 3 demonstrates that most of the harvest of managed stands occurs between 95% and 110% of culmination age. However, there are periods where a large proportion of the harvest comes from stands between 50% and 90% of culmination age. This result should be viewed in the context of the sensitivity analysis presented in the MP10 Analysis Report, which showed a small downward pressure associated with using a combination of relative oldest first scheduling and 90% culmination minimum harvest age. This result indicates that considerable flexibility is exercised in attaining the long-term harvest level, but that periodic intrusions below culmination age do not compromise long-term sustainability relative to other standard harvest rules.

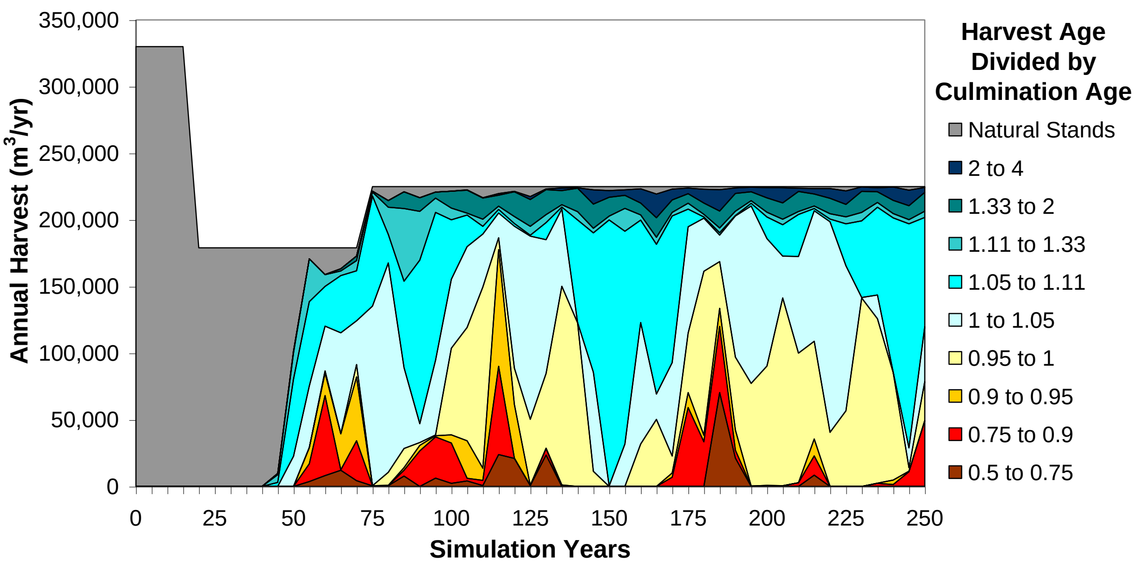

Figure 3: Age of harvested volume relative to the culmination age of the yield table it was harvested on—Canfor Preferred Scenario.

Question 6: The non-recovered losses curve indicated a minimum NRL of 1 million m3 regardless of harvest level (subject to our modeling methods). What is the breakdown of these non-recovered losses?

A breakdown of non-recovered losses is shown in Table 4. This table identifies whether NRLs are from THLB stands (available for harvest) or from OGMAs, which include Preservation VQOs and "no harvest" Lakeshore Management Zones". There is a further separation into NRLs from stands that were harvested during the short term ("salvaged"), and stands that were not. Approximately half of the NRLs in the extreme salvage scenario (800,000 m3/yr short term harvest level) occur in the THLB. Of this, the majority is in salvaged stands. Only 12% of the total NRLs come from stands that were not salvaged, presumably due to exclusion from a twenty-year plan block. NRLs in OGMAs were almost exclusively from unsalvaged stands.

Table 4: Breakdown of Non-Recovered Losses NRLs in the Extreme Salvage Scenario (800,000 m^3/yr) and the Canfor Preferred Scenario (327,000 m^3/yr).

Scenario	Extreme Salvage Scenario	Canfor Preferred Scenario	Extreme Salvage Scenario	Canfor Preferred Scenario
Short Term Harvest Level (AAC equivalent) (m3/yr)	800,000	325,000	Percent of Total NRL	
NRL from unsalvaged stands in THLB	122,972	555,224	12%	32%
NRL from salvaged stands in THLB	424,624	682,177	41%	39%
Total NRL from THLB	**548,522**	**1,238,021**	**53%**	**71%**
NRL from unsalvaged stands in OGMAs	471,198	491,780	46%	28%
NRL from salvaged stands in OGMAs	13,491	1,877	1%	0%
NRL from OGMAs	**485,070**	**494,038**	**47%**	**29%**
Total NRL	**1,033,592**	**1,732,059**	**100%**	

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Question 7: What is the success of the Canfor Preferred Scenario in salvaging the susceptible pine on the TFL? In other words, how much of the total volume of pine actually gets harvested in the short term under various scenarios?

Figure 4 shows the proportion of the total pine >60 years old that gets harvested in the short term at harvest levels of 177,000 m^3/yr, 327,000 m^3/yr, and 800,000 m^3/yr. The proportion is:

[2004 inventory pine volume of harvested stands]/[total 2004 inventory pine volume]

Pine in OGMAs and other "no harvest" zones is not included in the pool of susceptible pine. The 800,000 m^3/yr scenario provides a measure of how effectively the other scenarios are salvaging pine. The Canfor Preferred Scenario achieves high levels of salvage (approx 75%) in stands with a >40% pine component. Stands with lower percentages of pine are relatively untouched. The current AAC achieves poor salvage efficiency in all stands except for high pine stands.

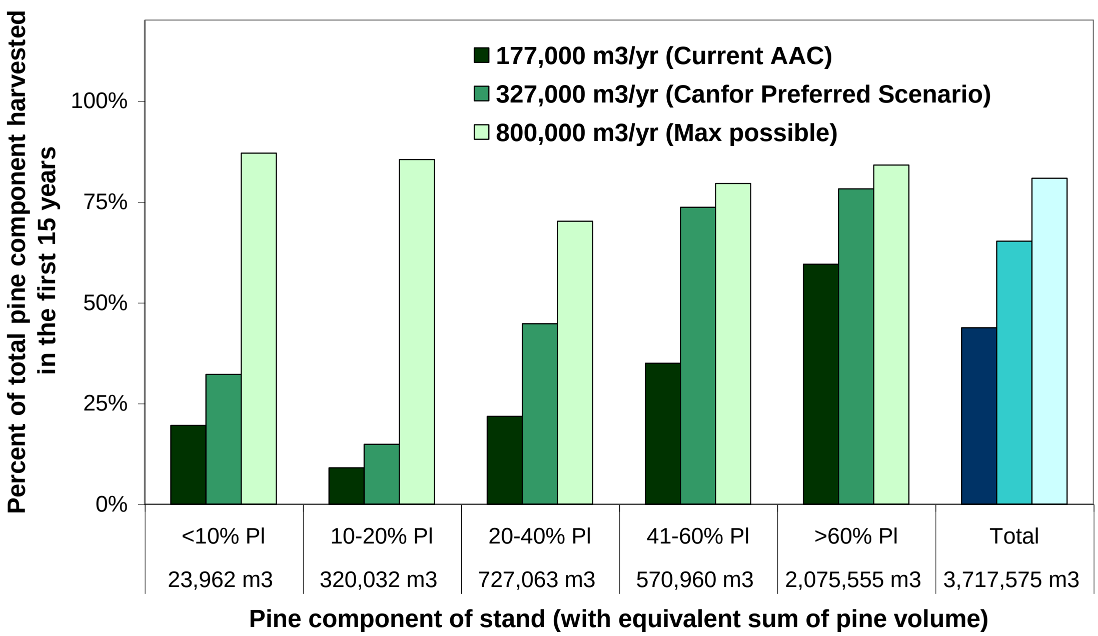

Figure 4: Proportion of the total pine >60 years old that gets harvested in the short term at harvest levels of 177,000 m^3/yr, 327,000 m^3/yr, and 800,000 m^3/yr.

Question 8: What are the ECA results for the Canfor Preferred Scenario?

The basic ECA results for the first 150 years are shown in Figure 5. It is useful to know when the ECAs are exceeding the "red flag" levels for the watershed, and this context is provided by Figure 6. The overall pattern shown by these graphs is that the watersheds located primarily in the SBS (Mann, Italia, Maury, and Canimred) exceed their red flag levels during the salvage period, followed by a recovery during the medium term. This requires a shift into the non-pine areas of the TFL (Sock, Brookfield, Wylie, Mackenzie, Goodwin). Gill creek exceeds its ECA at the beginning of the medium term.

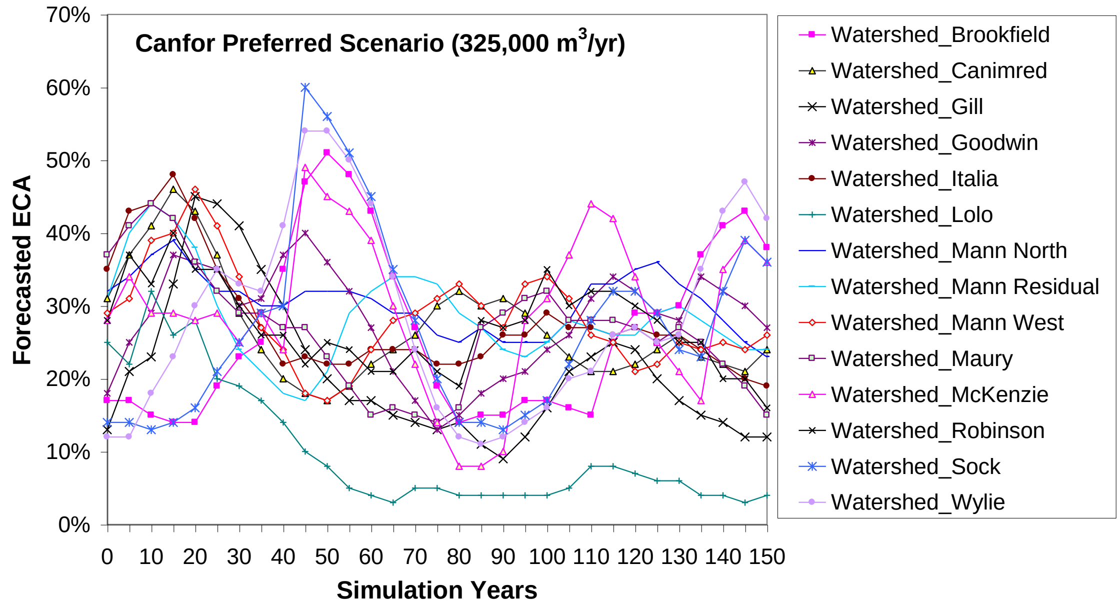

Figure 5: ECA of TFL18 watersheds over the first 150 years

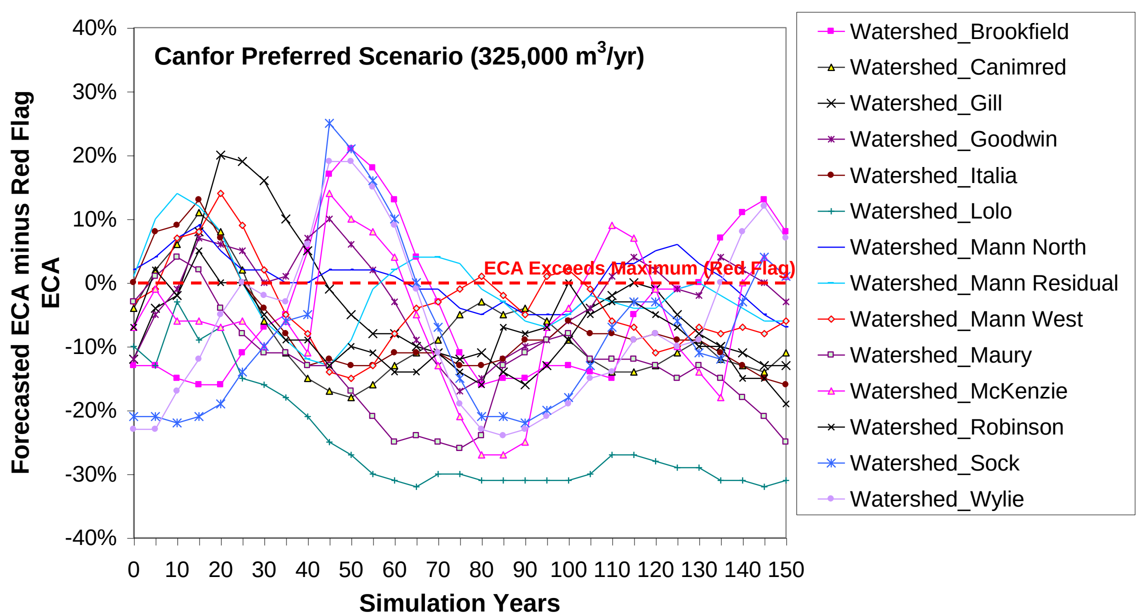

Figure 6: ECA of TFL18 watersheds over the first 150 years, relative to red flag levels.

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Question 9: Are there any THLB stands that never get harvested? Where do these occur and why are they not harvested?

Excluding OGMAs and other "no harvest" zones, there are 1,221 ha of stands that remain unharvested throughout the entire 500-year planning horizon. These stands are located almost entirely within VQO polygons. They are approximately as productive as the rest of the TFL, on average. The most likely hypothesis for these stands not being harvested is that they occur in large resultant polygons, relative to the size of the VQO polygon. Harvesting them at any point would violate the VQO constraint, so they are never eligible for harvest. These areas account for 2% of the current THLB, current volume, and future productivity of the TFL. Therefore, there is an approximately 2% downward pressure on the entire planning horizon due to this modeling artifact.

Table 5: THLB stands that remain unharvested throughout the planning horizon of the Canfor Preferred Scenario

	Current THLB Area (ha)	Current THLB Volume (m^3)	Future THLB Area (ha)	LRSY (m^3/yr)	Future MAImax (m^3/ha/yr)
Total THLB (No OGMAs or VQO-"P")	57,460	10,640,952	56,917	241,196	4.2
Unharvested THLB	1,221	200,458	1,205	4,528	3.8
Unharvested in VQOs	1,114	174,777	1,099	4,188	3.8
Unharvested % of Total	2.1%	1.9%	2.1%	1.9%	
VQO % of unharvested	**91%**	**87%**	**91%**	**92%**	

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Question 10: How much of each species is harvested relative to the overall species component of the TFL at any given period?

The graphs below show the deviation of harvest from the species profile for pine and fir. The values shown in this graph are:

[(Spp % of harvest) – (Spp % of Growing Stock)]/(Spp % of Growing Stock)

For example, if pine made up 25% of the total growing stock in a given period, and 50% of the total volume harvested in that period, then the harvest deviation from the volume profile would be +100%. One problem with these graphs is that it was impossible to separate out OGMAs from the "growing stock by species" FSOS reports. As a result, these results are biased by the inclusion of OGMAs. The dotted line in the graphs is an attempt to correct for this bias, and is an approximation of the true "zero" line, based on the average long-term results.

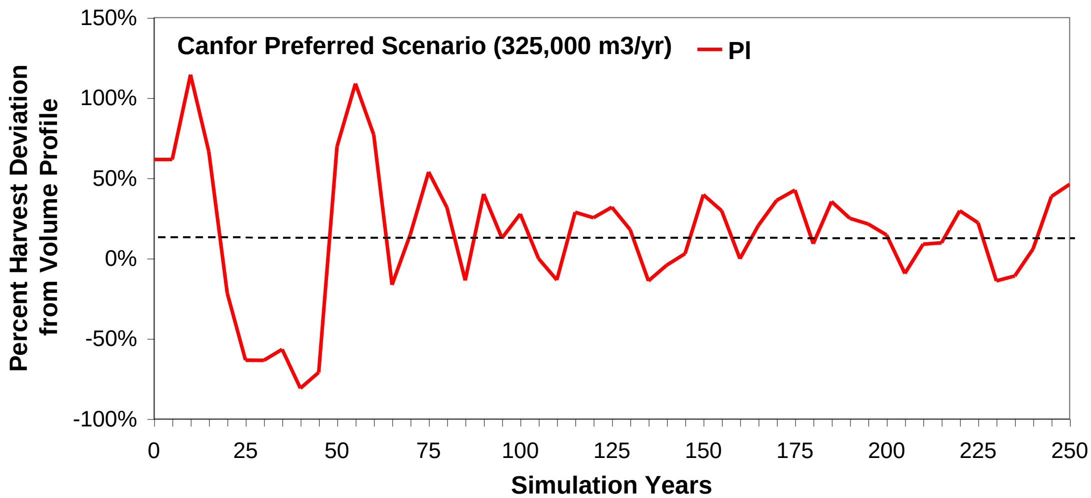

Figure 7: Pine proportion of harvest relative to the pine proportion of growing stock.

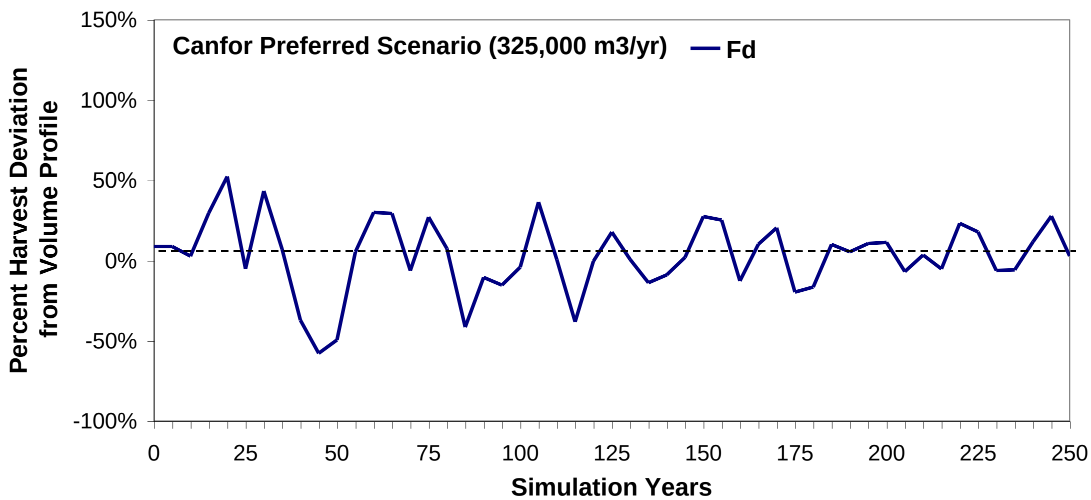

Figure 8: Douglas-fir proportion of harvest relative to the Douglas-fir proportion of growing stock.

Question 11: Two percent seems low for the roads reduction. Is this correct?

Canfor completed a statistical road area estimate in June 2004 (JS Thrower & Associates 2004). Table 6 summarizes the results of this project, which estimated length, width, and area by road class (including landings and borrow pits), and across all road classes using two methods. The total road area estimate is approximately 1,500 ha, with a 13% sampling error. This area is just over 2% of the total area of the TFL.

Table 6: Summary statistics for road classes 1 to 4, and averaged across all road classes in TFL 18. (Source: JS Thrower & Associates 2004. Road width and road area estimation for TFL 18. Contract report prepared for Canadian Forest Products. June 30, 2004.)

	Road class					Overall	
	1	2	3	4			
				Method 1	Method 2	Method 1	Method 2
Sample size (n)	30	30	30	30	30	120	120
Total road length (m)	35,140	135,595	168,387	1,002,069	1,002,069	1,341,191	1,341,191
Average road width (m)	24.9	13.6	13.5	10.9	9.6	11.9	10.9
95% CI road width (m)	[22.1, 27.7]	[11.6, 15.7]	[11.7, 15.3]	[8.8, 13.1]	[7.9, 11.3]	[10.3, 13.5]	[9.4, 12.3]
Total road area (ha)	88	185	227	1,097	960	**1,596**	**1,459**
Sampling error (%)	11%	15%	14%	19%	18%	13%	13%
Additional samples to reach 15% error	0	0	0	19	0	19	0
Additional samples to reach 10% error	7	35	23	76	55	141	120

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Question 12: Could we show by graph/map the Pl and Spruce leading stands by susceptibility category?

See attached map.