Lillooet TSA
Timber Supply Analysis
Addendum

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Lillooet TSA Timber Supply Analysis Addendum

Background

The British Columbia Forest Service released the Lillooet TSA Timber Supply Analysis in December 1993. Since publication of the analysis report, errors were discovered in the computer code used to determine the timber harvesting land base. As well, since the data and assumptions were compiled for the original report, forest management practices have changed within the Lillooet TSA. The Forest Service felt that discussions about alternative timber harvest levels in the Lillooet TSA would be best facilitated by assessing the effects on timber supply forecasts of these errors and changes in forest management practices.

It is stressed that neither the results of this addendum, nor those of the original analysis should be construed as recommendations on the allowable annual cut (AAC). These reports have been produced to facilitate discussion of alternative timber harvest levels among interested parties.

This report is intended as an addition to, not a replacement of, the original Lillooet TSA Timber Supply Analysis Report. It is assumed that the reader is familiar with the original analysis report which contains definitions of terms, describes the Lillooet TSA, and outlines analysis methods.

The first part of this report describes the computer coding errors contained within the original report and their effects on the timber supply forecasts for the Lillooet TSA. The second part of the report presents sensitivity analyses additional to those described in the original timber supply analysis report. Discussion of the sensitivity analyses includes a description of changes to forest management practices within the Lillooet TSA and the resulting effects on timber supply forecasts.

Description of errors

After completion of the Lillooet TSA Timber Supply Analysis Report, errors were noted in the computer programs used to define the timber harvesting land base. The most significant error caused a large area of open-growing Douglas-fir stands with very low timber volumes to be included in the timber harvesting land base. Less significant errors were found in area reductions applied to account for environmentally sensitive areas and low productivity sites. Table 1 shows a summary of the areas excluded, after all corrections, to define the timber harvesting land base.

The numbers in bold highlight the land base deductions that changed relative to those in the original analysis (shown in Table 1, page 6, of the original report) when the error was corrected. The primary difference is in the non-merchantable stands category, in which approximately 40 000 additional hectares are excluded from the timber harvesting land base. However, less area of low site quality is now excluded. The result is a reduction in the current timber harvesting land base of 26 402 hectares, or about 8.7%, most of which is the open-growing Douglas-fir stands noted above.

Impact on timber supply forecasts

Changes in the harvest forecasts resulting from changes in the land base and management regime are discussed in this report. It should also be noted that the area of older stands of Douglas-fir on dry sites with poor productivity will be smaller in all land base and species/site class summaries, shown in Figures 3 through 7 in the original report.

Despite the substantial reduction in the size of the timber harvesting land base, the short-term harvest forecast is unchanged from the original analysis for the base case, and for all sensitivity analyses done for the original report. Figure 1 shows the corrected base case harvest forecast, which starts at the present AAC of 650 000 cubic metres per year. After 80 years, the corrected harvest forecast falls below the original harvest forecast to a new long-term level of 362 600 cubic metres per year, 9.5% below the original long-term level.

The short-term harvest forecast for the Lillooet TSA depends primarily on the existing volume of mature timber on the timber harvesting land base. Although the corrections to the analysis reduce the size of the timber harvesting land base by about 8.7%, they reduce the existing merchantable timber volume available for harvesting by less than 4%. The reduction in mature timber volume is less than that for the area for two reasons. First, the open-growing Douglas-fir stands excluded have lower than average volumes of timber per hectare.

Second, these stands are managed using a selection harvesting system (rather than a clearcut system), and only 40% of the existing timber volume is assumed to be available for harvest. The remaining timber volume is retained as residual growing stock. Although the existing mature timber volume is 4% lower, no harvest level changes relative to those indicated in the original analysis are required over the next 90 years. This is mostly because of the lower long-term level to which the revised harvest forecast declines.

The explanations contained within the original report describing the major factors that determine timber supply over time are still applicable. The reader is advised to refer to the original report for this information. The entire series of corrected sensitivity analysis graphs are available upon request from:

- Lillooet Forest District, Bag 700, Lillooet, phone 256-1200;
- Kamloops Forest Region, 515 Columbia Street, Kamloops, phone 828-4131;
- Timber Supply Branch, first floor, 1450 Government Street, Victoria, phone 356-5947.

Table 1. Corrected timber harvesting land base, Lillooet TSA Addendum, 1995.

Classification	Area (hectares)	Per cent of total area	Per cent of Crown forest area
Total area on inventory file	1 123 827	100	
Not managed by B.C. Forest Service	110 821	9.9	
Non-forest	483 854	43.0	
Total productive forest managed by Forest Service (Crown forest)	529 152	47.1	100
Reductions to Crown forest:			
Non-commercial cover (brush)	680	0.1	0.1
Environmentally sensitive areas	**113 895**	**10.1**	**21.5**
Sites with low timber growing potential	**40 311**	**3.6**	**7.6**
Deciduous types	**2 006**	**0.2**	**0.4**
Non-merchantable stands	**54 740**	**4.9**	**10.3**
Inoperable	**32 083**	**2.9**	**6.1**
Existing roads, trails, landings	**7 258**	**0.6**	**1.4**
Not satisfactorily restocked (NSR)	**15 060**	**1.3**	**2.8**
Total current reductions	**266 034**	**23.7**	**50.3**
Initial timber harvesting land base	**263 118**	**23.4**	**49.7**
Additions:			
Not satisfactorily restocked	**15 060**	**1.3**	**2.9**
Total current timber harvesting land base	**278 178**	**24.7**	**52.6**
Future reductions:			
Future roads	**20 357**	**1.8**	**3.9**
Long-term timber harvesting land base	**257 821**	**22.9**	**48.7**

Bold type indicates the figures that are different from the original timber supply analysis report.

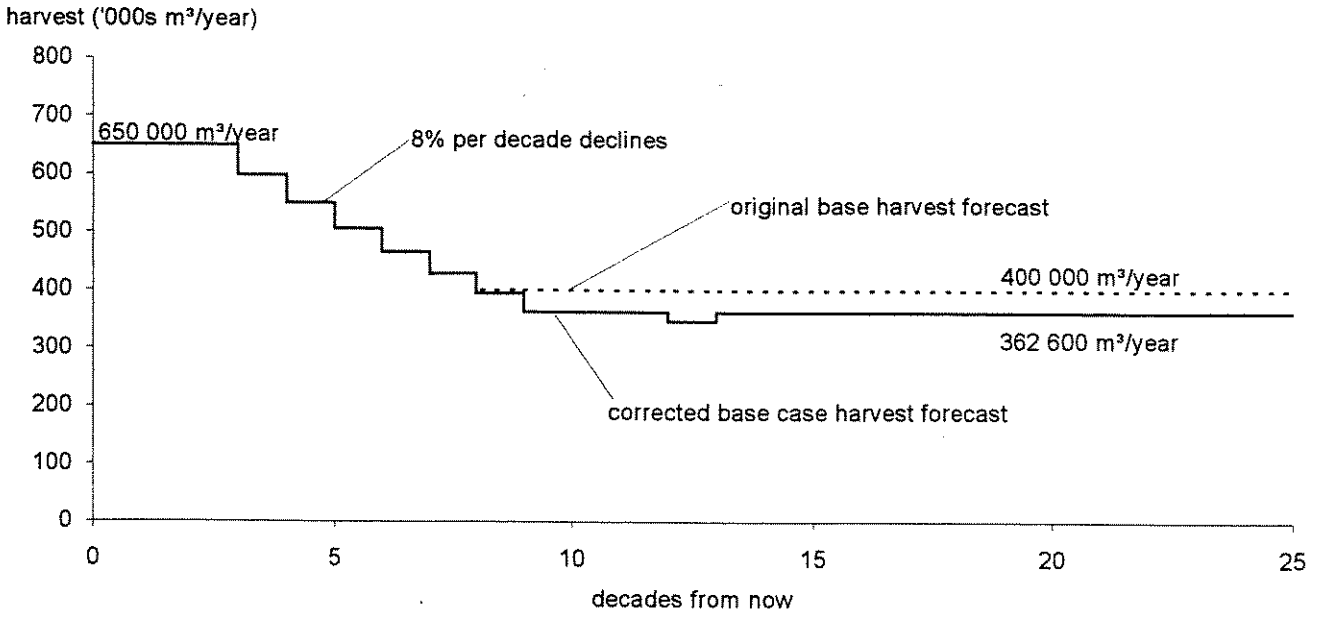

Figure 1. Corrected base harvest forecast, Lillooet TSA Addendum, 1995.

Sensitivity analysis

Forest management is a complicated, ever-changing endeavor, which must account for the dynamics of complex ecosystems, and fluctuating and uncertain social and economic factors. The Timber Supply Review for the Lillooet TSA was initiated during the spring of 1992. Forest management practices in effect during that time were used as the basis for the analysis report released in December of 1993. Since initiation of the original analysis, the *Lillooet District Harvesting Guidelines* were introduced. These guidelines require some changes to forest management compared to the regime assumed in the original analysis. One way to deal with such changes is through frequent planning and decision-making to ensure the most up-to-date information is used. Since no decisions resulted from the original analysis, this is a good opportunity to update the analysis to provide the most current assessment of the Lillooet TSA forest management regime. It is also useful to assess, through sensitivity analysis, how data and management uncertainties might affect timber supply. Sensitivity analysis can clarify whether current best estimates provide safe bases for decisions, or whether high uncertainty around important variables means more conservative decisions may be wiser. The following sensitivity analyses examine the effects both of changes to the management regime and of uncertainties. The sensitivity analyses should be used as a supplement to the original analysis as they provide the basis for further discussion around forest management practices and alternative harvest levels within the Lillooet TSA.

Sensitivity to uncertainty in cutblock adjacency requirements

To ensure that harvesting does not become overly concentrated in an area, harvesting guidelines establish a maximum limit on the proportion of the area that does not meet green-up conditions at any time, and also require that a harvested area must reach green-up conditions before adjacent areas may be harvested. This sensitivity analysis examines how timber supply would change if either a 4-pass or a 5-pass harvesting system (rather than a 3-pass system) were required to meet adjacency guidelines within the Lillooet TSA. In a 4-pass system, no more than 25% of the TSA timber harvesting land base may be younger than green-up age, which varies from 20 years in areas with a timber management emphasis, to 35 years in the Mid-Stein zone. A 5-pass harvesting system allows no more than 20% of the area to be younger than green-up age.

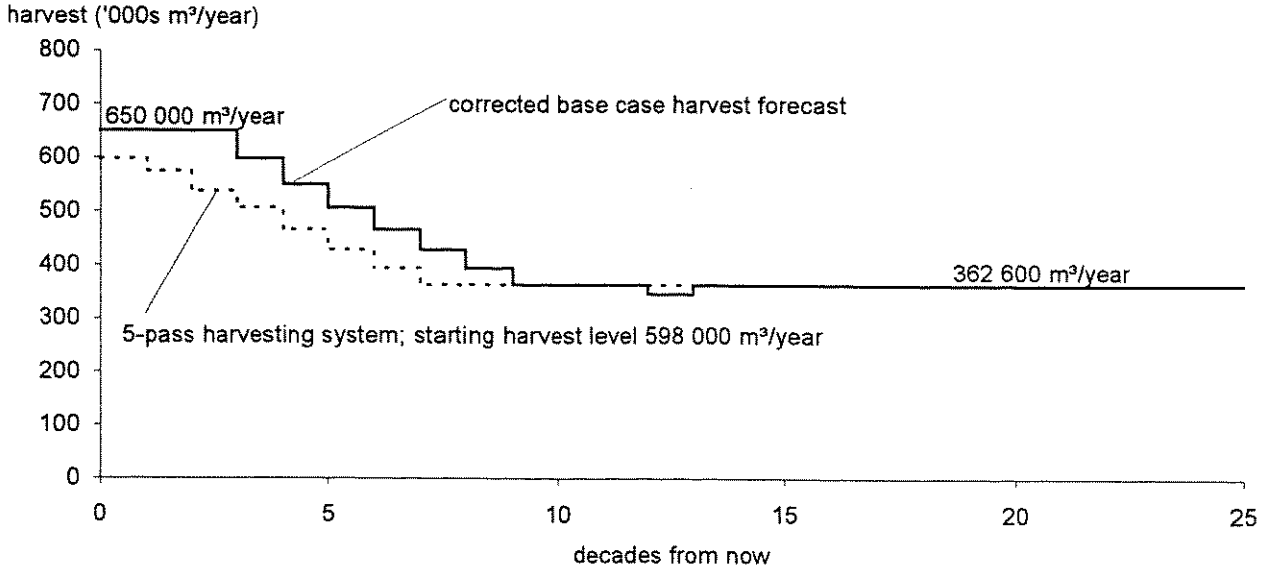

Figure 2. Sensitivity to cutblock adjacency requirements, Lillooet TSA Addendum, 1995.

Implementing a 4-pass harvesting system within the Lillooet TSA would not change the harvest forecast relative to the revised base case However, if cutblock adjacency guidelines required a 5-pass harvesting system, harvests would need to drop immediately by 8% from the current harvest level, to 598 000 cubic metres per year, in order to meet forest cover requirements (Figure 2).

Sensitivity to uncertainty in the timber harvesting land base

The area that is assumed to be suitable and available for timber harvesting is one of the primary inputs into timber supply analysis. Introduction of the *Lillooet District Harvesting Guidelines* and review of the assumptions used to determine the timber harvesting land base for the original analysis presented some concern both that more area may be required to protect non-timber forest values, and that more area may be physically and economically inoperable. Therefore, the timber harvesting land base may be smaller than originally defined. Figure 3 shows the effects of reducing the timber harvesting land base by 10% and 20%.

When the timber harvesting land base is reduced by 10%, the initial harvest level can be maintained for 20 years, 1 decade less than the base case, if followed by 10% per decade declines. The long-term harvest level of 328 500 cubic metres per year, 9% lower than the base case, is reached 80 years from now.

When the timber harvesting land base is reduced by 20%, the starting harvest level must drop immediately by 5%, to 617 000 cubic metres per year, to allow a 10% per decade rate of decline to the long-term level. The long-term harvest level of 301 000 cubic metres per year, 17% lower than the base case level, is reached in 70 years.

Sensitivity to uncertainty in cutblock adjacency and the timber harvesting land base

The previous sensitivity analyses have examined the effects on timber supply of individual uncertainties in forest management practices. The following sensitivity analyses focus on the combined effects of these uncertainties as a means to provide further input into timber supply discussions.

Figure 4 shows the effect on timber supply of combining either a 4 or 5-pass harvesting system with a 10% reduction in the timber harvesting land base. Using 4-pass system to represent cutblock adjacency would not cause any reductions in timber supply additional to those resulting if the land base was 10% smaller. The harvest forecast would be identical to that shown in Figure 3, when only a 10% land base reduction is applied.

When cutblock adjacency is constrained to a 5-pass system and the land base is 10% smaller than in the revised base case, an immediate reduction in the initial harvest level to 559 000 cubic metres per year, 14% below the base case, is required. Due to forest cover constraints, harvests decline towards the long-term level at an uneven rate. That is, after 10 years the harvest level declines by 10%, while the decline after 20 years is 6%, followed by 8% per decade declines to the long-term level.

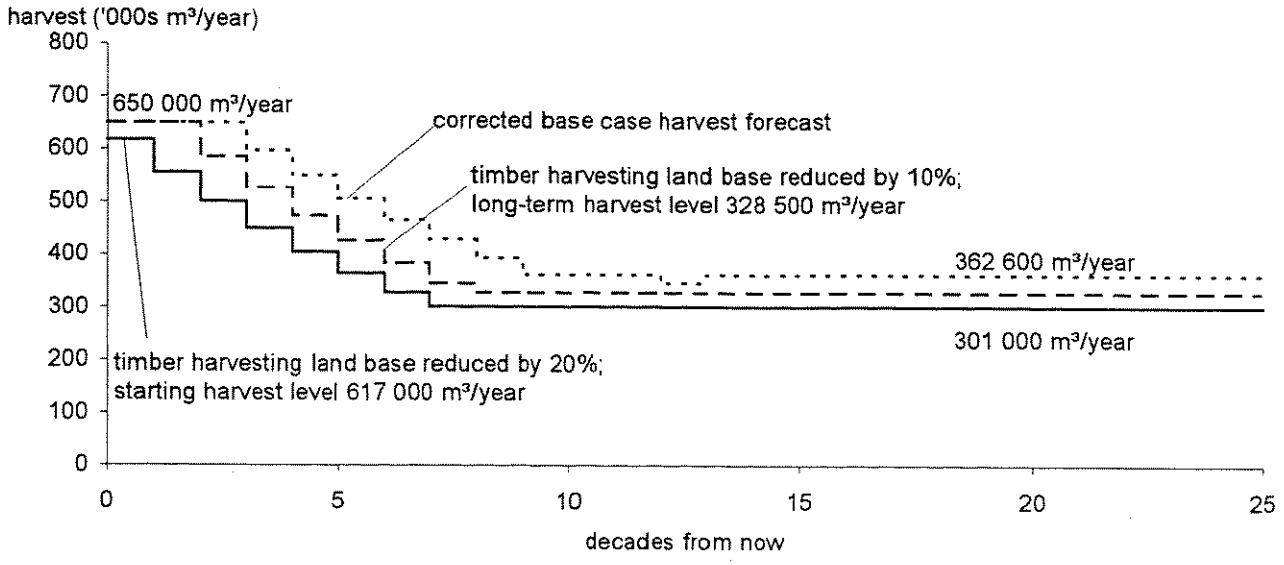

Figure 3. Sensitivity to changes in the timber harvesting land base, Lillooet TSA Addendum, 1995.

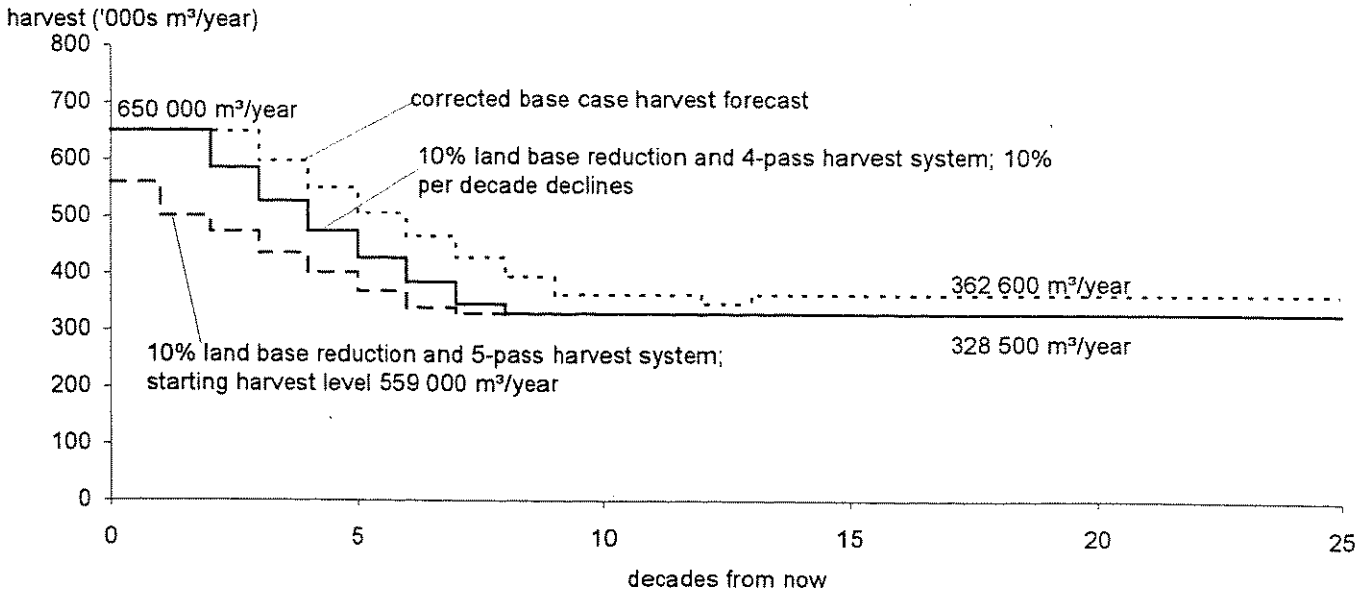

Figure 4. Sensitivity to a 10% reduction in the timber harvesting land base and increases in the stringency of cutblock adjacency requirements, Lillooet TSA Addendum, 1995.

Figure 5 shows the effect of combining a 20% reduction in the timber harvesting land base with either a 4 or 5-pass harvesting system. If cutblock adjacency was constrained to a 4-pass system and the land base was 20% smaller, the initial harvest level must decline immediately to 598 000 cubic metres per year, 8% below the base case starting level. As shown in Figure 3 under "Sensitivity to uncertainty in the timber harvesting land base," a 20% reduction in the land base alone requires an immediate 5% reduction in the harvest level. The rate of decline per decade shown for the combination of a 4-pass harvesting system to represent adjacency objectives, and a 20% smaller land base is not constant, due to forest cover requirements. The harvest level falls at a rate of 10% per decade, except between decades 3 and 4 where the decline is only 4%. The long-term harvest level of 301 000 cubic metres per year, 17% below the base long-term level, is reached after 80 years.

When a 20% land base reduction is combined with a 5-pass harvesting system the initial harvest rate declines to 498 000 cubic metres per year, 23% below the base case level. Harvest levels then decline by 10% between decades 1 and 2, and 8% between decades 2 and 3. Between decades 3 and 4, the harvest level can increase by 8% to 446 000 cubic metres per year. The long-term harvest level of 301 000 cubic metres per year is reached, following 8% declines per decade, in year 80.

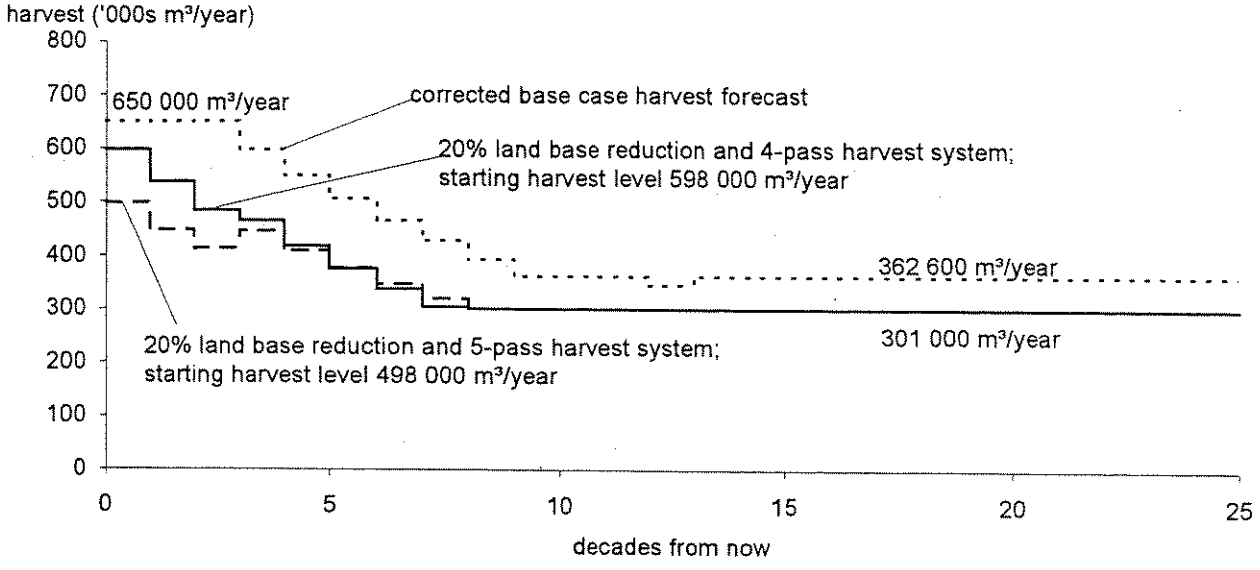

Figure 5. Sensitivity to a 20% reduction in the timber harvesting land base and increases in the stringency of cutblock adjacency requirements, Lillooet TSA Addendum, 1995.

Sensitivity to uncertainty in timber volume estimates for existing stands

About 80% of the stands in the Lillooet TSA timber harvesting land base are currently classified as mature (over 80 years old for lodgepole pine and over 120 years old for other species). This means that timber volumes in existing stands are important in determining timber supply over the next several decades. The original analysis showed that a 10% change in existing stand volume estimates would change by 2 decades the time over which the current harvest level could be maintained, if harvest level declines were kept about the same as in the base case. That is, if existing stands were found to have 10% more volume than estimated for the original base case, the current harvest level could be maintained for 5 decades rather than 3 decades as in the original base case. If the volumes were actually 10% lower, the current harvest level could be maintained for only 1 decade.

Figure 6 shows how the harvest forecast would be affected by a greater degree of uncertainty than examined in the original analysis. If timber volumes in existing stands were actually 20% higher than estimated for the corrected base case, the current harvest level could be achieved for 7 decades — 4 decades longer than in the base case — if harvests declined at 10% per decade, (slightly faster than the 8% shown for the base case). Conversely, if volumes were 20% lower than estimated for the corrected base case, the initial harvest would have to drop to 18% below the current harvest level to allow a 10% per decade rate of decline to the long-term level without resulting in severe future timber supply shortages. The long-term harvest level would not be affected by changes in existing stand volume estimates.

In summary, uncertainty about existing stand volumes in the range of 20% would have a large effect on estimates of timber supply over the next 100 years. However, this uncertainty would not affect the long-term harvest level.

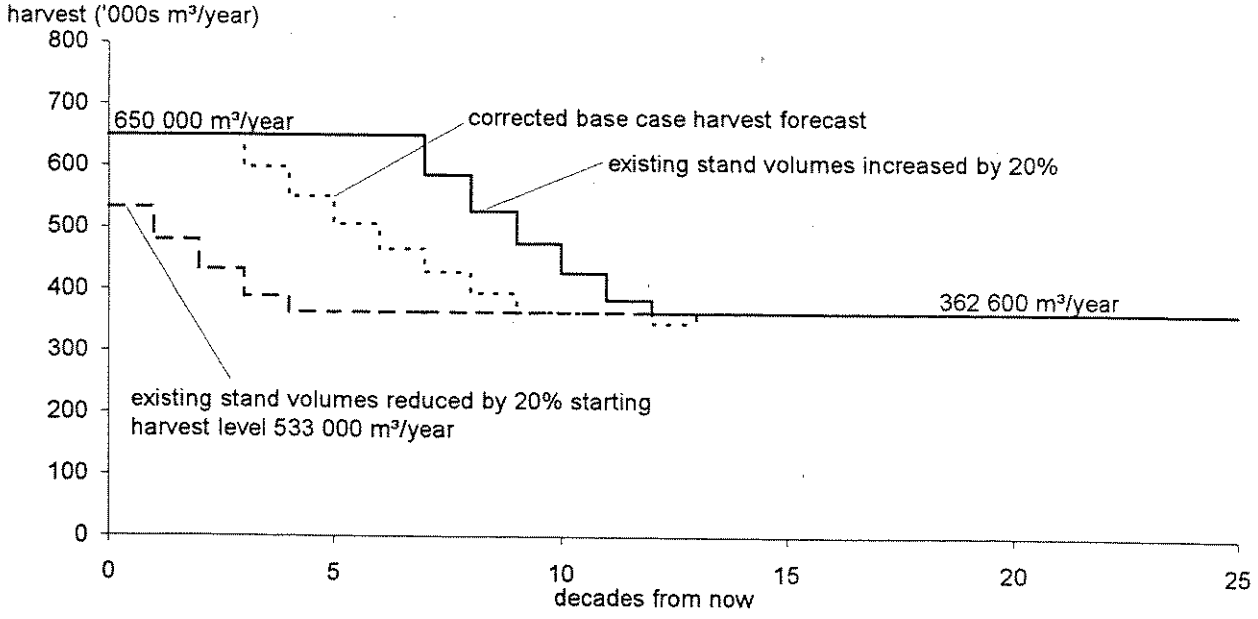

Figure 6. Sensitivity to 20% changes in existing stand volumes, Lillooet TSA Addendum, 1995.