Kamloops TSA
Timber Supply Analysis

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Preface

This analysis is part of the provincial Timber Supply Review carried out by the British Columbia Forest Service. The purpose of the review is to examine the short- and long-term effects of current forest management practices on the availability of timber for harvesting in Timber Supply Areas (TSAs) throughout British Columbia. In many areas of the province, timber supply analyses performed in the early 1980s have not been updated to reflect new inventory information or changes in management practices.

To determine allowable timber harvesting levels accurately and rationally, the Chief Forester must have an up-to-date assessment of the timber supply, based on the best available information and reflecting current management direction. **The report that follows provides this assessment but should not be construed as a recommendation on permissible harvest levels.**

Unlike past analyses, which normally assessed the implications of several forest management scenarios, this report focuses on a single scenario — current management practices. Current management practices are defined by the specifications in management plans for the timber supply area, and include guidelines for the protection of forest resources, and official land-use decisions made by Cabinet. The current nature and capabilities of the local forest industry are also considered.

Assessing the implications of only current practices rather than looking at a number of different management schemes will expedite the analysis process, allowing analysis of all TSAs in the province by mid-1995. An important part of these analyses is an assessment of how results might be affected by uncertainties — a process called sensitivity analysis. Together, the sensitivity analyses and the assessment of the effects of current forest management on the timber supply form a solid basis for discussions among stakeholders about alternative timber harvesting levels.

This report is the first of four documents that will be released for each TSA as part of the Timber Supply Review. Two of these documents provide detailed technical information on the results of the timber supply and socio-economic analyses. Another document summarizes this information to provide a focus for public discussions of possible timber harvest levels. The fourth outlines the Chief Forester's decision and the reasoning behind it.

Executive Summary

As part of the provincial Timber Supply Review, the British Columbia Forest Service has examined the availability of timber in the Kamloops Timber Supply Area (TSA). The analysis assesses how current forest management practices affect the supply of wood available for harvesting over the next 250 years. It also examines the potential changes in the timber supply stemming from uncertainties about forest growth and management actions. It is important to note that the various harvest forecasts included in the report indicate only the timber supply implications of current practices and uncertainty. **As such, the forecasts should be used for discussion purposes only; they are not allowable annual cut (AAC) recommendations.** This report does not include an analysis of the potential timber supply impacts of timber harvesting requirements under pulpwood agreements in the Kamloops TSA.

The Kamloops TSA consists of approximately 2.12 million hectares of which about 900 000 hectares are considered available for timber harvesting under current management assumptions. The area available for timber harvesting is dominated by stands of lodgepole pine, spruce, and Douglas-fir. The current AAC for the Kamloops TSA is 2 393 180 cubic metres per year, which excludes the volume allocated to woodlot licences and volumes currently being harvested in decadent cedar and hemlock stands.

Given current forest management assumptions and timber volume estimates, the analysis results indicate that the current harvest level can be maintained for 20 years. The harvest rate then drops by 9% per decade, reaching the long-term harvest level of 1 958 000 cubic metres per year, 18% below the current harvest level, in 40 years.

Several factors may affect the base case timber supply forecast in the short term. Immediate reductions in the current harvest level may be required if existing stand volumes are lower than was estimated, green-up forest cover requirements are more restrictive, the amount of time trees require to reach green-up heights is longer, or if minimum harvestable ages are longer than in the base case.

While approximately 60% of the Kamloops TSA timber harvesting land base contains stands of mature timber, a significant portion is currently unavailable for harvest because forest cover within the area being managed for visual quality (the landscape management zone) does not currently meet visual quality objectives. This zone comprises 22% of the timber harvesting land base and contains 24% of the mature timber. The first 20 years of harvest, therefore, must come almost entirely from the remaining land base. Increasing the maximum allowable area that does not meet visual green-up requirements within the landscape management zone by 5% would allow the current harvest level to be maintained for an additional 20 years, and increase the long-term harvest level by 7%.

Increases in timber supply over the next few decades that could allow for an extension or increase in the current harvest level may result if, compared to the base case: minimum harvestable ages are shorter; existing stand volumes are greater; the amount of time trees take to reach green-up heights is shorter; the timber harvesting land base is larger; or if decadent, over-mature hemlock volumes are included within the existing stand yield curves.

The long-term harvest level is most sensitive to uncertainties about managed-stand volume estimates, the length of time required to reach green-up heights, the amount of area required to meet green-up forest cover requirements, and the amount of area in the timber harvesting land base.

An approximation of the Kamloops Land and Resource Management Plan (LRMP) of December 1994 planning team recommendations showed that the initial harvest level could be maintained for 1 decade and that the long-term harvest level would increase by about 1% compared to the base case.

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Introduction

Timber supply is the quantity of timber available for harvest over time. Timber supply is dynamic, not only because trees naturally grow and die, but also because conditions that affect tree growth, and the social and economic factors that affect the availability of trees for harvest, change through time.

Assessing the timber supply involves considering physical, biological and socio-economic factors for all forest resource values, not just for timber. Physical factors include the land features of the area under study as well as the physical characteristics of living organisms, especially trees. Biological factors include the growth and development of living organisms. Economic factors include the financial profitability of forest operations, and the broader community and social aspects of managing the forest resource.

All of these factors are linked: the financial profitability of harvest operations depends on the terrain, as well as the physical characteristics of the trees to be harvested. Determining the physical characteristics of trees in the future requires knowledge of their growth. Decisions about whether a stand is available for harvest often depend on how its harvest could affect the growth and development of another part of the forest resource, such as a wildlife or a recreation area.

These factors are also subject to both uncertainty and different points of view. Financial profitability may change as world timber markets change. Unforeseen losses due to fire or pest infestations will alter the amount and value of timber. The appropriate balance of timber and non-timber values in a forest is an ongoing subject of debate, and is complicated by changes in social objectives over time.

Thus, before an estimate of the timber supply is interpreted, the set of physical, biological and socio-economic conditions on which it is based, and which define current forest management — as well as the uncertainties affecting those conditions — must first be understood.

Timber supply analysis is the process of assessing and predicting the current and future timber supply for a management unit (a geographic area). For a timber supply area (TSA)*, the timber supply analysis forms part of the information used by the Chief Forester of British Columbia in determining an allowable annual cut (AAC)* — the permissible harvest level for the area.

Timber supply projections made for TSAs look far into the future — 200 years or more. However, because of the uncertainty surrounding the information and forest management objectives change through time, these projections should not be viewed as static prescriptions that remain in place for that length of time. They remain relevant only as long as the information upon which they are based remains relevant. Thus, it is important that re-analysis occurs regularly, using new information and knowledge to update the timber supply picture. Indeed, the *Forest Act* now requires that the timber supply for management units through British Columbia be reviewed at least every 5 years. This allows close monitoring of the timber supply and of the implications for the AAC stemming from changes in management practices and objectives.

Timber supply area (TSA)
An integrated resource management unit established in accordance with Section 6 *of the* Forest Act.

Allowable annual cut (AAC)
The allowable rate of timber harvest 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 7 *of the* Forest Act.

Introduction

Timber supply analysis involves three main steps. The first is collecting and preparing information and data. The B.C. Forest Service forest inventory* plays a major role in this. The second step is using this data along with a timber supply computer model or models to make projections or estimates of possible harvest levels over time. These projections are made using different sets of assumed values or conditions for the factors discussed above. The third step in the timber supply analysis is the interpretation and reporting of results.

The following sections outline the timber supply analysis for the Kamloops TSA. Following a brief description of the area in Section 1, data preparation and formulation of assumptions are discussed in Section 2. Analysis methods and results are presented in Sections 3 and 4. Section 5 examines the sensitivity of the results to uncertainties in the data and assumptions used. The report ends with a summary and conclusions about the analysis.

The appendix contains further details about the data and assumptions used in this analysis.

**Throughout this document, an asterisk after a word or phrase indicates that it is defined in a box at the foot of the page, as well as in the glossary.*

Forest inventory
Assessment of British Columbia's timber resources. It includes computerized maps, a database describing the location and nature of forest cover, including size, age, timber volume, and species composition, and a description of additional forest values such as recreation and visual quality.

1 Description of the Kamloops Timber Supply Area

The Kamloops TSA is one of four TSAs in the Kamloops Forest Region, and is administered from the forest district offices in Kamloops and Clearwater (Figure 1). The Kamloops TSA covers 2.12 million hectares of the south-western interior of the province, including the Thompson-Okanagan Plateau and portions of the interior transition mountain ranges. The Thompson River and its tributaries wind through the heart of the area, travelling southward and westward to its confluence with the Fraser River. Ecosystems range from dry, hot grasslands in the south, to wet, rugged mountains in the north. The Monashee and Cariboo Mountains in the northern portion of the Kamloops TSA experience high snowfall. In the central part of the Kamloops TSA, the mountains give way to high plateaus dissected by steep river valleys, and dotted with lakes. Further south, the landscape becomes drier and gentler, with rolling uplands and numerous lakes.

The dense forests of the north and central areas contrast with the mixed lodgepole pine-fir forest and grasslands in the south. Common tree species include Douglas-fir, lodgepole pine, spruce and true firs (balsam). Western redcedar and hemlock dominate stands on a small portion of the Kamloops TSA.

Forests in the Kamloops TSA provide several important resources including community water supplies, wildlife habitat, visual quality, recreational opportunities, and timber.

The current total allowable annual cut (AAC) for the Kamloops TSA is 2 416 680 cubic metres per year. About 23 500 cubic metres per year of the total AAC are apportioned to woodlot licences. Woodlots and their AACs are administered separately from the rest of the land base.

1 Description of the Kamloops Timber Supply Area

Figure 1. Map of the Kamloops TSA.

2 Information Preparation

Many pieces of information are required to conduct a timber supply analysis. Each piece falls into one of three categories: land base inventory, timber growth and yield, or management practices.

2.1 Land base inventory

Land base inventory information used in this analysis comes in the form of a computer file prepared by the British Columbia Forest Service Inventory Branch in 1994. This file contains a considerable amount of data about the thousands of pieces of forest land that make up a TSA, including the geographic location, area, and nature of the forest cover (such as presence or absence of trees, number of trees, species, age, and timber volume).

Initially, this file is a representation of the land base for the entire TSA. It includes data on areas on which timber harvesting operations are not expected to take place, and therefore, do not contribute to the timber supply of the area. Examples include land that has been set aside for a park, or areas occupied by power lines, highways or town sites. Before this land base file is used to make timber supply projections, data for these non-contributing areas must be removed to ensure that the file represents the timber harvesting land base*.

The reduced data file is derived through a process that identifies information for non-contributing areas and removes it from the file. When these reductions are made, care is taken to ensure that only a single reduction is made where categories overlap (for example, where a park area also has unstable soils).

It is important to remember that removal of data for areas not contributing to the timber supply does not imply withdrawal of these areas from the TSA. The British Columbia Forest Service still manages the entire area of the TSA (except for certain designated lands) as a forest unit that contributes a mix of timber and non-timber values. Within that integrated resource context, the timber supply is managed. The timber supply analysis discussed in this report is consistent with this philosophy.

This section describes the types of areas not contributing to the timber harvesting land base. Use of the term timber harvesting land base in this report does not mean that an area is open to unrestricted harvesting activities. Rather, it implies that forests in the area contain timber of sufficient economic value — and sites with adequate environmental resilience — to accommodate timber harvesting with due care for other resources.

Timber harvesting land base
The portion of the total land area of a management unit considered to contribute to, and be available for, long-term timber supply. The harvesting land base is defined by deducting non-contributing areas from the total land base according to specified management assumptions.

2 Information Preparation

Areas on which timber harvesting is not expected to occur, given current forest management in the Kamloops TSA, are as follows:

- non-Crown land — areas not administered by the British Columbia Forest Service as part of the timber harvesting land base;
- non-forest land — areas not occupied by productive forest cover (for example: rock, swamp, and alpine areas);
- inoperable areas — areas classified as unavailable for harvest for terrain-related reasons;
- non-commercial cover areas — areas occupied by non-commercial tree or brush species;
- environmentally sensitive areas (ESAs)* — portions of the areas considered to be sensitive;
- deciduous forest types;
- non-merchantable forest types* — forest types with poor timber quality or low timber volume that cannot be harvested economically. This includes sites with low timber growing potential (low site index);
- woodlot licences — the allowable annual cut for woodlot licences is not administered as part of the TSA. These areas are excluded from the timber harvesting land base;
- specified no-harvest areas — these areas include the Hudson's Bay Trail and lakeshore areas around Class A lakes*. To protect recreational and environmental values, harvesting is not currently allowed in these areas;
- riparian areas — to account for the *Kamloops TSA Riparian Management Area Guidelines*, a 1.16% area reduction was applied to the area remaining after all previous reductions;
- forest roads, skid trails, and landings — to account for the loss of productive forest land that has occurred during past timber harvesting and development, 12.8% of all areas currently younger than 21 years and 1.0% of all areas older than 20 years were removed. Further, it is estimated that due to future timber harvesting-related development, 7.6% of the productive forest area not currently accessed will be lost to further production after the initial harvest;
- untreated not satisfactorily restocked (NSR)* areas — these areas were initially removed, but the portion of the total NSR area still considered available for timber harvesting and production was added back into the timber harvesting land base.

The land base and timber that may be harvested as part of Pulpwood Agreement #16 are not included in the timber harvesting land base for this analysis. The area was deducted under the categories described above, mostly under non-merchantable forest types.

Table 1 summarizes the areas represented by these categories. A more detailed description of these categories and the rationale for the removals and additions are provided in Appendix A, "Description of Data Input and Assumptions."

Environmentally sensitive areas
Areas with significant non-timber values or fragile or unstable soils, or where there are impediments to establishing a new tree crop, or areas where timber harvesting may cause avalanches.

Non-merchantable forest types
Stands that are accessible and otherwise available for harvesting but are assumed to be non-merchantable due to stand characteristics such as small piece size, incidence of decay, species composition and low stocking.

Class A lakes
Class A lakes have significant values for fisheries, recreation, wildlife, or commercial interests such as fish camps. These are small (1-40 hectares) to medium-sized lakes (40-200 hectares) with a low ability to sustain pressure on the fisheries resource. Management guidelines include no commercial harvesting within the lakeshore management zone, and a Visual Quality Objective of preservation within the lakeshore visual management zone.

Not satisfactorily restocked (NSR)
An area not covered by a sufficient number of tree stems of desirable species. Stocking standards are set by the B.C. Forest Service, Silviculture Branch. If the expected regeneration delay (the period of time between harvesting and the date by which an area is occupied by a specified minimum number of acceptable well-spaced trees) has not elapsed, the land is defined as current NSR. If the expected delay has elapsed, the land is classified as backlog NSR.

2 Information Preparation

Table 1. Timber harvesting land base, Kamloops TSA.

Classification	Area (hectares)	Per cent of total area	Per cent of productive forest area
Total land base	2 117 718	100.00	
Not administered as part of timber harvesting land base[a]	- 283 908	13.41	
Non-forest land	- 392 692	18.54	
Total productive forest	1 441 118	68.05	100.00
Reductions to productive forest:			
Inoperable areas	101 386	4.79	7.04
Non-commercial cover	3 366	0.16	0.23
Environmentally sensitive	104 606	4.94	7.26
Deciduous types	46 135	2.18	3.20
Low site	32 902	1.55	2.28
Problem forest types	165 743	7.83	11.50
Riparian areas	10 483	0.50	0.73
Tod Mountain	32	0.00	0.00
Roads, landings, and trails	27 513	1.30	1.91
Not satisfactorily restocked	73 739	3.48	5.12
Woodlots	7 021	0.33	0.49
Lakeshore management areas	965	0.05	0.07
Hudson's Bay heritage trail	96	0.00	0.01
Total current reductions	- 573 987	- 27.10	- 39.83
Current timber harvesting land base (before additions)	867 131	40.95	60.17
Additions to productive forest:			
Not satisfactorily restocked	69 920	3.30	4.85
Timber licence reversions	11 639	0.55	0.81
TFL take back area	2 142	0.10	0.15
Total additions	83 701	3.95	5.81
Current timber harvesting land base	950 832	44.90	65.98
Future reductions:			
Future roads, landings, and trails	- 60 536	- 2.86	- 4.20
Long-term timber harvesting land base	890 296	42.04	61.78

(a) Includes private land, and Crown land either managed by government agencies other than the Forest Service, or administered by the Forest Service but not contributing to the timber supply for this analysis.

2 Information Preparation

Figure 2 summarizes the land base categories for the Kamloops TSA. Approximately 68% of the Kamloops TSA is Crown forest land, and about 60% of this area is available for timber harvesting. Overall, the current timber harvesting land base (not including NSR, timber licences, and the TFL take back) accounts for about 41% of the total Kamloops TSA area (Table 1).

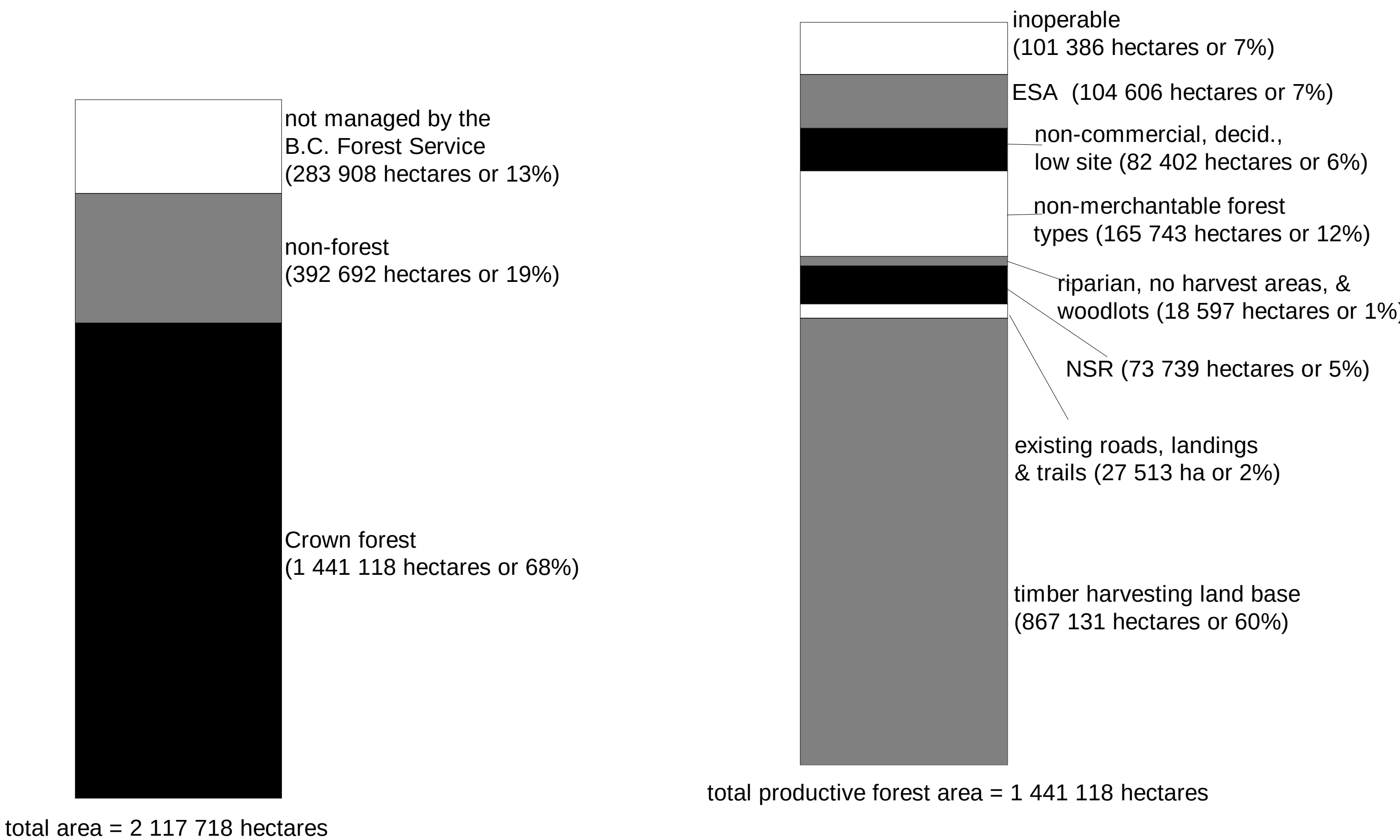

Figure 2. Classification of the total and Crown forested land base for the Kamloops TSA, 1995.

2 Information Preparation

Figure 3 shows the timber harvesting land base by species group and maturity (a stand is defined as mature if it is older than the minimum harvestable age of 80 years for wet-belt fir and lodgepole pine types or 100 years for all other species). Areas to be selectively harvested are included in the areas shown. Overall, 62% of the land base consists of mature stands. Stands dominated by lodgepole pine make up approximately 29% of the mature area and 27% of the total timber harvesting land base.

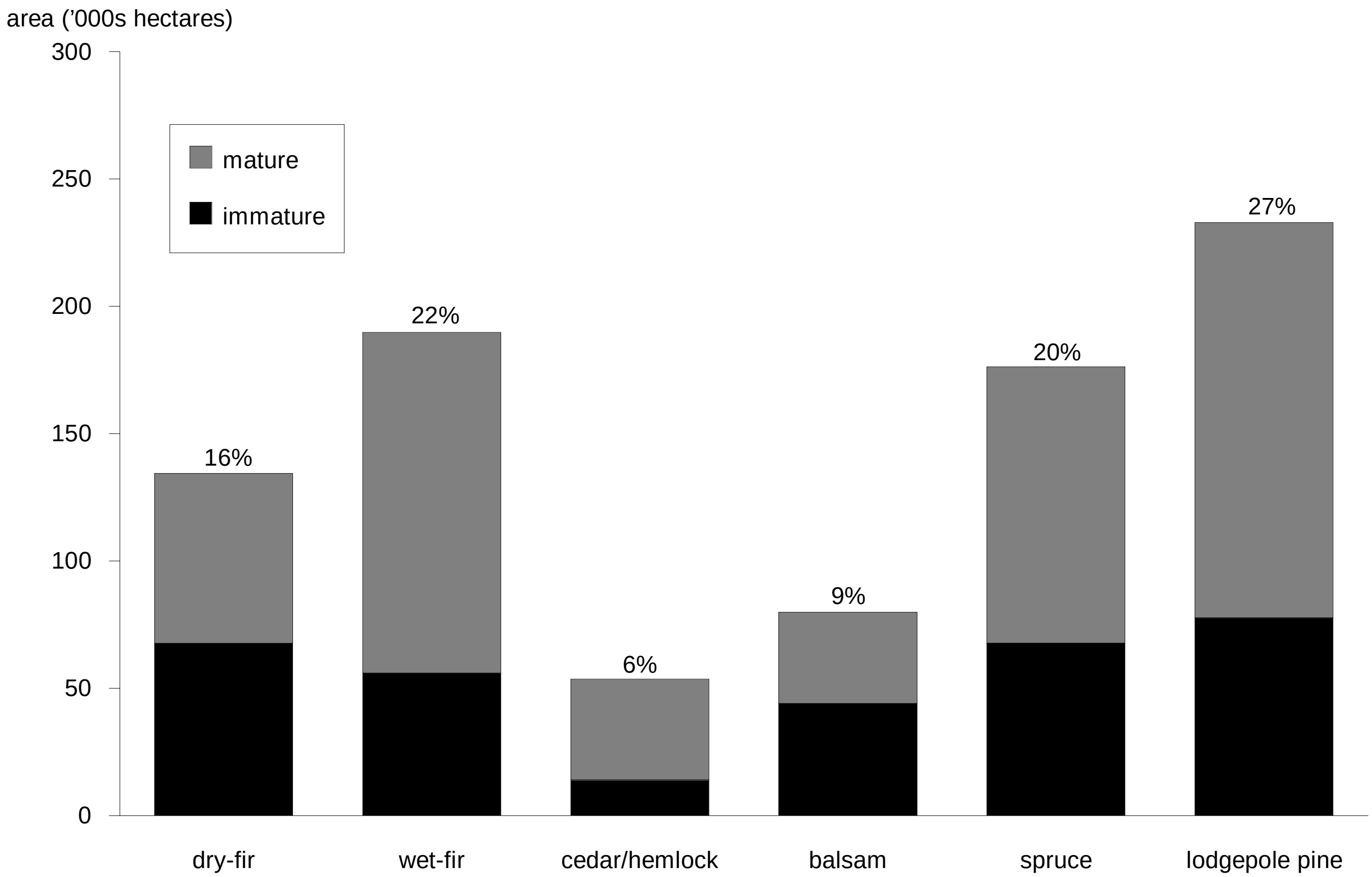

Figure 3. Area by dominant tree species and maturity — Kamloops TSA timber harvesting land base, 1995.

Figure 4 shows the current composition of the Kamloops TSA timber harvesting land base by stand age. Since stands managed using selective harvest methods consist of trees of many different ages, they are not included in the age class distribution shown. As well, areas managed for late winter caribou habitat are not included, as they are managed on a 150-year harvest cycle with at least 12% of the area being older than 200 years of age at all times. At present, 26% of stands on the timber harvesting land base are older than 140 years of age, with stands younger than 80 years making up approximately 34% of the Kamloops TSA. As illustrated in Figure 3, a large portion of stands in the Kamloops TSA timber harvesting land base are at or above the minimum harvestable ages used in this analysis.

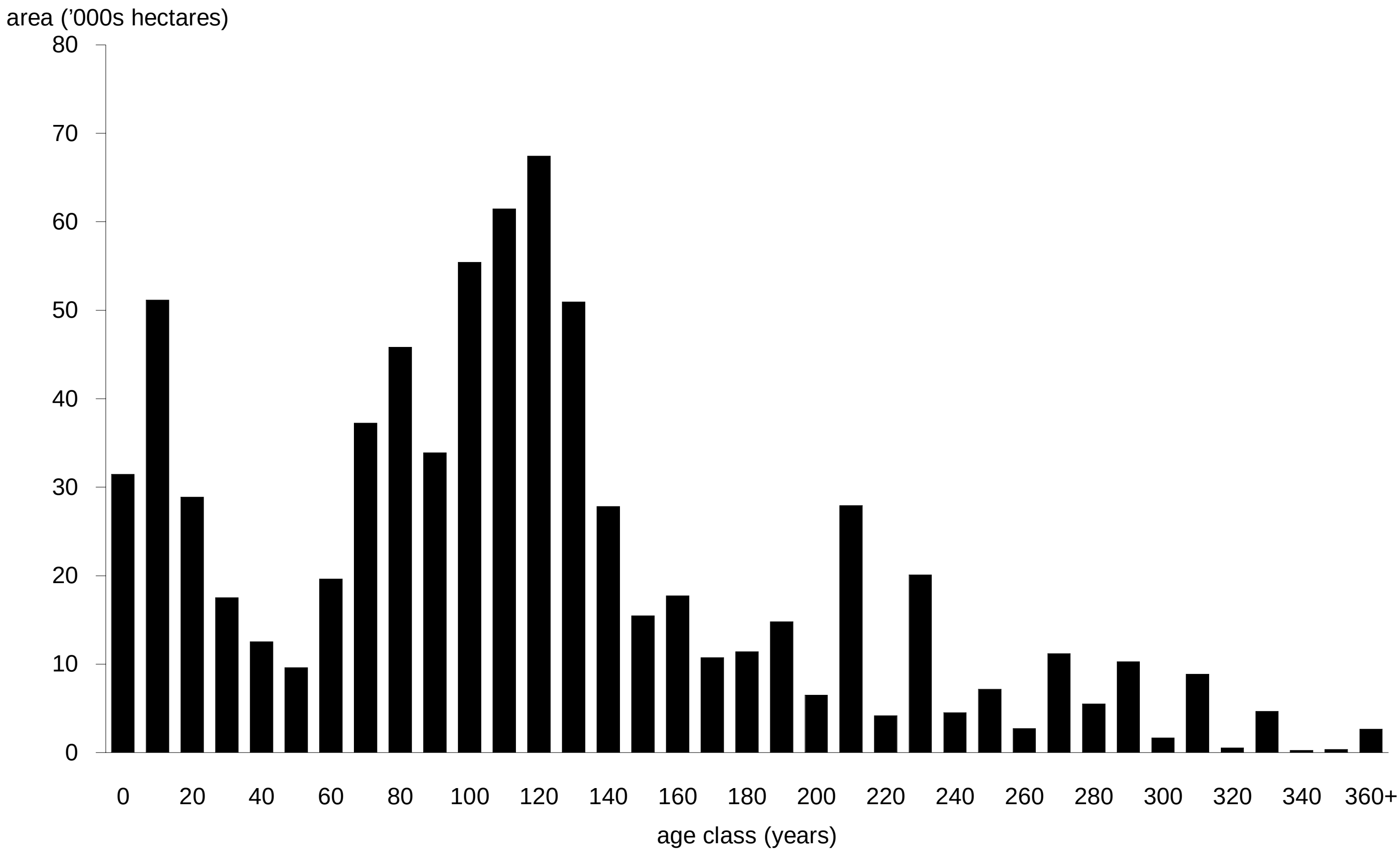

Figure 4. Current age class distribution, timber harvesting land base — Kamloops TSA, 1995.

2.2 Timber growth and yield

Timber growth and yield refers to the prediction of growth and development of individual forest stands over time. The most common measure of the amount of standing timber is volume per area (in British Columbia, cubic metres per hectare). This measure assumes a utilization level or set of dimensions that establish minimum size limits for trees and logs that can be harvested and must be removed from a site. Utilization levels specify a maximum stump height and minimum diameters at the tree base and top.

Estimates of timber volumes within existing stands for the Kamloops TSA analysis are based on the Variable Density Yield Prediction (VDYP) model developed by the B.C. Forest Service, Inventory Branch. This model provides estimates of stand volume according to age. Timber volumes estimates for managed stands are based on the Table Interpolation Program for Stand Yields (TIPSY) model developed by the B.C. Forest Service, Research Branch. Sensitivity analysis addresses the possibility that stand volumes may be different from those predicted by these models.

2.3 Management practices

Timber supply is directly connected to forest management activities. The focus of the Timber Supply Review is to describe the timber supply based on current management practices, as implemented in plans and operations for the area. The following harvesting and silvicultural practices, guidelines and estimates reflect current forest management in the Kamloops TSA, and are represented in the timber supply analysis.

- Basic silviculture levels — defines reforestation activities required to establish free-growing stands* of acceptable species after harvesting. In the Kamloops TSA most areas are managed using a clearcut harvesting* system followed by planting or natural regeneration.
- Selection management* — about 16% of the timber harvesting land base is ecologically suited to management by selection harvesting. It is assumed that these areas will be entered approximately every 30 years and trees will be ready for harvest at about 120 years of age. Therefore, an area will be harvested over a 120-year period. Stands managed in this fashion will contain trees of various ages (referred to as uneven-aged stands).

Free-growing
An established seedling of an acceptable commercial species that is free from growth-inhibiting brush, weed and excessive tree competition.

Clearcut harvesting
A harvesting method whereby all trees that meet utilization standards are harvested. The harvested site is then regenerated to acceptable standard by appropriate means including planting and natural seeding.

Selection management
A silvicultural system used to maintain or create areas containing a wide range of tree ages or sizes. The time interval between harvests in such areas is fairly short (usually less than 30 years) and during these harvests either single scattered trees or small groups of trees are removed from across the entire area.

- Forest health and unsalvaged losses* — expected timber losses due to fire, pest (insect, disease, and animals), and wind damage. In the Kamloops TSA unsalvaged losses are estimated to be 43 400 cubic metres per year (these losses have been subtracted from all of the harvest forecasts shown in this report).
- Utilization levels — tree and log size limits that are to be removed from the site.
- Minimum harvestable ages — the time it takes for stands to grow to harvestable size. The minimum harvestable age defines the youngest age at which a stand may be harvested. Actual harvest age depends on many factors, including the ages of other stands, limits on overall harvest level, and forest cover requirements. A stand could therefore be harvested at an older age than the minimum harvestable age.
- Cutblock adjacency* and green-up* — guidelines that specify the spatial distribution of cutblocks and the condition that previously harvested sites must reach — expressed as average tree height or age — before adjacent mature timber may be harvested. Green-up guidelines specify that no more than a specified percentage of the forest may fail to meet green-up conditions, that is, be younger than the green-up age at any time.
- Forest cover objectives*— specify the desired composition of forest areas by stand age. These objectives are used to represent general adjacency and green-up guidelines as well as desired conditions for wildlife habitat and aesthetics.

A more detailed description of these management assumptions* can be found in Appendix A, "Description of Data Inputs and Assumptions."

2.4 Management zones

In the Kamloops TSA, the delineation of specific areas into management zones, that is, areas where management emphasis is on a particular forest value, was done within the context of the *Kamloops Region Integrated Resource Management Timber Harvesting Guidelines*. The goal of these guidelines is to ensure that the forests of the Kamloops TSA are managed for a full range of forest resources, while at the same time, promoting a vigorous and efficient forest industry. Forest management zones were specified where resource values such as wildlife, visual quality, or timber are particularly important. Areas where selection management is to be practiced were also delineated as a management zone. Overall, seven management zones were defined for the timber harvesting land base. (Figure 5).

Unsalvaged losses
The volume of timber killed or damaged annually by natural causes (e.g., fire, wind, insects and disease) and not harvested.

Cutblock adjacency
The desired spatial relationship among cutblocks as specified in integrated resource management guidelines. They can be approximated by specifying the maximum allowable proportion of a forested landscape that does not meet green-up requirements.

Green-up
The time needed after harvesting for a stand of trees to reach a desired condition (e.g., top height) to ensure maintenance of water quality, wildlife habitat, soil stability or aesthetics.

Forest cover objectives
Desired distributions of areas by age or size class groupings. These objectives can be used to reflect desired conditions for wildlife, watershed protection, visual quality and other integrated resource management objectives.

Management assumptions
Approximations of management objectives, priorities, constraints and other conditions needed to represent forest management actions in a forest planning model. These include, for example, the criteria for determining the timber harvesting land base, the specification of minimum harvestable ages, utilization levels, integrated resource guidelines and silviculture and pest management programs.

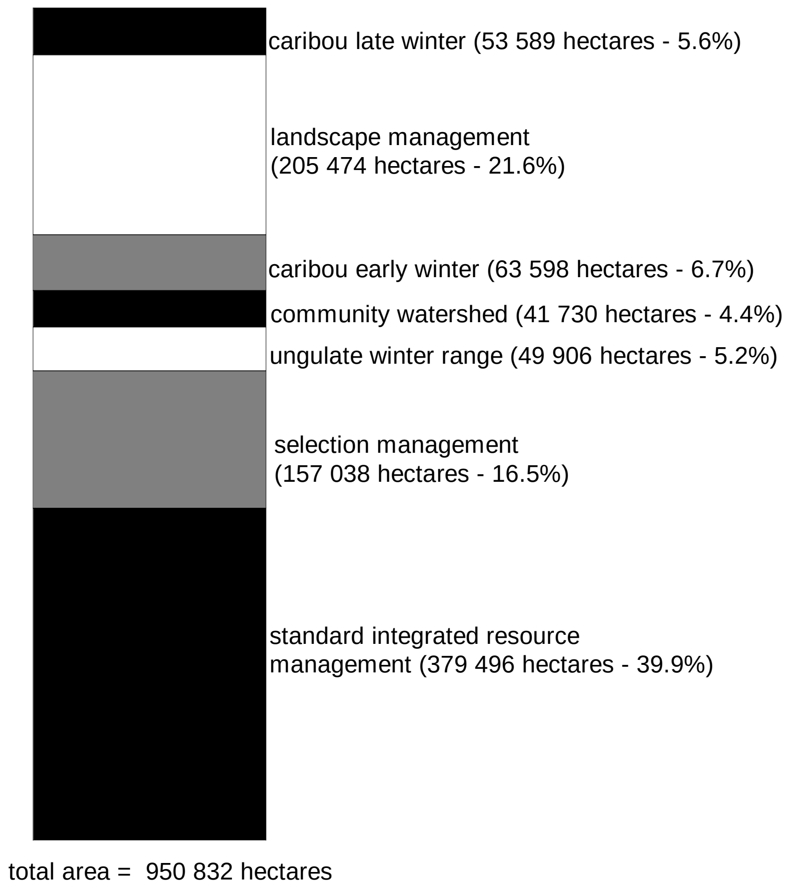

Figure 5. Management zones for the Kamloops TSA timber harvesting land base, 1995.

Forest cover requirements that limit the area not meeting green-up conditions, and that specify a minimum proportion of the area that must exhibit characteristics of older forest were applied to most zones. The green-up requirement ensures harvesting does not become overly concentrated, and the old-age cover requirements ensures maintenance of wildlife habitat.

The forest cover requirements for each zone are described below and are discussed in more detail in Appendix A, "Description of Data Inputs and Assumptions." When deriving the forest cover requirements, it was recognized that forest outside the timber harvesting land base can contribute to forest cover objectives.

- Caribou late winter habitat — to maintain the winter range resource for woodland caribou. The forest cover requirements are that no more than 33% of the late winter habitat area may be below 3 metres in height (22 years of age on average) and that at least 12% of the area must be at least 200 years of age. The entire area will be managed on the basis of a 150-year harvest cycle (rotation).
- Landscape management — to maintain visual quality along corridors where people live, work, recreate, and travel. Management for visual quality was represented by a forest cover requirements that no more than 10.7% of the area may be below 6 metres in height (25 years of age), and that at least 6.6% of the area is greater than 20 metres in height (82 years of age) at all times.

- Caribou early winter habitat— to maintain the early winter/transitional range resource for the woodland caribou. The forest cover requirements are that no more than 32% of the early winter habitat area may be below 3 metres in height (21 years of age) and that at least 30% of the area must be above 19.5 metres in height at all times (92 years of age).
- Community watershed — to manage for water quality and quantity. The forest cover requirements are that no more than 24% of the community watershed area may be below 5.4 metres in height (23 years of age) and that at least 9.3% of the area must be 20 metres or greater in height (84 years of age) at all times.
- Ungulate winter range — to maintain or enhance forage production by dispersing the harvest throughout the winter range. The forest cover requirements ensure that no more than 20% of the ungulate winter range area is below 3 metres in height (16 years of age) and that at least 28.4% of the area is greater than 20 metres in height (77 years of age) at all times.
- Selection management — this zone encompasses areas in the Kamloops TSA which are managed using selection harvest systems. Some areas being selection harvested are located in the management zones described above. However, forest cover requirements do not apply in the selection harvest zone since only small patches are cleared, creating multi-aged stands which are assumed to satisfy forest cover requirements of the other zones.
- Standard integrated resource management — this zone includes areas where no special wildlife, recreation, visual, or watershed values have been identified, and therefore, where no special forest cover objectives apply. The emphasis is on timber management, while ensuring environmental quality is maintained and non-timber values are recognized and integrated into plans and operations. This zone is managed on a 4-pass harvesting system within the Kamloops Forest District and a 3-pass harvesting system within the Clearwater Forest District. The cover requirements are that no more than 28% of the area be below 3 metres in height (17 years of age) and that at least 7% of the area be above 20 metres in height (84 years of age) at any one time to provide thermal cover for ungulates.

3 Analysis Methods

The purpose of this analysis was to examine both the short- and long-term timber harvesting opportunities in the Kamloops TSA, in light of current forest management practices. A timber supply computer simulation model developed by the B.C. Forest Service was used to aid in the assessment. A timber supply model, as distinct from a growth and yield model, assists the timber supply analyst in determining how a whole forest (collection of stands) could be managed to obtain a harvest forecast (supply of timber over time). The simulation model uses information about the timber harvesting land base, timber volumes, and the management regime to represent how trees grow and are harvested over a period of up to 400 years. However, only the results for the first 250 years are shown graphically in this report because the harvest remains constant after that time.

Similar to other models, the B.C. Forest Service model assumes that trees grow according to provided yield projections, and are harvested according to either a volume target or a specified objective set by the analyst, such as harvest volume maximization. The Forest Service model also allows the use of forest cover guidelines that specify the desired age composition of the forest. These guidelines can be used to examine the effects of harvest block spatial distribution rules and green-up prescriptions. For example, guidelines might specify that no more than some maximum percentage of the forest can be younger than a specified green-up age, or that some minimum percentage of the forest must be in older age classes to provide wildlife habitat. The B.C. Forest Service simulation model facilitates examination of the effects of such guidelines on timber supply.

This type of analysis is used to determine the timber supply implications of a particular timber harvesting regime. The results of the analysis are especially important in determining allowable cuts that will not restrict options of future resource managers, and that will allow local B.C. Forest Service staff to administer their programs according to relevant guidelines and principles. **However, the results of the analysis are not meant to be taken as recommendations of any particular AAC.**

The main results of the analysis are forecasts of potential timber harvests and timber inventory changes (ages and volumes) over time. Although this information gives field staff only very limited guidance in the design of operational activities such as harvesting block location and silviculture planning, it does help ensure that the timber harvest level supports rather than hinders sustainable forest management in the field.

4 Results

This section presents results of the timber supply analysis for the Kamloops TSA. The analysis uses the most recent assessments of current forest management, the land available for timber harvesting, and timber yields as described in Section 2, "Information Preparation." These results will be referred to as the base case because they form the basis for comparison when assessing the effects of uncertainty on timber supply. Because forest management is inherently a very long-term venture, uncertainty surrounds much of the information important in determining timber supply. These factors will be discussed in Section 5, "Timber Supply Sensitivity Analyses."

4.1 Harvest forecast

The harvest forecast based on current management assumptions for the Kamloops TSA is shown in Figure 6. The present AAC of 2 393 180 cubic metres per year may be maintained for 20 years. To avoid severe future timber supply shortages, the harvest level must then decline by 9% per decade until it reaches the long-term harvest level of 1 958 000 cubic metres per year about 40 years from now.

Harvest flow patterns over time other than shown for the base case are possible. For example, the initial harvest level could be different, the current level could be maintained for a longer period, or the rate of decline to the long-term level could be different. Alternative harvest forecasts are discussed in Section 5, "Timber Supply Sensitivity Analyses."

Forest cover requirements will be important determinants of the general location of harvesting over the short term. As was shown in Figure 3, more than 60% of the Kamloops TSA contains stands of mature timber. When forest cover requirements are applied to the land base, however, much of the timber in some management zones becomes unavailable. For example, areas being managed for visual quality (the landscape management zone) contain approximately 24% of the mature timber within the Kamloops TSA. However, due to past harvesting, the forests in the area currently do not meet forest cover requirements. It is not until 10 years from now that limited harvesting is forecasted to begin within these areas. While forest cover requirements will affect the location of harvesting, they do not limit total harvests over the next few years. The cover requirements, however, do affect timber supply over the next several decades (see Section 5.6, "Green-up and mature age forest cover requirements").

4 Results

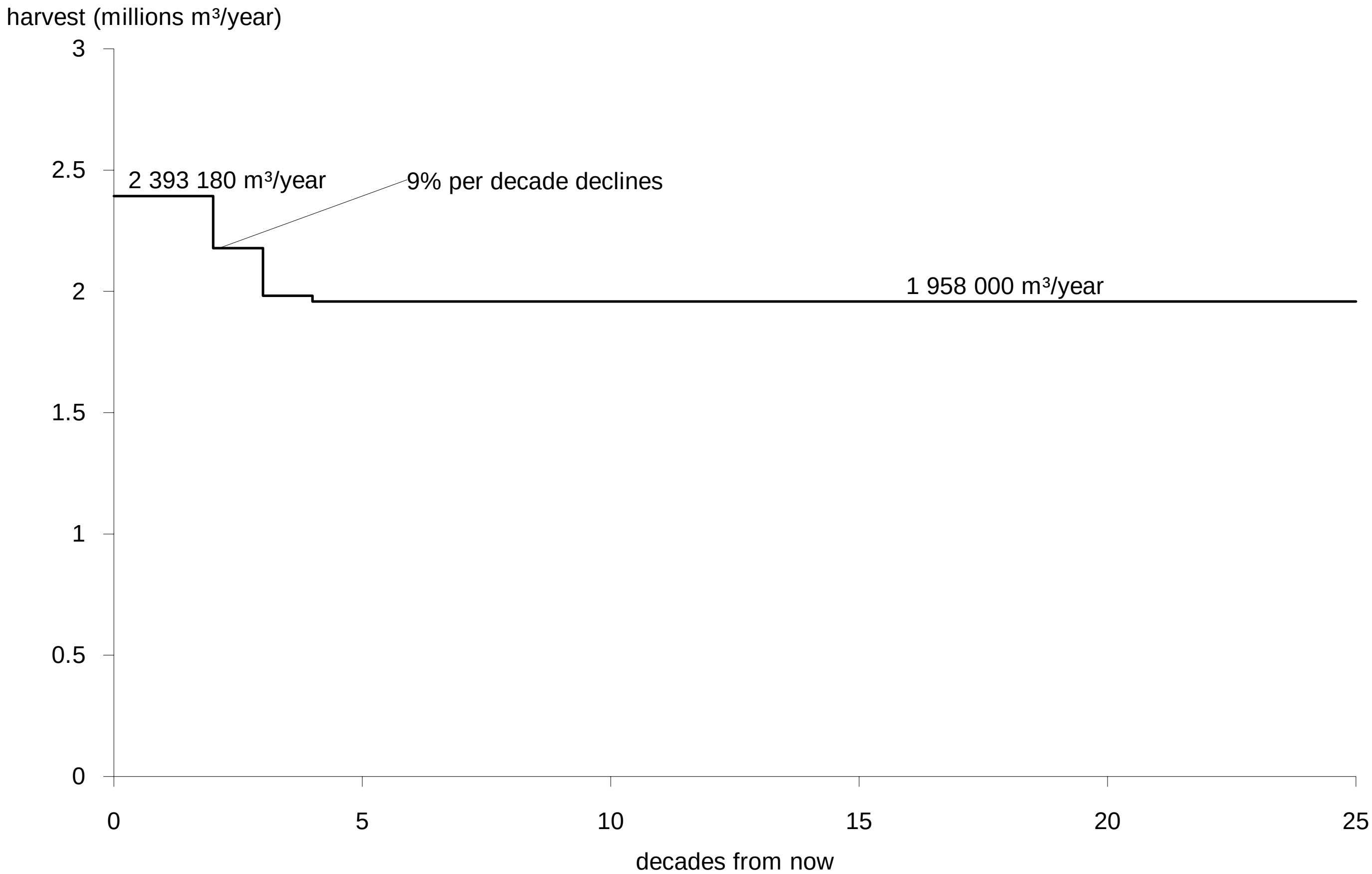

Figure 6. The base case harvest forecast for the Kamloops TSA, 1995.

Figure 7 shows the projected timber growing stock given the base case harvest flow. The present total growing stock of 152 million cubic metres is projected to decline over the next 140 years to an approximate long-term level of 120 million cubic metres. The initial drop in growing stock reflects the forecasted transition from the mostly older forest currently on the timber harvesting land base, to a younger, managed forest. The growing stock reaches a low of 110 million cubic metres in decade 9 when the transition from the old existing forest to second growth is nearly complete. The long-term harvest level was set to maintain total timber growing stock at a nearly constant level once most existing stands in the timber harvesting land base have been harvested and reforested. The stability of the growing stock volume over time indicates that the long-term harvest level shown in Figure 6 is close to the maximum that can be sustained without causing disruptions in timber supply.

The available growing stock — stands of harvestable age not required to meet mature forest cover requirements — is also shown in Figure 7. Beginning at about 124 million cubic metres (82% of the total growing stock), the available timber volume declines to an average of 69 million cubic metres (56% of the total growing stock) between 100 and 140 years from now. Growing stock volume in selection-managed stands, and areas managed for caribou late winter habitat (for which the management regime was represented by approximately equal annual area harvests, that is, area regulation), are shown separately in Figure 7. The initial volume of total growing stock within these areas is estimated as 17 million cubic metres. This volume declines to approximately 10 million cubic metres over the long term.

4 Results

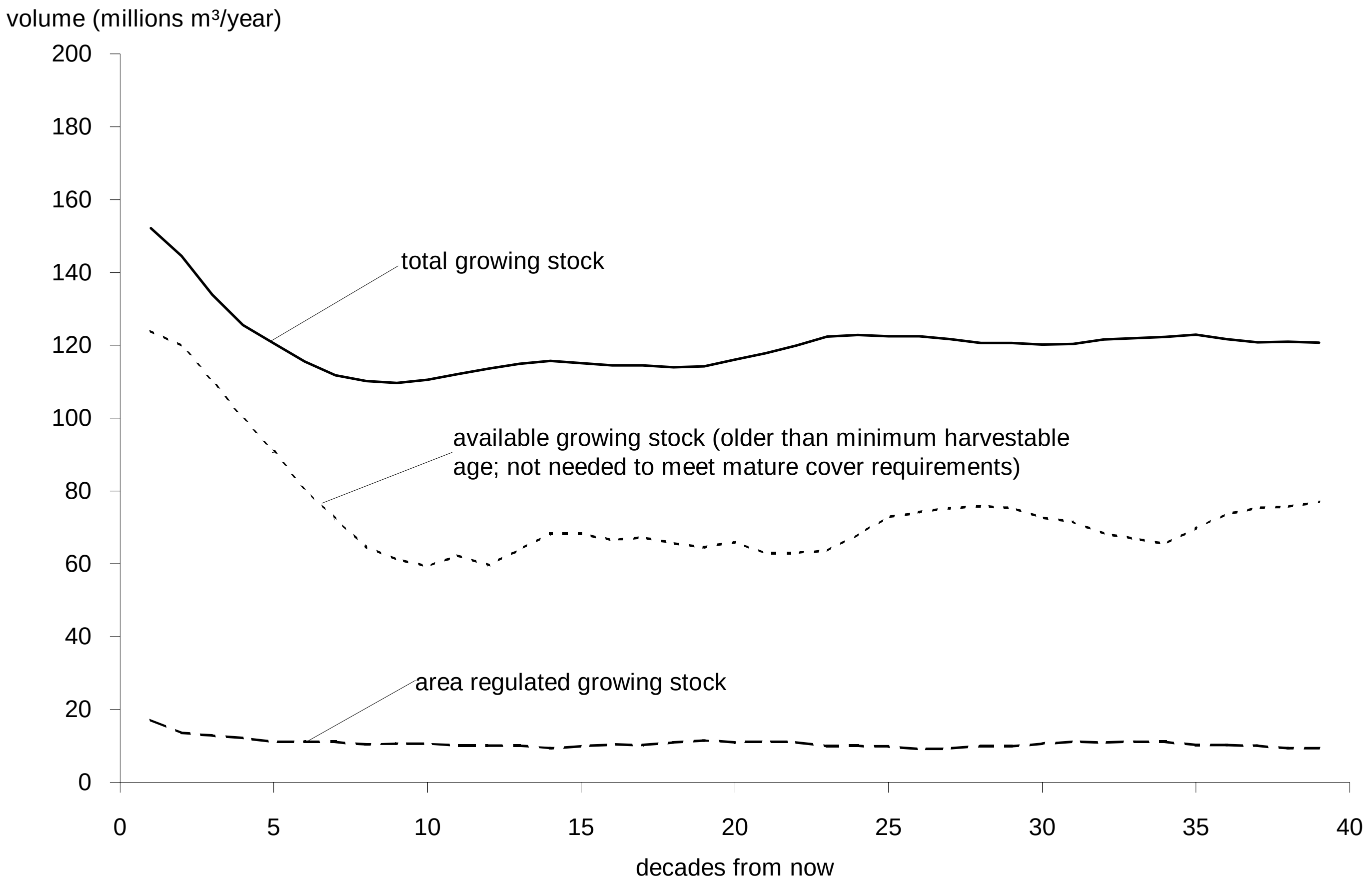

Figure 7. The base case growing stock over time for the Kamloops TSA, 1995.

The long-term harvest level of 1 958 000 cubic metres per year is not the same as a theoretical maximum sustainable harvest level based on the maximum average growth rate, or culmination of mean annual increment (MAI)* of the forest. The theoretical level of approximately 2 371 140 cubic metres per year, is not achievable for several reasons. The losses from fire and other causes must be deducted from the theoretical maximum. This reduces the maximum possible harvest to 2 327 740 cubic metres per year. The base case long-term harvest is approximately 84% of this level. This difference arises because stands are not always harvested at ages that would maximize volume yield over the long term. This can occur because of the applied minimum harvestable ages, forest cover objectives, or imposed harvest flow patterns.

Note that the harvest forecast shown here, as well as those in Section 5, "Timber Supply Sensitivity Analyses" provide an upper limit on timber supply, given the land base and management practices discussed earlier. This forecast is for discussion purposes only and is not intended to suggest a particular AAC.

Mean annual increment (MAI)
Stand volume divided by stand age. The age at which average stand growth, or MAI, assumes its maximum is called the culmination age. Harvesting all stands at this age results in a maximum average harvest over the long term.

4.2 Age class distribution over time

Figure 8 shows the changes that occur in the stand age composition of the timber harvesting land base over the 250 year analysis horizon. Selection-harvested and caribou winter range areas have not been included in the stand age distribution charts. Stands managed by selection harvesting consist of trees of many different ages and thus do not fall into a single age class. Management of the caribou winter range areas on a 150-year harvest cycle, represented by area regulation for this analysis, did not allow their inclusion.

Currently, 26% of the forest comprises of stands over 140 years of age and 34% younger than 80 years of age. A large proportion of the area, 40%, falls within the range of 80 to 140 years. The current stand age distribution indicates that approximately 62% of the timber harvesting land base for the Kamloops TSA is or soon will be available for harvest. As Figure 8 shows, over the next 250 years the distribution of stand ages is forecast to become gradually more even (approximately equal areas at each age up to about 120 years), while older stands are maintained throughout the 250-year period to accommodate forest cover requirements.

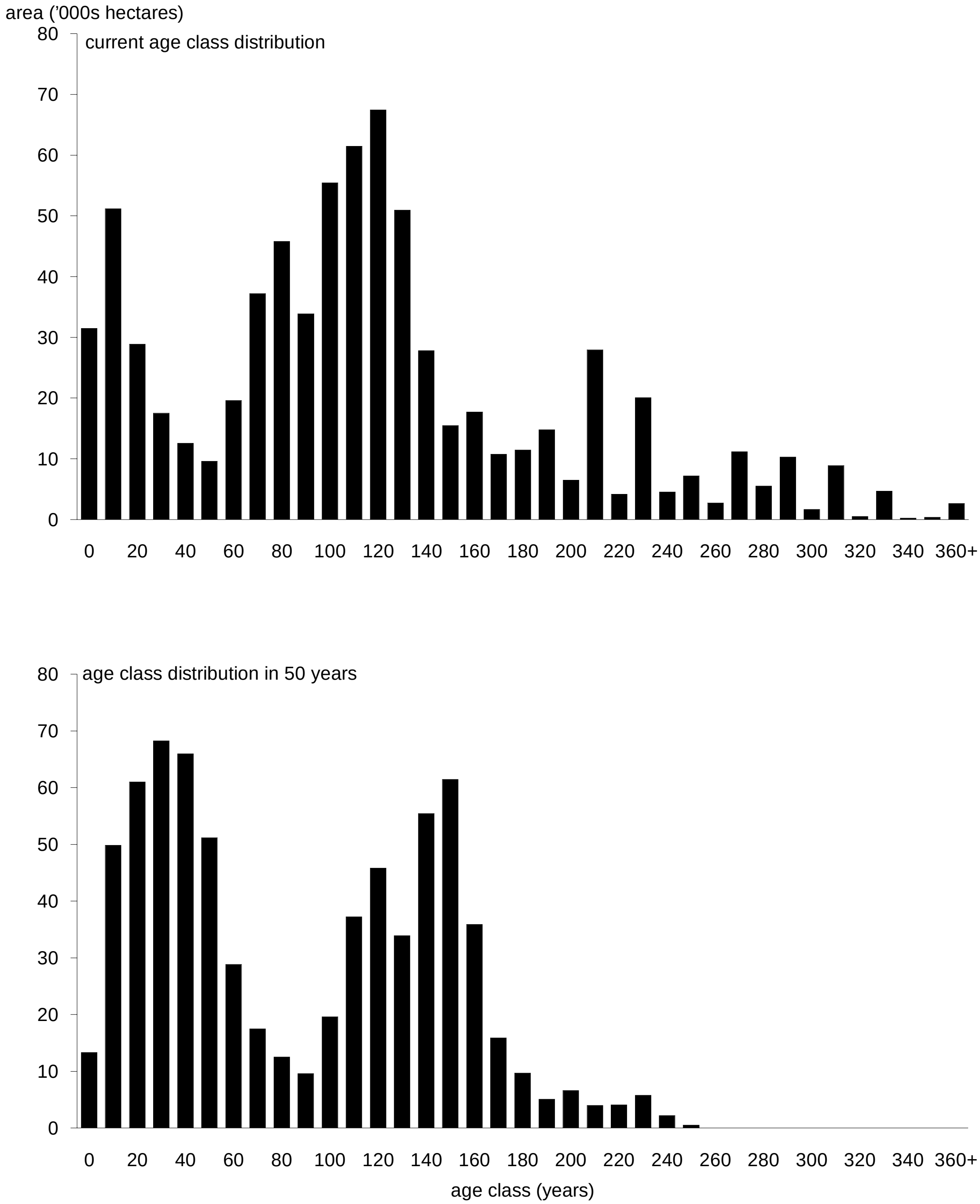

Figure 8. Age class distribution over time — Kamloops TSA, 1995.

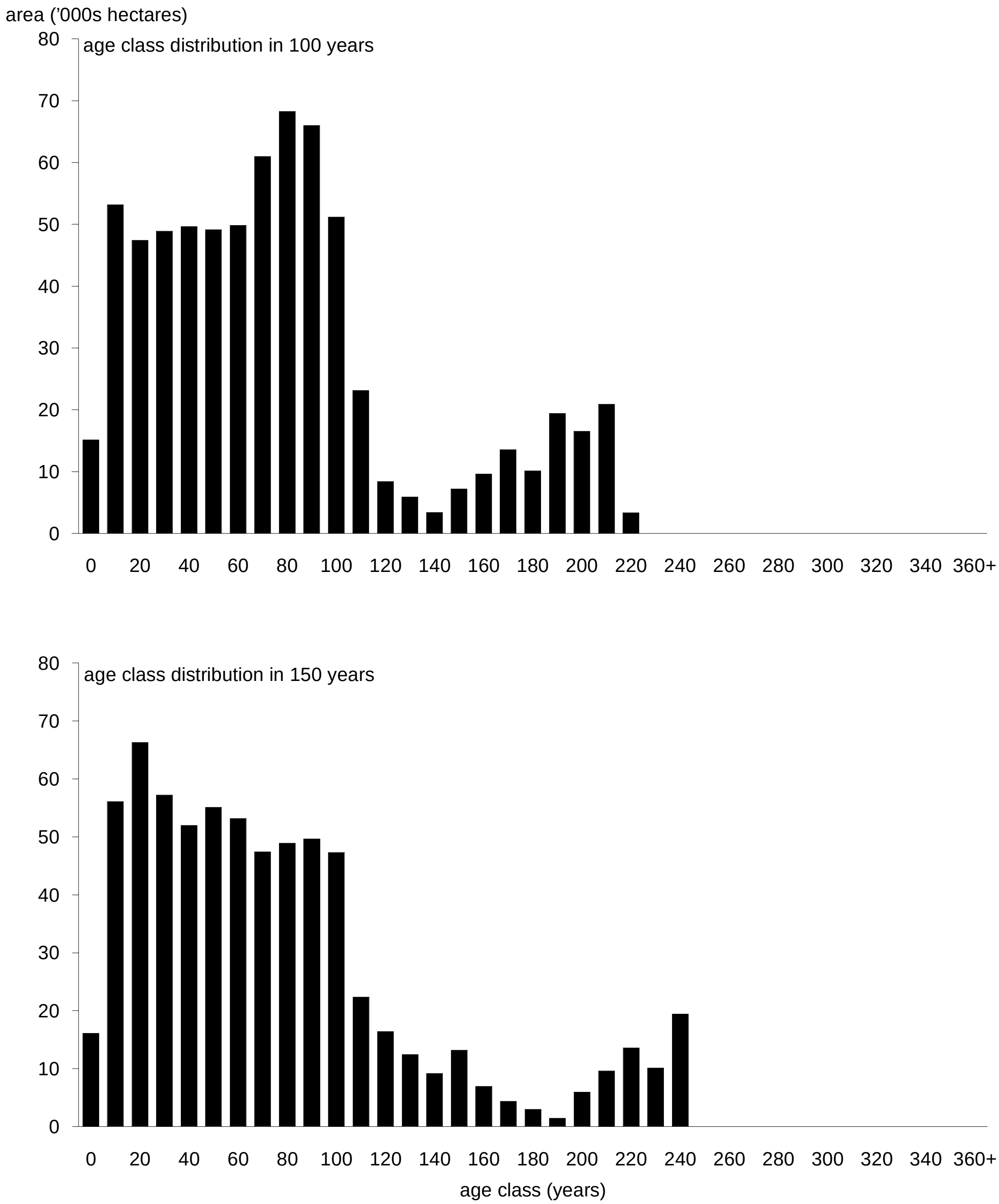

Figure 8. Age class distribution over time — Kamloops TSA, 1995.

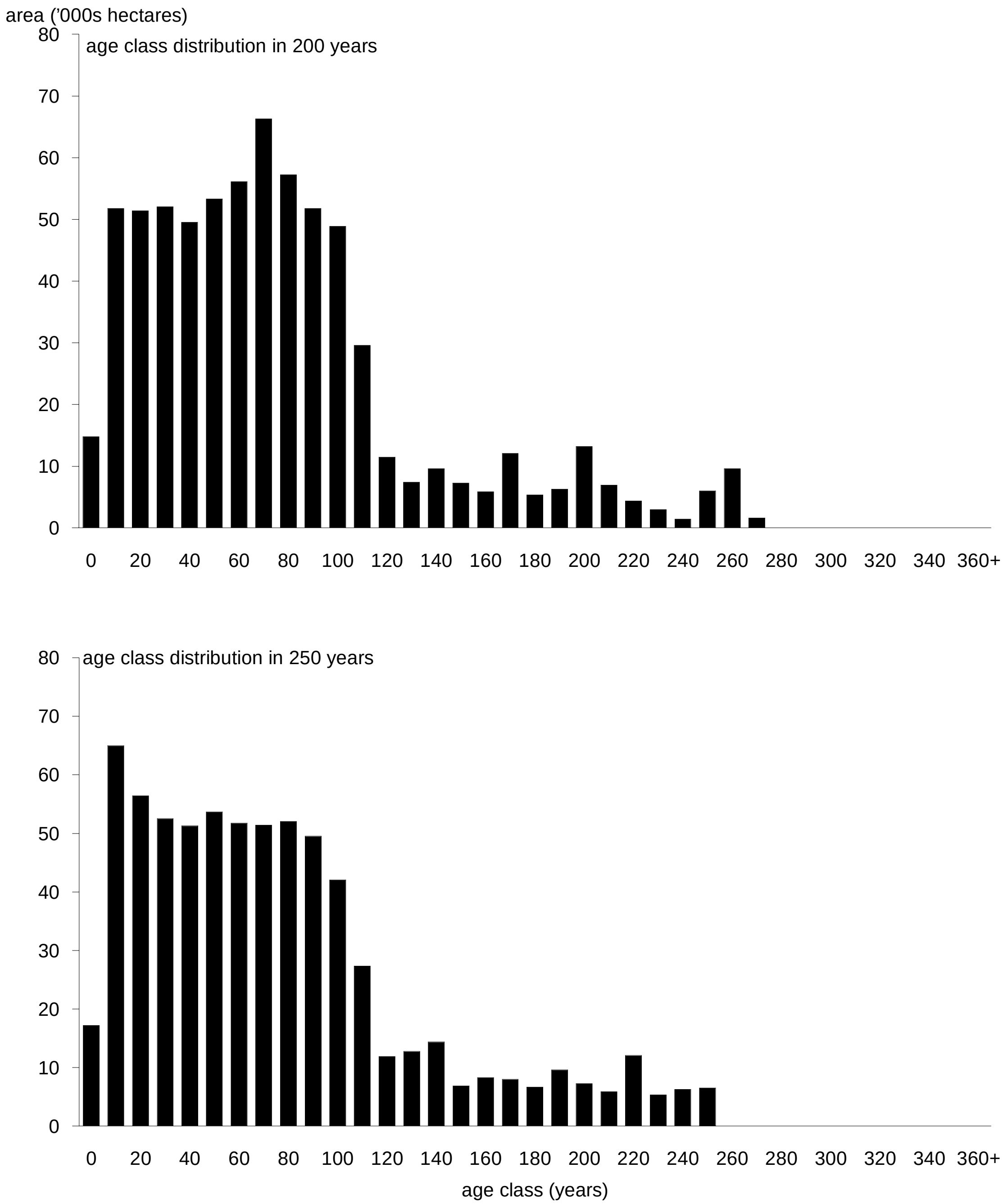

Figure 8. Age class distribution over time — Kamloops TSA, 1995 (concluded).

4.3 Average area harvested, harvest age, and volume per hectare

Figure 9 shows the average area harvested each year by clearcutting and selection harvesting methods. Caribou winter range areas have been included within the clearcutting category. The average area harvested by clearcutting starts at approximately 6500 hectares per year. Peaks in area harvested occur in decades 2, 13, and 24. The peak in decade 2 is a result of the significantly lower selection harvest, forcing more areas to be clearcut harvested. The peaks occurring in decades 13 and 24 are a result of the lower than average volumes per hectare being harvested, as shown in Figure 11. A shift to harvesting of second-growth stands begins around decade 10. Over the long term, average area harvested by clearcutting is approximately 5700 hectares per year.

It is notable from Figure 9 that the area harvested under selection management is proportionately much larger than the total area subject to selection harvesting. This occurs because selection management involves harvesting individual trees or small patches of trees, and only a portion of the total stand volume is removed. Thus, the volume per hectare harvested is much lower than in clearcut stands. Clearcutting, however, removes essentially all the volume from the site, therefore requiring that less area be harvested relative to selection-harvested stands to achieve the same harvest volume. Initially 15% of the volume harvested comes from selection stands but, as Figure 9 shows, 45% of the total area harvested is in these areas. The area harvested by selection methods starts at approximately 5300 hectares annually, and averages about 4900 hectares per year over the long term.

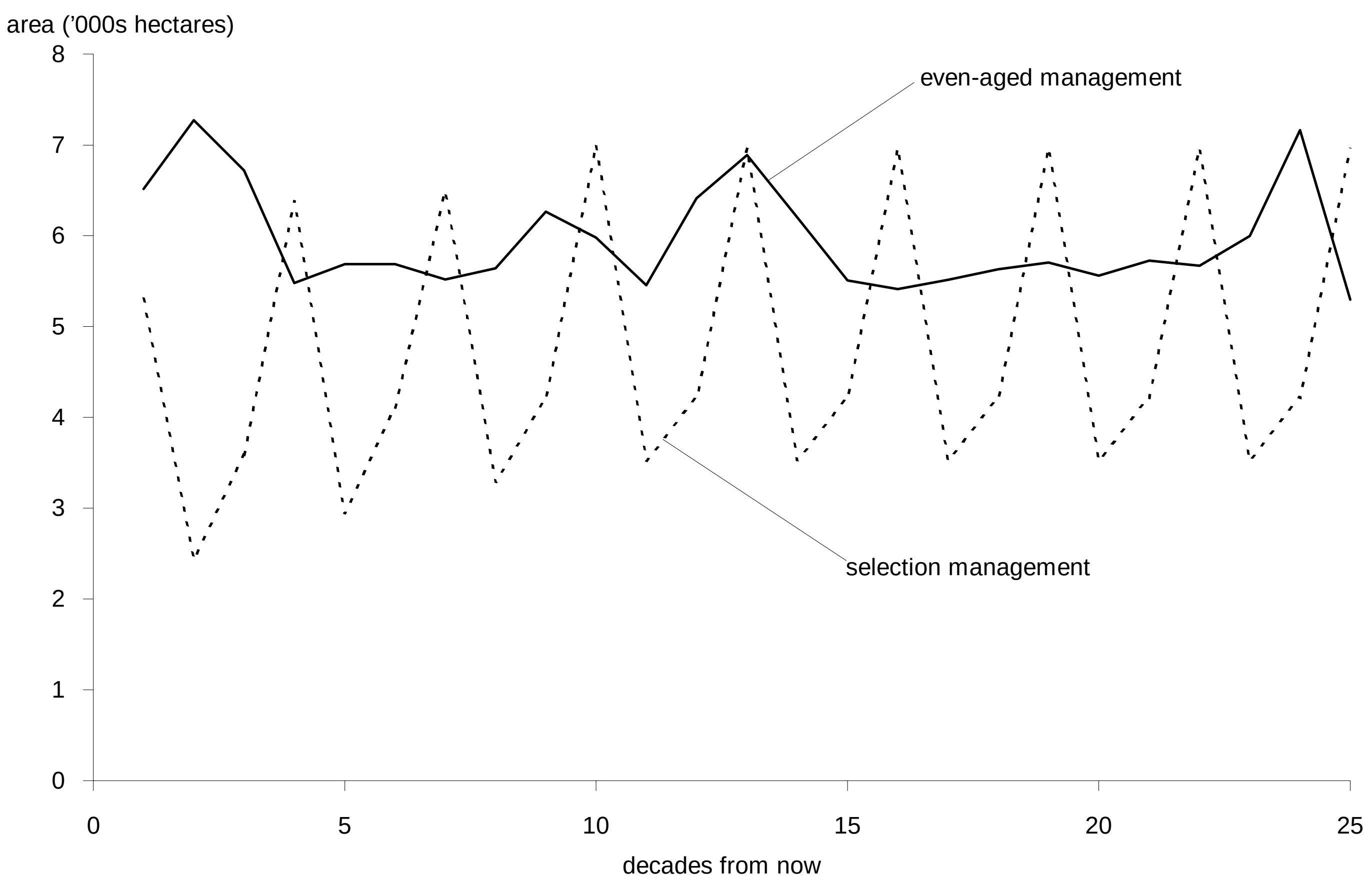

Figure 9. Area harvested annually for base case — Kamloops TSA, 1995.

The trend in average harvested ages for clearcut harvested stands is shown in Figure 10. Stands under selection management are again not included because the trees that make up these stands are of many different ages. Stands managed within the caribou winter range zone are also not included because their management was represented by fairly constant area harvests, and harvested ages were not recorded. Average harvested age starts at about 220 years, increases to 250 years in decade 2, then declines rapidly to about 165 years in decade 4. The lower average harvested age projected over the next 10 years results because a desired mix of species is harvested (sometimes referred to as a harvest profile constraint). As a result, over 20% of the first decade harvest comes from the relatively younger lodgepole pine stands instead of the older cedar and hemlock stands. After the first decade this requirement is removed, and harvests come from the oldest stands regardless of species. As harvesting shifts from existing forest stands to second-growth managed stands, the average harvest age continues to decline, but at a less rapid rate than over the first 40 years. Beginning in decade 10, the average harvested age reaches a fairly steady long-term average of about 130 years.

Figure 11 shows the changes in average volume harvested per hectare over time for clearcut-harvested areas. The average volume per hectare harvested remains relatively constant over the planning horizon at approximately 325 cubic metres.

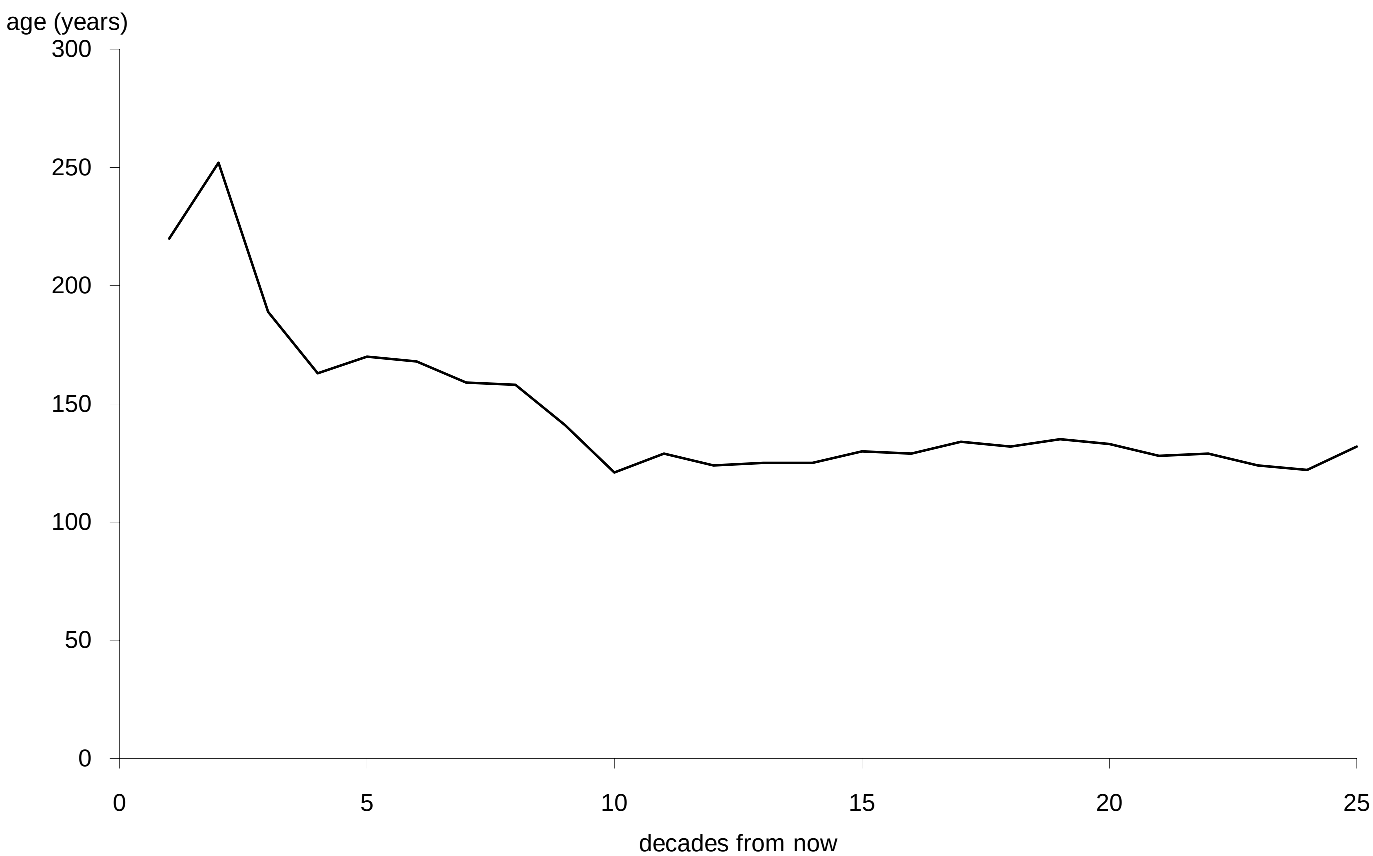

Figure 10. Average harvest age over time — Kamloops TSA, 1995.

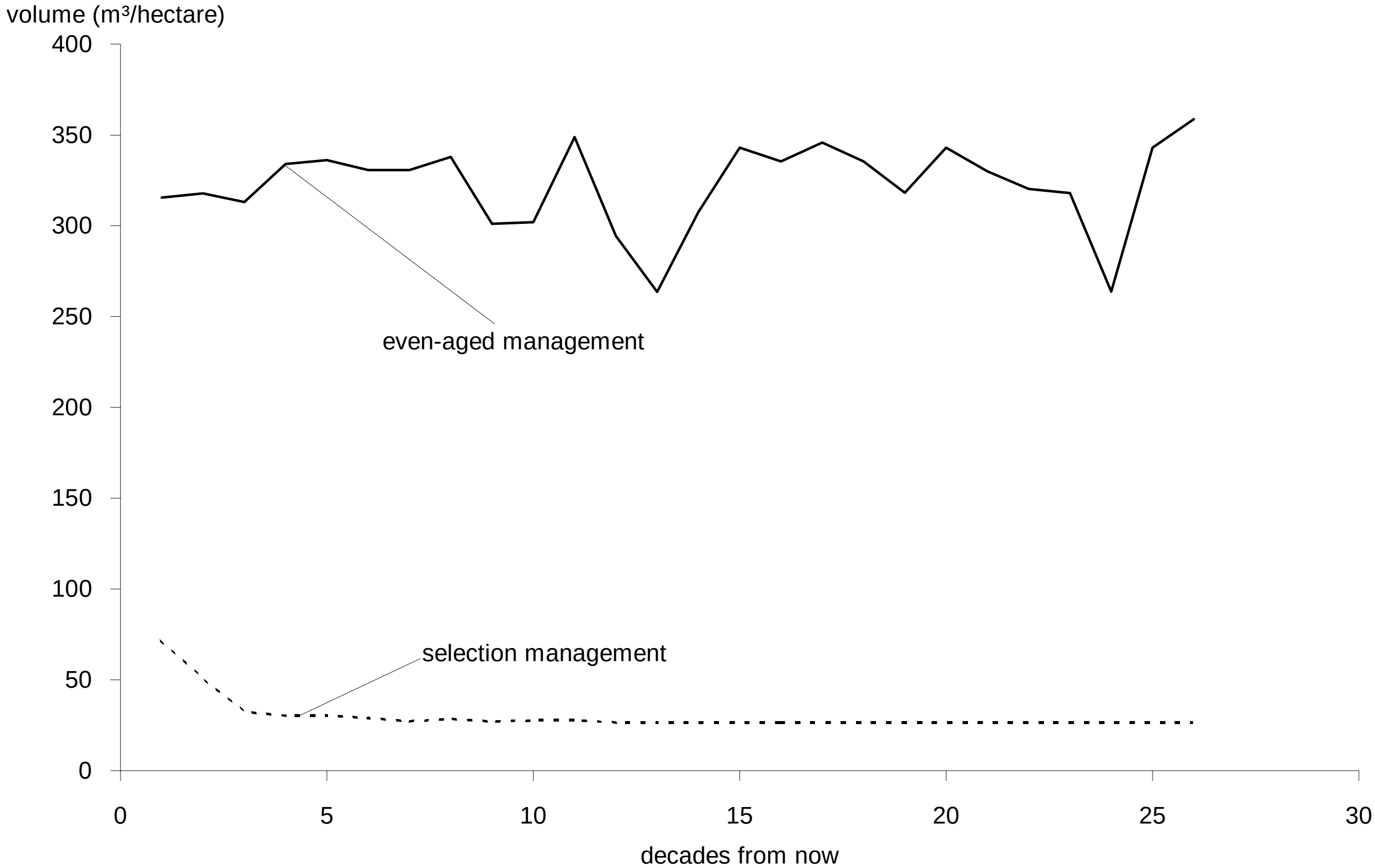

Figure 11. Average volume per hectare harvested over time — Kamloops TSA, 1995.

5 Timber Supply Sensitivity Analyses

The best available information on forest inventories and management practices is used to analyse the timber supply implications of continuing with current management. However, forest management is a complicated and ever-changing endeavor that must account for diverse and changing human values, the dynamics of complex ecosystems, and fluctuating and uncertain economic factors. As well, forests grow quite slowly in terms of human time spans, which means that decisions we make today have not only short-term but also long-term effects. In such a context, we cannot be certain that all data accurately reflect the current state of all conditions in the forest, how the forest will change, or how our management activities will affect the forest.

One important way to deal with this uncertainty is to revise plans and analyses frequently to ensure they incorporate up-to-date information and knowledge. Frequent planning and decision-making can help minimize any negative effects that may occur if decisions are based on inaccurate information. Frequent revision can also ensure that opportunities which become apparent from new information are not missed.

Another important way of dealing with uncertainty is to assess how values of interest, for example, timber supply, could change if the information used in the analysis is not accurate. Sensitivity analysis is one way of evaluating how uncertainty could affect analysis results, and ultimately decision-making. Sensitivity analysis can highlight that fairly small uncertainties about some variables could have large effects on timber supply projections, or conversely that fairly large inaccuracies in others could have negligible effects. Also, sensitivity analysis could show that some variables affect timber supply more in the short term than in the long term, while others have the opposite effect. Sensitivity analysis can highlight priorities for collecting information for future analyses, and show which variables, and associated uncertainties, have the most significance for decisions. It can clarify whether current best estimates provide safe bases for decisions, or whether high uncertainty about important variables means more conservative decisions may be wiser.

Some recognition of the potential effects of uncertainty is important because every decision, either implicitly or explicitly, incorporates an attitude towards uncertainty. For instance, someone who feels that existing information accurately reflects reality is, technically speaking, neutral to uncertainty, essentially believing that any inaccuracies probably balance out. Ignoring uncertainty is implicitly neutral. If maximizing timber supply were the goal, someone with an optimistic attitude towards uncertainty would believe that current information probably underestimates timber supply, and that problems can be resolved through human ingenuity and changes to practices. A conservative position would be that current information probably overestimates timber supply, and that decisions should minimize the potential for future timber supply shortages, or negative effects on other values.

This report does not advocate any of these positions. One of its goals is to supply information to assist people with different attitudes towards forest management and uncertainty to provide input.

In this section, results of several sensitivity analyses are discussed. The results that are based on current forest management assumptions (shown in Figures 6 to 11) are referred to as the base case.

5.1 Alternative initial harvest levels and harvest flows over time

The base case harvest forecast shown in Figure 6 was defined using criteria such as maximum rate of decline per decade, avoidance of large harvest shortfalls, and maintenance of a fairly constant growing stock level over the long term. While the last of these criteria is linked to maintaining the productivity of forest land, and is therefore a legislated requirement, the other criteria are not requirements, rather they are attempts to avoid both excessive changes from decade to decade, and significant timber shortages in the future which might limit future options. However, there are many possible harvest flows, with different decline rates, starting harvest levels, and potential trade-offs between short-term and long-term harvests.

For a given set of forest management assumptions, many different harvest flow patterns are often possible. The base case harvest forecast in this analysis has a starting harvest level of 2 393 180 cubic metres per year. The long-term harvest level of 1 958 000 cubic metres per year is reached in 40 years after declines of 9% per decade. This section examines three alternative harvest flows (Figure 12).

The first alternative begins at 10% above the long-term level, or 2 153 800 cubic metres per year, which is also about 10% less than the current harvest level. Harvests could be maintained at this level for 40 years and then decline to the long-term level without violating forest cover objectives or causing severe timber supply disruptions further in the future.

A second alternative forecast begins with a harvest rate 10% above the current level, that is, 2 632 498 cubic metres per year. If this level is held for the first decade and then reduced by 9% per decade until reaching the long-term level 40 years from now, a combination of forest cover requirements and shortage of merchantable timber would result in a timber supply disruption between 90 and 100 years from now, requiring that harvests be reduced to approximately 22% below the long-term level.

The third harvest flow alternative shown in Figure 12 involves maintaining the current harvest level for as long as possible before timber supply shortages require severe harvest reductions. The current harvest rate could continue for 60 years, but severe fluctuations in the harvest rate would follow for the next 40 years with a low of 1 296 545 cubic metres per year (34% below the base case) between years 70 and 80.

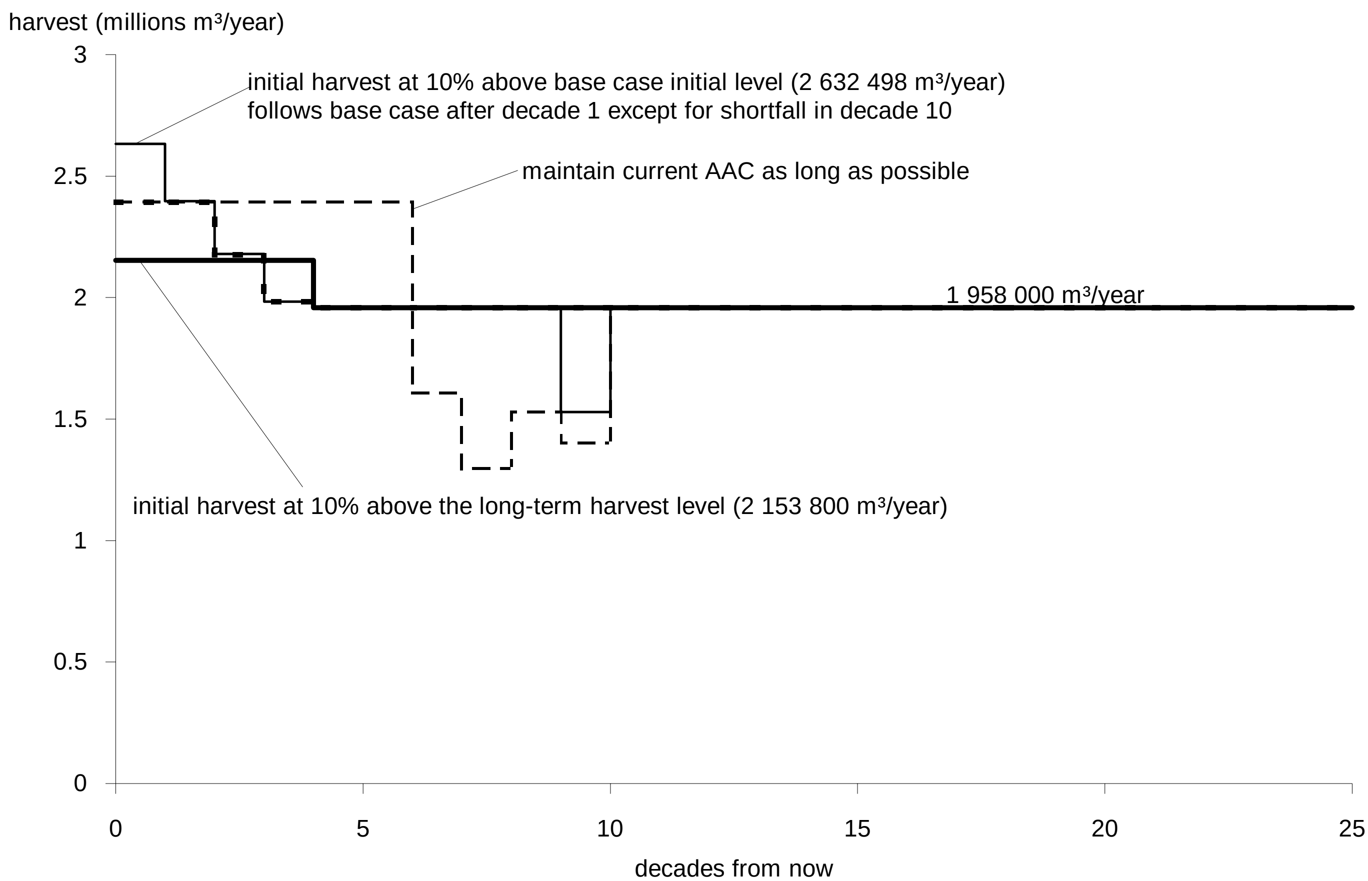

Figure 12. Alternative harvest forecasts — Kamloops TSA, 1995.

5.2 Minimum harvestable ages

The minimum harvestable age for a given stand of timber is an estimate of the time needed for the stand to grow to a merchantable condition. Minimum harvestable ages define when second growth will be available for harvest, and therefore determine how quickly existing stands may be harvested without resulting in timber supply shortfalls. The time at which stands will become merchantable is highly uncertain, partly because of uncertainty about the growth of regenerated stands, but more importantly because we cannot foresee future conditions that will determine merchantability.

In the base case, the minimum harvestable ages (outside the selection management zone) were set at 81 years for lodgepole pine and wet-fir types, and 101 years for all other species. Given these ages, the weighted average minimum harvestable age for the Kamloops TSA is approximately 90 years. If harvests were to occur at the age when average long-term production is highest,, the weighted average harvest age would be about 113 years. In the base case, actual harvest ages are usually higher, as indicated in Figure 10 which shows the long-term average harvest age is approximately 130 years. This difference between the average minimum harvestable ages specified for each forest type, and the actual average age of harvest occurs because forest cover requirements, as well as practicalities of scheduling harvests, cause harvesting to occur at ages above the minimums. Figure 13 shows how uncertainty about minimum harvestable ages may affect timber supply.

If minimum harvestable ages are 20 years greater than in the base case, (that is, stands take 20 years longer to reach merchantable condition) the long-term harvest level of 1 958 000 cubic metres per year could not be maintained throughout the analysis horizon. For this case, where the harvest rate must drop below the long-term level for a period of time, two alternatives are shown. In the first alternative the harvest is reduced immediately, and maintained at a constant level until harvests can be raised to the long-term level without causing future timber supply shortages. To follow such a harvest flow pattern, the harvest level must fall immediately to 1 885 000 cubic metres per year, 21% below the base case starting level and 4% below the long-term level. The harvest rate can then climb to the long-term level 120 years from now. The second harvest flow alternative is to maintain the starting harvest rate as close to the base case rate as possible, allowing for drops below the long-term level at some future time. As shown in Figure 13, the base case starting level could be maintained for 10 years if followed by declines of 10% per decade for 30 years, with harvests remaining constant for 90 years at 1 821 000 cubic metres per year, or 7% below the base case long-term level. Harvests could rise to the long-term level 120 years from now without causing timber supply shortfalls further in the future.

Extending the minimum harvestable ages means that it will take longer for second-growth stands to attain a merchantable condition. Therefore, existing timber must be harvested over a longer time period, meaning less availability over the next several decades. For example, if the base case harvest forecast were followed, but the minimum harvestable ages of second growth were 20 years longer, severe timber shortages would occur between decades 9 and 12. To minimize these shortfalls, harvest rates need to decrease during the next few decades.

If minimum harvestable ages are reduced by 20 years, the initial harvest level can be maintained for an additional two decades compared to the base case. A reduction in minimum harvestable ages has the opposite effects of an increase. Timber availability increases because second-growth stands can be harvested sooner.

As shown in Figure 13, the long-term harvest level is lower than the base case long-term level when minimum harvestable ages are either increased or decreased by 20 years. This occurs because stands are harvested further away from the age when long-term productivity is maximum. This effect is slightly more pronounced when minimum harvestable ages are younger than in the base case.

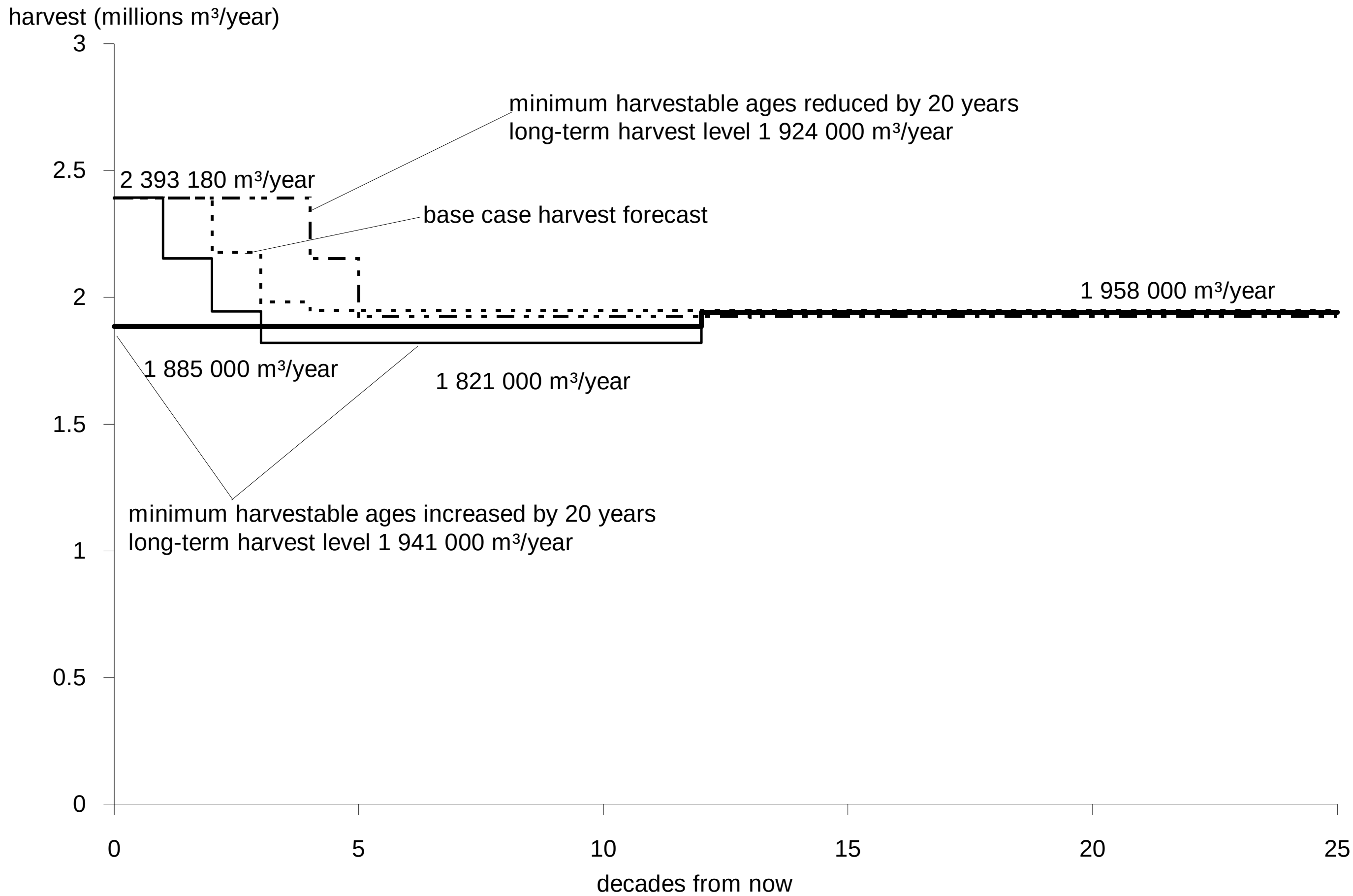

Figure 13. Harvest forecast with minimum harvestable ages increased and decreased by 20 years — Kamloops TSA, 1995.

5.3 Existing stand volume estimates

Volume estimates from the Variable Density Yield Prediction (VDYP) system were used in the base case for existing stands. These estimates have a degree of uncertainty stemming from factors such as: the statistical process used to develop the VDYP system, inventory classification procedures, and differences between assumed and actual utilization standards. To examine this uncertainty, existing stand volumes were increased and decreased by 10%. The results are shown in Figure 14.

If volume estimates for existing stands are 10% higher than was assumed for the base case, the initial harvest level can be maintained for 60 years, 4 decades longer than the base case. The harvest level then declines by 7% per decade to the long-term level 80 years from now to avoid future timber supply shortfalls. Since volumes per hectare are higher, less area has to be harvested each decade to meet the same harvest level. Thus, the existing stands can be harvested at a slower rate and over a longer period of time.

Figure 14 shows two alternative harvest forecasts if volumes for existing stands are 10% lower than was assumed for the base case. Harvests must fall below the long-term level for a period of time to avoid causing severe timber supply disruptions further in the future. To achieve the long-term harvest level after 110 years, the initial harvest level would need to fall immediately by 24% to 1 808 000 cubic metres per year. If the base case initial harvest were to be maintained for 1 decade, the harvest forecast would need to fall by 10% per decade, reaching a low of 1 721 000 cubic metres per year after 40 years. This harvest level would then need to be maintained for 60 years before climbing back up to the base case long-term harvest level in decade 11. Note that in all cases, changes in estimates of existing stand volumes do not affect the long-term harvest level.

In summary, estimates of existing timber volumes have a significant effect on potential harvests over the next several decades. If actual stand yields are 10% greater than estimated for the base case, the current harvest level could be maintained for up to 60 years. Conversely, if actual yields are 10% lower, immediate harvest level reductions, or many years of harvests well below the long-term level would be necessary to avoid severe timber supply shortages further in the future.

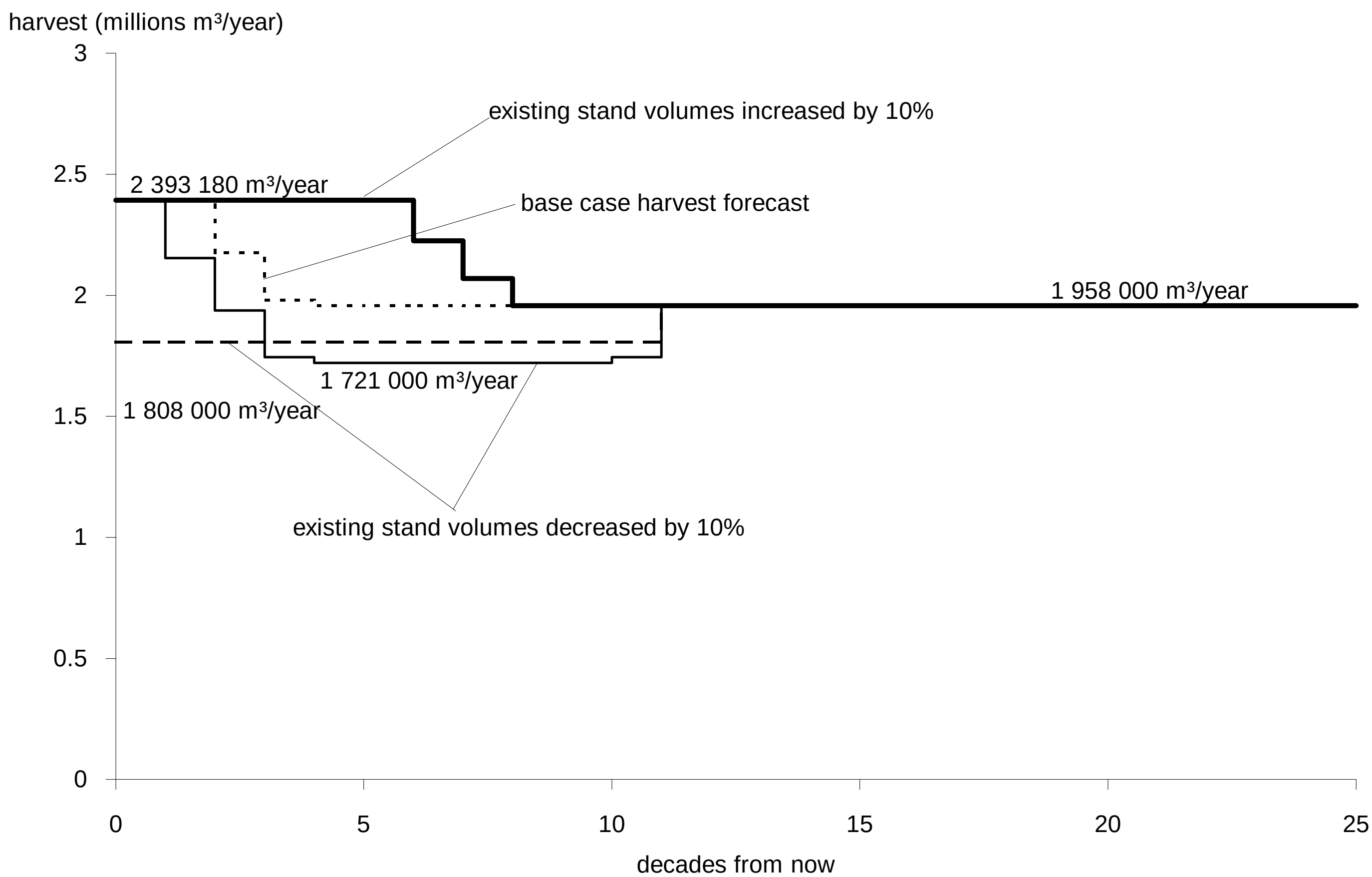

Figure 14. Harvest forecast with existing volumes increased and decreased by 10% — Kamloops TSA, 1995.

5.4 Regenerated stand volume estimates

The Table Interpolation Program for Stand Yields (TIPSY) model was used in the base case to develop yield estimates for regenerated stands (except in the selection management zone). Future stand yields are usually higher than existing stand yields because of stand management techniques such as density control, and the planting of high quality stock. On average, the yields estimated from the TIPSY model are 48% higher than those estimated from the VDYP model at the age when average long-term production is highest (age of maximum mean annual increment.)

Estimates indicate that on sites with stands currently older than 140 years of age, future managed stands will contain, on average, 85% greater volume than do existing stands at the same ages. This is primarily because the decadent hemlock component of existing stands is excluded from the volume estimates. After harvest, these stands will be reforested, and the area now occupied by decadent hemlock will grow merchantable timber. Uncertainty in regenerated stand volume estimates may arise from a number of sources such as using inventory data from existing mature forests to predict the productivity of future stands, uncertainty about the effect of replacing existing forests with different tree species after logging, and the effects of soil degradation, pests and forest disease on future productivity. To examine this uncertainty, all future yields (excluding selection management yields) were increased and decreased by 10%. The results are shown in Figure 15.

If future stand volumes are 10% higher than those in the base case, the increase to the long-term level begins in decade 11 with a 10% increase to 2 162 000 cubic metres per year.

If future stand volumes are 10% lower, harvests could follow the base case projection for 11 decades, before declining to a long-term harvest level of 1 778 000 cubic metres per year, 9% below the base case long-term level.

Changes to regenerated stand yields do not affect short-term timber supply: higher regenerated stand volumes would not permit increased short-term harvests, while lower volumes would not require reductions in the next few decades.

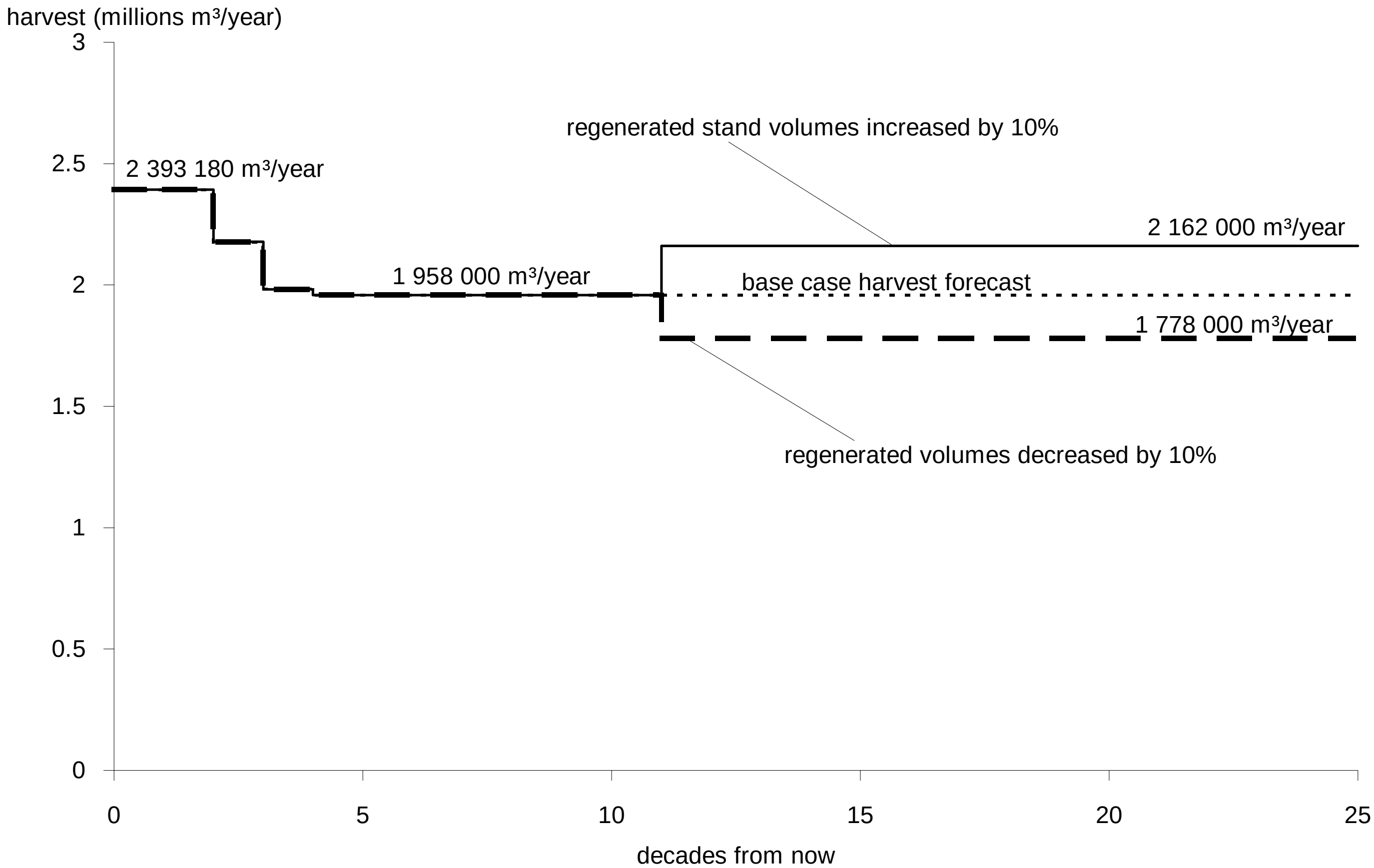

Figure 15. Harvest forecast with regenerated volumes increased or decreased by 10% — Kamloops TSA, 1995.

5.5 Green-up periods and mature age definition

Forest cover requirements specify the desired stand-age composition of an area. For this analysis, forest cover requirements were represented by (i) limiting the area which may be younger than a specified age (green-up age), and (ii) maintaining a minimum amount of area older than a specified age representing when stands are anticipated to reach a mature or old-growth condition. Sensitivity analysis of the impact of varying the young and mature age requirements are presented in the following sections.

5.5.1 Green-up periods

Green-up period refers to the estimated number of years required before the trees on a previously harvested site reach the required height. In the Kamloops TSA, green-up heights vary from 6 metres in the landscape management zone to 3 metres in the ungulate winter range and standard integrated resource management zones. Green-up guidelines are not applied to the selection management zone since a significant proportion of trees in selection-harvest stands are retained. In the base case, green-up ages range from 16 to 25 years. These estimates have a degree of uncertainty because the stand height that provides the necessary forest cover for various resource values such as visual quality or wildlife habitat are difficult to state exactly. In addition, the actual time it takes for a stand to reach these heights may be more or less than current estimates. To examine the effects of this uncertainty, all green-up periods were increased and decreased by 5 years.

If green-up periods are shorter than estimated for the base case, harvested stands would more quickly reach a condition allowing harvest of adjacent stands. The result is that if green-up periods were shorter, the forest cover requirements would place fewer limitations on harvesting. As shown in Figure 16, when green-up periods are reduced by 5 years, the initial harvest level can be maintained for an additional decade compared to the base case. To avoid severe timber supply shortfalls further in the future, harvest levels would then need to decline by 10% per decade until reaching a long-term harvest level of 2 020 000 cubic metres per year, 3% above the base case long-term level in decade 4.

Increased green-up periods would generally increase limitations on harvesting associated with forest cover requirements. Figure 16 shows that the initial harvest rate cannot be maintained without causing future timber supply shortfalls if green-up periods are 5 years longer.

The starting harvest level is 5% less than the base case initial level, or 2 272 000 cubic metres per year. Harvests would need to reach the long-term level of 1 902 000 cubic metres per year, 3% below the base case long-term level after 20 years to avoid significant timber supply shortages further in the future.

The amount of time required by trees to reach green-up height has a moderate effect on timber supply, particularly over the next few decades. If green-up heights can be reached 5 years sooner, forest cover requirements are not as constraining, allowing an extension of the current harvest level. If trees require more time to reach green-up height, then an immediate reduction in the initial harvest level is required to avoid violation of cover requirements or timber supply shortages in the future.

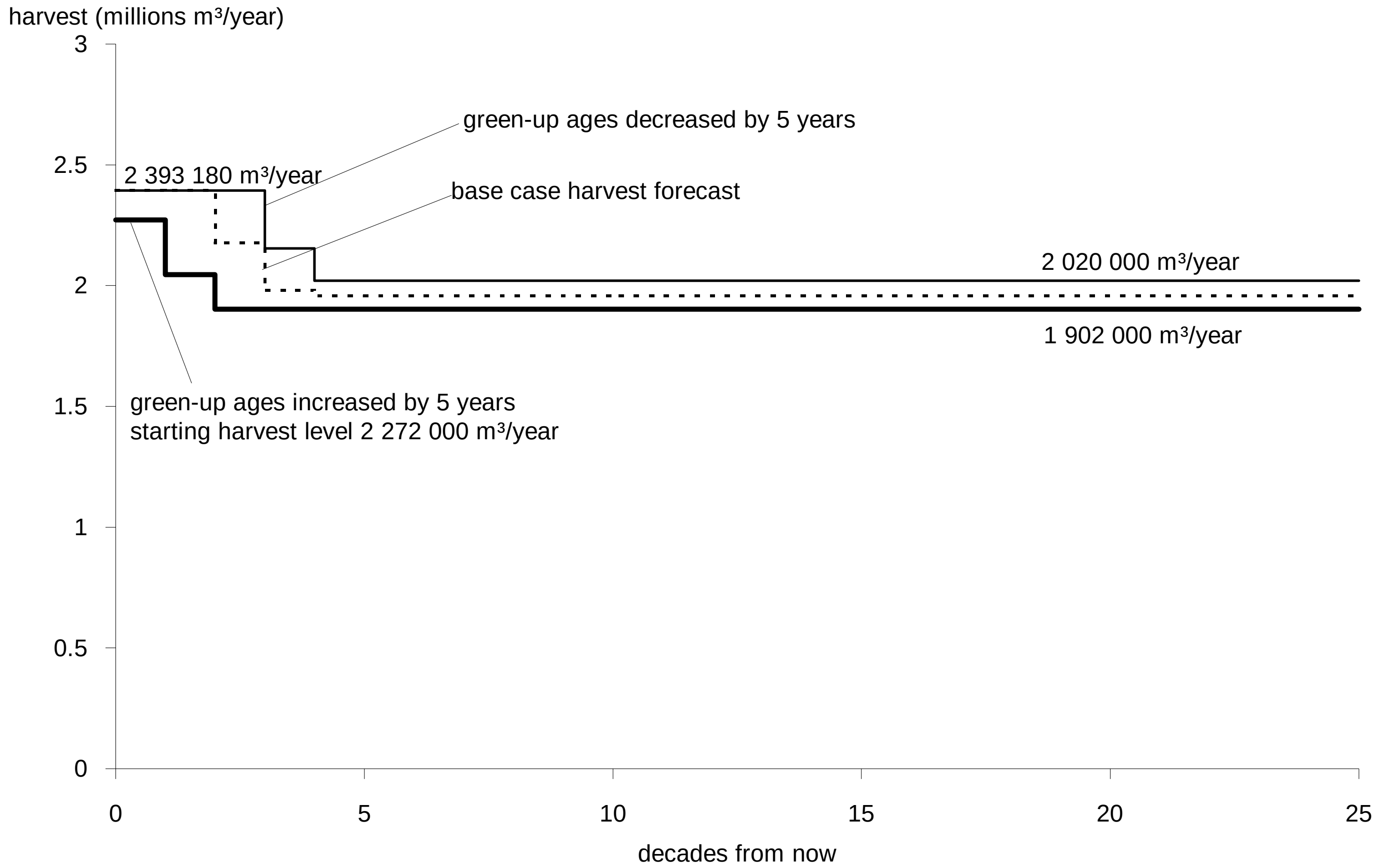

Figure 16. Harvest forecast with green-up periods increased or decreased by 5 years — Kamloops TSA, 1995.

5.5.2 Mature age definition

Forest management guidelines for the Kamloops TSA require that a certain percentage of stands in the TSA be above either a certain height or age to maintain conditions suitable for ungulate range. The ages required to meet this height vary from 77 to 200 years. This guideline is not applied in the selection management zone as it is assumed that forest cover there will be sufficient to meet ungulate winter range requirements at all times. As was the case with the green-up periods, there is some uncertainty as to the exact height required to meet these values, and the precise length of time required to achieve those heights. This sensitivity analysis examined the possibility that these age requirements may vary by 10 years.

As illustrated in Figure 17 when mature cover ages are increased by 10 years relative to the base case, the initial harvest level can be maintained for only 1 decade. Harvests then decline by 9% per decade until the long-term harvest level of 1 958 000 cubic metres per year is reached in 20 years.

If mature cover ages are 10 years younger than in the base case, the only change from the base case harvest forecast is a small increase in the long-term harvest level (10 000 cubic metres per year) to 1 968 000 cubic metres per year.

The base case harvest forecast is relatively insensitive to a decrease in the amount of time required for trees to reach mature cover height. If the amount of time required were to increase however, the initial harvest level can only be maintained for 1 decade to avoid creating future harvest shortfalls.

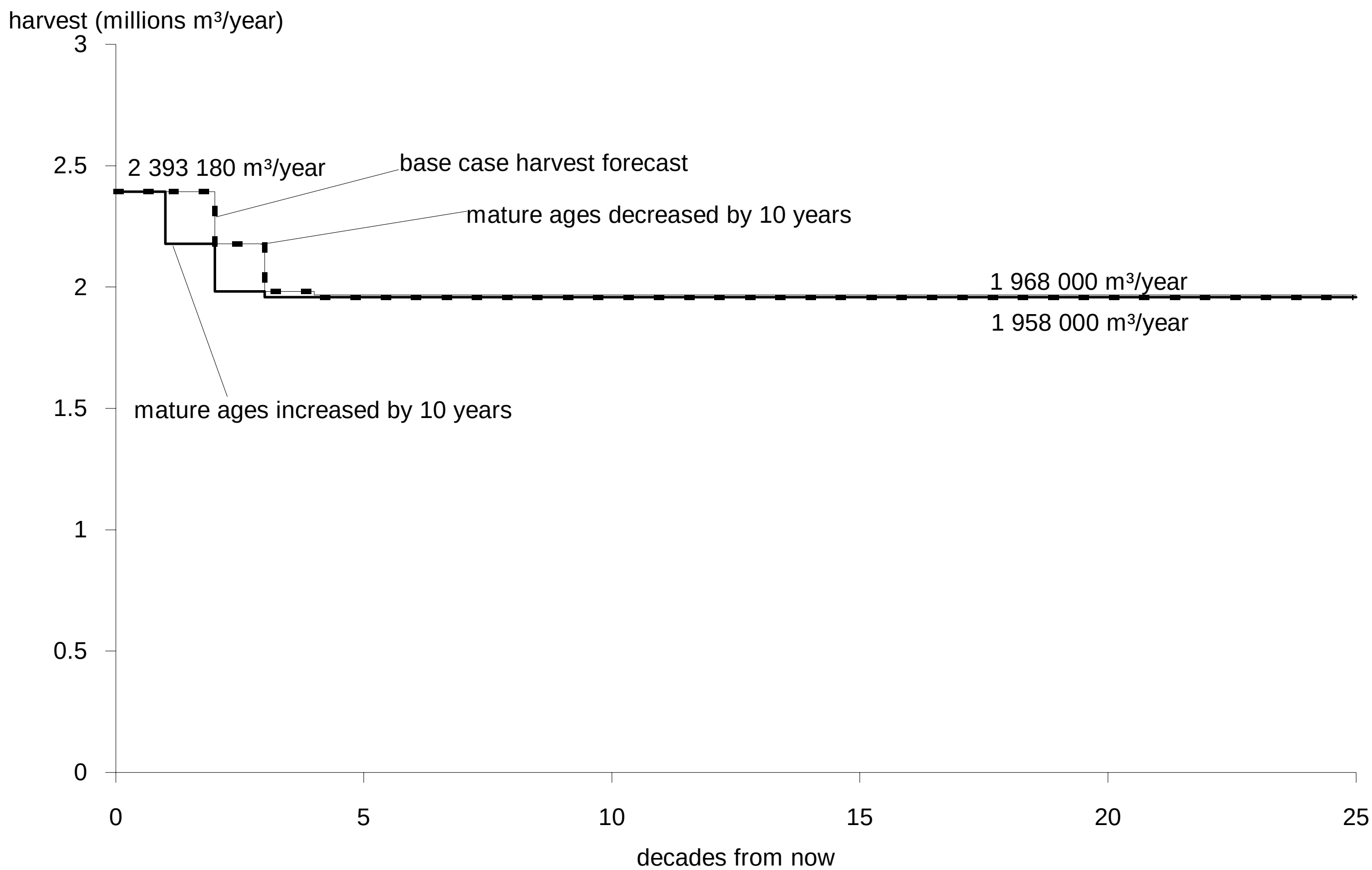

Figure 17. Harvest forecast with mature cover ages increased or decreased by 10 years — Kamloops TSA, 1995.

5.6 Green-up and mature age forest cover requirements

Forest cover requirements limit the amount of area that can be younger than the green-up age, or require a minimum amount of the area to be older than a specified age. The guidelines applied in the base case have a degree of uncertainty since it is not possible to define the exact forest structure required to meet the management objectives for a particular area. The effects of changes in these limits are discussed below.

5.6.1 Maximum area below green-up ages

Green-up forest cover requirements were increased and decreased in each management zone, except the selection management zone, by 5%. For example, a 20% forest cover guideline was increased (relaxed) by 5% to 25% and decreased (tightened) by 5% to 15%. Increasing this percentage value relaxes the cover requirement because it allows more of the forest to be below the green-up age. Decreasing the percentage tightens the cover requirement because it allows less of the forest to be below the green-up age.

As shown in Figure 18, if green-up forest cover guidelines were relaxed by 5%, the initial harvest level could be maintained for 4 decades without causing future timber supply shortfalls. The harvest level then declines by 10% per decade until reaching a long-term harvest level of 2 082 000 cubic metres per year, 6% above the base case long-term level in decade 6.

Tightening green-up forest cover guidelines would require that to avoid violating forest cover requirements in period 2 the harvest level must drop immediately to 2 256 000 cubic metres per year, 6% below the base case initial harvest level. The harvest rate would then need to decline by 10% per decade before reaching the long-term level of 1 798 000 cubic metres per year, 8% below the base case.

5 Timber Supply Sensitivity Analyses

The base case harvest forecast has proven to be very sensitive to the amount of area allowed under the green-up age. Relaxing or tightening green-up guidelines by 5%, would allow an extension or require immediate reduction of the initial harvest level, and change the long-term level by 6%.

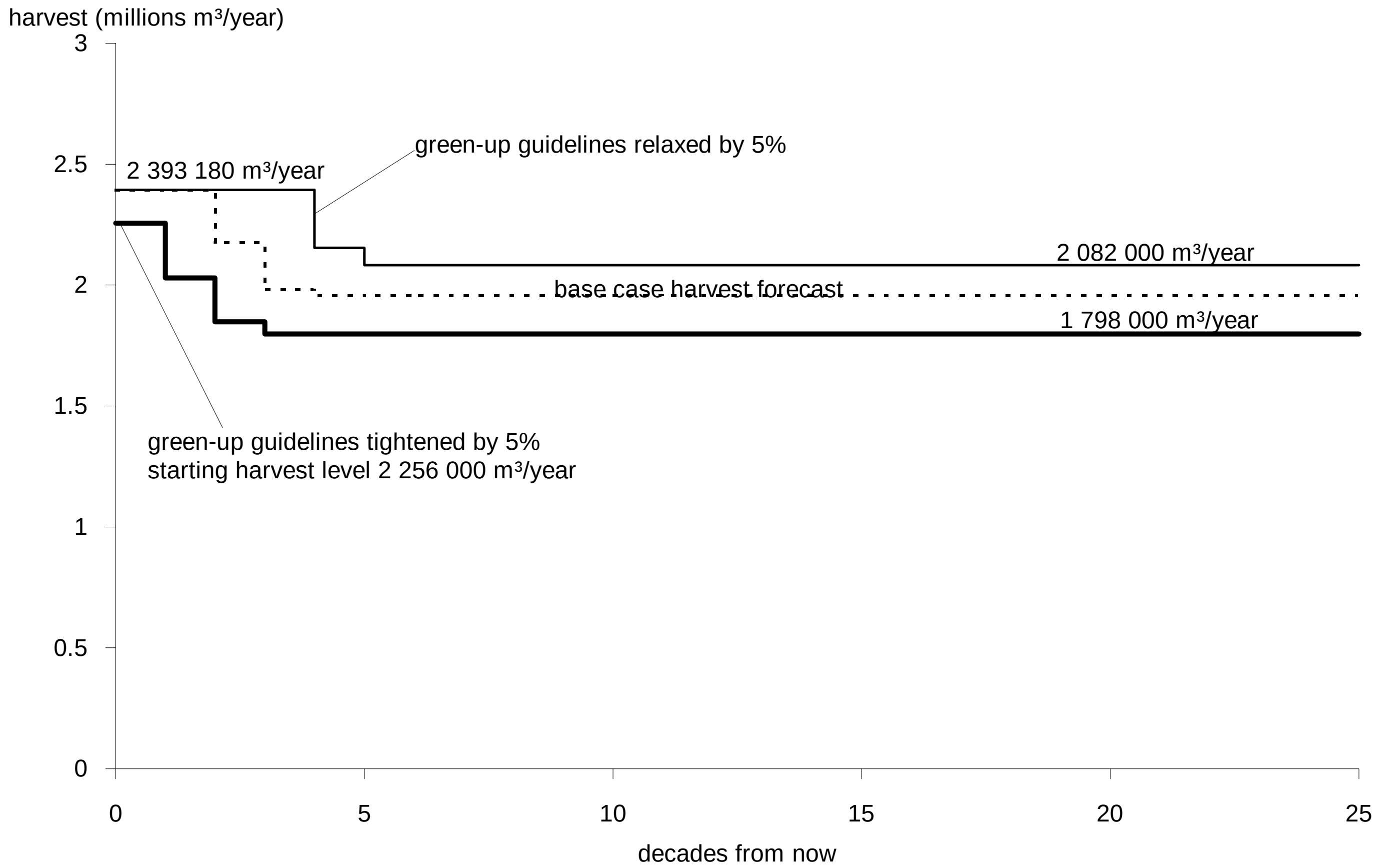

Figure 18. Harvest forecast with green-up cover guidelines relaxed or tightened by 5% — Kamloops TSA, 1995.

Figure 19 shows the results of relaxing or tightening the green-up cover requirement for areas managed for visual quality (the landscape zone) in isolation. Comparison of Figures 18 and 19 shows that forest cover requirements for visual quality are the dominant factors determining the overall effect of green-up guidelines. If the percentage of the landscape management zone allowed to be younger than green-up age was 5% larger than in the base case, the initial harvest level could be maintained for 40 years. The harvest level then declines by 9% per decade until decade 5, when the long-term harvest level of 2 080 000 cubic metres per year is reached.

If the visual quality cover requirement is tightened by 5%, the base case initial harvest level can be maintained for only 1 decade to avoid violating forest cover requirements. Harvest levels then decline by 10% per decade, reaching the long-term harvest level of 1 816 000 cubic metres per year, 7% below the base case, in decade 3.

When sensitivity to green-up cover requirements was tested on all other zones, the deviation from the base case harvest forecast was small. Specific results for these sensitivity analyses are therefore not included.

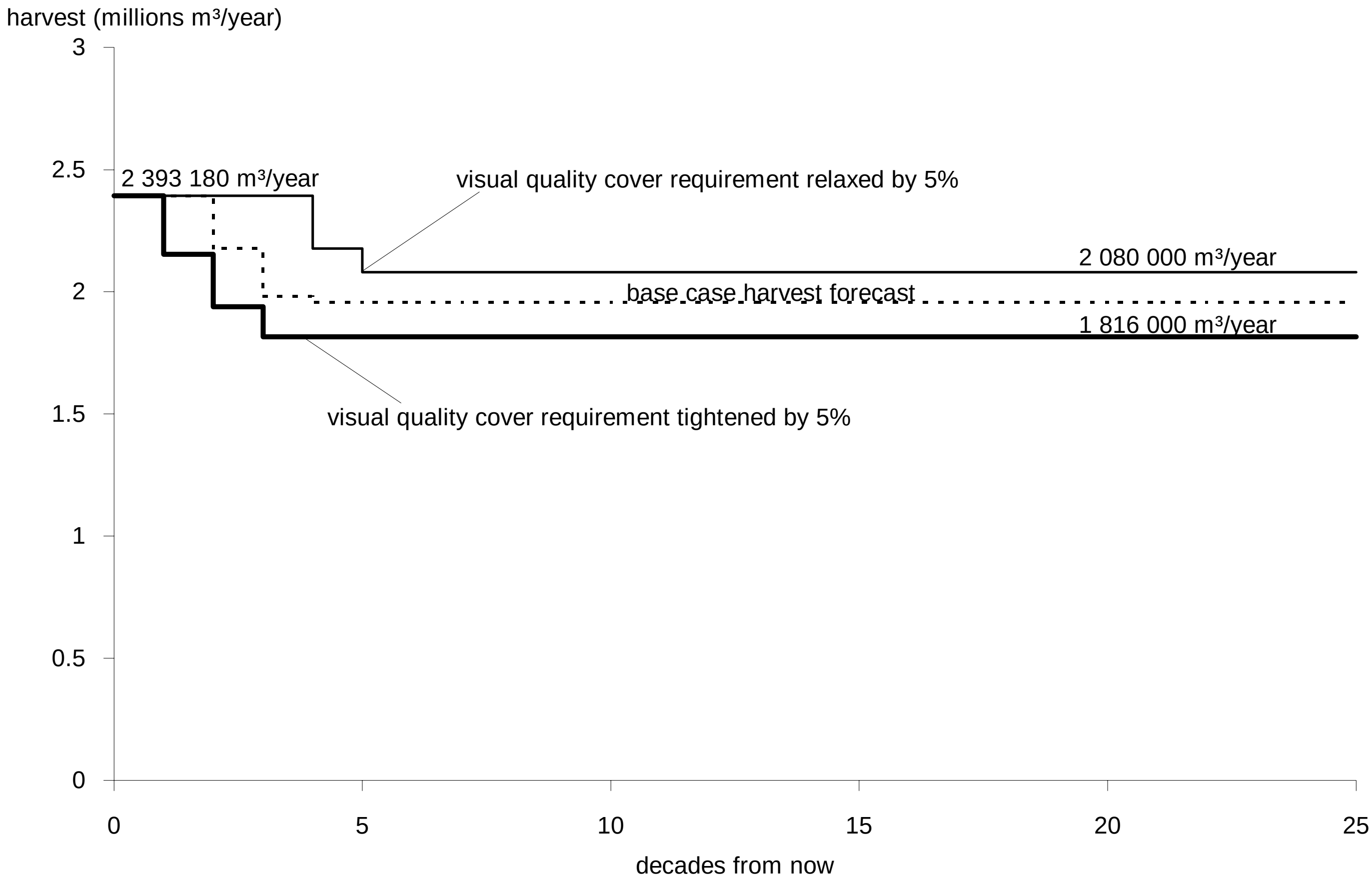

Figure 19. Harvest forecast with green-up cover guidelines relaxed or tightened by 5%, landscape management zone — Kamloops TSA, 1995.

5.6.2 Minimum area over mature-age criterion

To assess the sensitivity of timber supply to uncertainty in requirements for mature-age forest cover, these requirements were increased and decreased in each management zone, excluding the selection management zone, by 10%. For example, a 13.5% forest cover requirement was increased (tightened) by 10% to 23.5% and decreased (relaxed) by 10% to 3.5%. Increasing this percentage value tightens the cover requirement because it requires more of the forest to be above the mature age at all times. Decreasing the percentage relaxes the cover requirement because it allows less of the forest to be above the mature age. Figure 20 shows the results.

If forest management objectives requiring a minimum area of mature-age stands could be met with less area than estimated for the base case, the initial harvest rate could remain the same as in the base case. Harvests would need to reach the long-term harvest level 21 000 cubic metres higher than the base case long-term level, or 1 979 000 cubic metres per year, in decade 4 to avoid future timber supply shortages.

If the requirement for area covered by mature stands was increased by 10%, the starting harvest level could be maintained for only 1 decade to avoid having to reduce harvests below the long-term level further in the future. Harvests would have to decline to the long-term level of 1 936 000 cubic metres per year, 22 000 cubic metres less than the base case, in 20 years to avoid future shortfalls.

In summary, the base case harvest forecast is relatively insensitive to a relaxation in the amount of area required in mature ages. If more area were required in mature ages, the initial harvest level could be maintained for only 1 decade to avoid causing severe harvest shortfalls in the future.

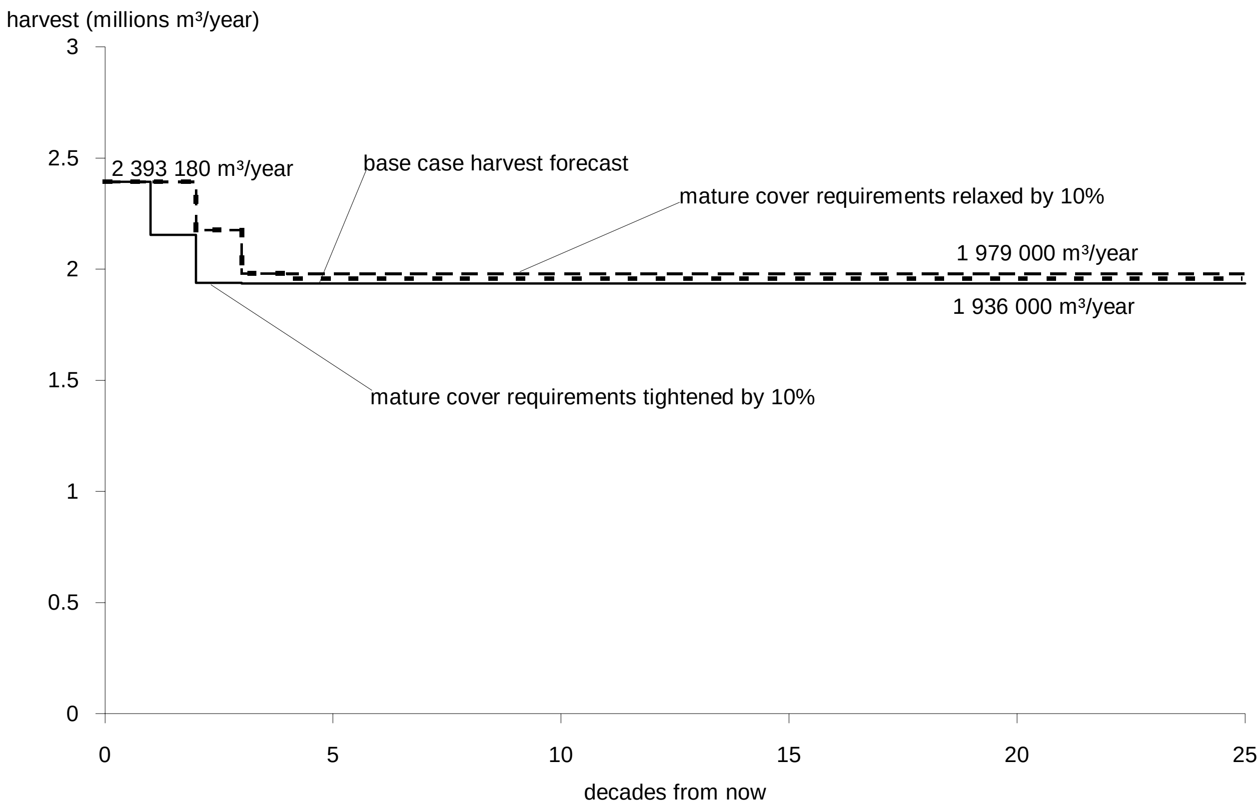

Figure 20. Harvest forecast with mature cover guidelines relaxed or tightened by 10% — Kamloops TSA, 1995.

5.7 Uncertainty in the size of 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. The timber harvesting land base could be larger or smaller than expected if the areas deducted in categories shown in Table 1 prove to be different in practice. The timber harvesting land base could be smaller than expected if, for example: improved operability information indicated a smaller operable land base; harvesting costs increased, reducing the economic feasibility of operations; guidelines to protect sensitive areas were inadequate and additional protection was necessary; or protection of important values required deduction of additional area. The timber harvesting land base could be larger than expected as a result of improved harvesting techniques and equipment, or due to increases in the value of currently unmerchantable forest types. For example, the timber harvesting land base for this analysis does not include decadent, over-mature hemlock volumes which could be harvested economically given an appropriate market.

Figure 21 shows the effect on potential harvests of a 10% increase or decrease in the size of the timber harvesting land base. If the timber harvesting land base were 10% larger than in the base case, the initial harvest level could be maintained for 50 years. The harvest level would then need to drop to the long-term harvest level of 2 164 000 cubic metres per year, 10% above the base case, by year 60 to avoid timber supply shortfalls further in the future.

If the timber harvesting land base were 10% smaller, the initial harvest rate could be maintained for only 1 decade. To avoid future timber shortages, harvests would need to be reduced to the long-term harvest level of 1 754 000 cubic metres per year, 10% below the base case, by year 30 following 10% per decade declines.

The harvest forecast is very sensitive in the both short- and long-term to changes in the size of the timber harvesting land base. Reductions in the timber harvesting land base allow only 1 decade at the initial harvest level, and cause a decline in the long-term harvest level proportional to the land base reduction. A 10% increase in the size of the timber harvesting land base allows for an extension of the current harvest level for 30 years beyond the base case, and a proportionate increase in the long-term harvest level.

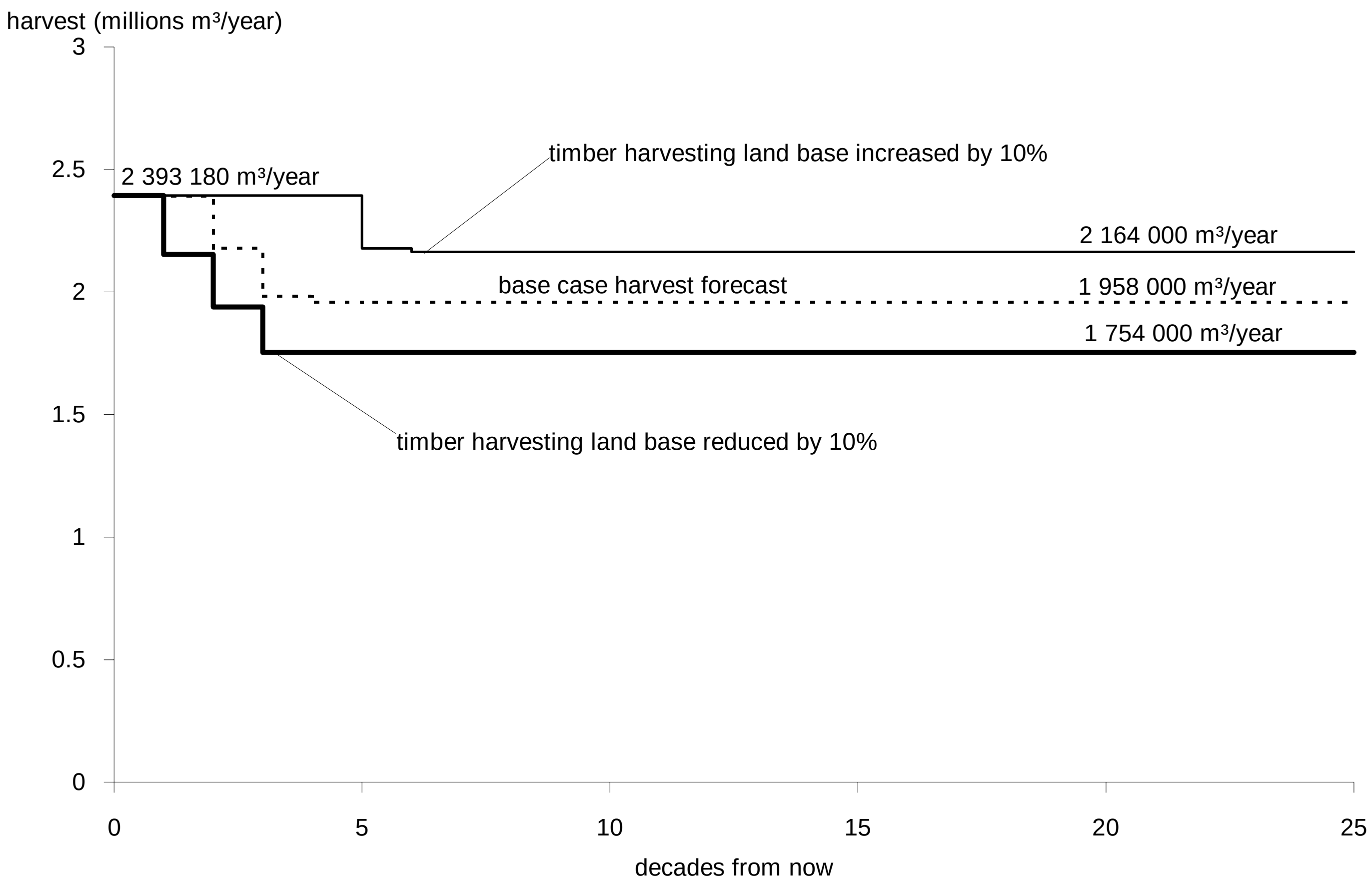

Figure 21. Harvest forecast with increases or decreases in the timber harvesting land base — Kamloops TSA, 1995.

5.8 Inclusion of decadent, over-mature hemlock volumes

The hemlock volume component of all existing stands over 140 years of age was excluded from stand volume estimates used for the base case harvest forecast. Experience has demonstrated this timber to be less desirable than that from other species which can produce sawn wood products. The advent of new technologies and an advantageous marketplace have been changing the outlook for utilization of the largely decadent hemlock timber. The inclusion of this volume increases both total and available growing stock by approximately 7 million cubic metres, or about 4.6% and 5.6%, respectively. Figure 22 shows two alternative harvest forecasts to display the effects of including the hemlock in stand volume estimates.

The inclusion of decadent, over-mature hemlock volumes allows the initial harvest level to be maintained for an additional decade. The harvest rate then declines by 6% per decade, reaching the base case long-term harvest level in year 60.

It is also possible to increase the harvest level above the current base case if hemlock volumes are included. If it is required that the increase be maintained for the same length of time as the base case initial level, that is 20 years, it is possible to increase the starting harvest level by approximately 9%, to 2 598 000 cubic metres per year. After 20 years, harvests decline by 10% per decade until reaching the base case long-term harvest level in year 40.

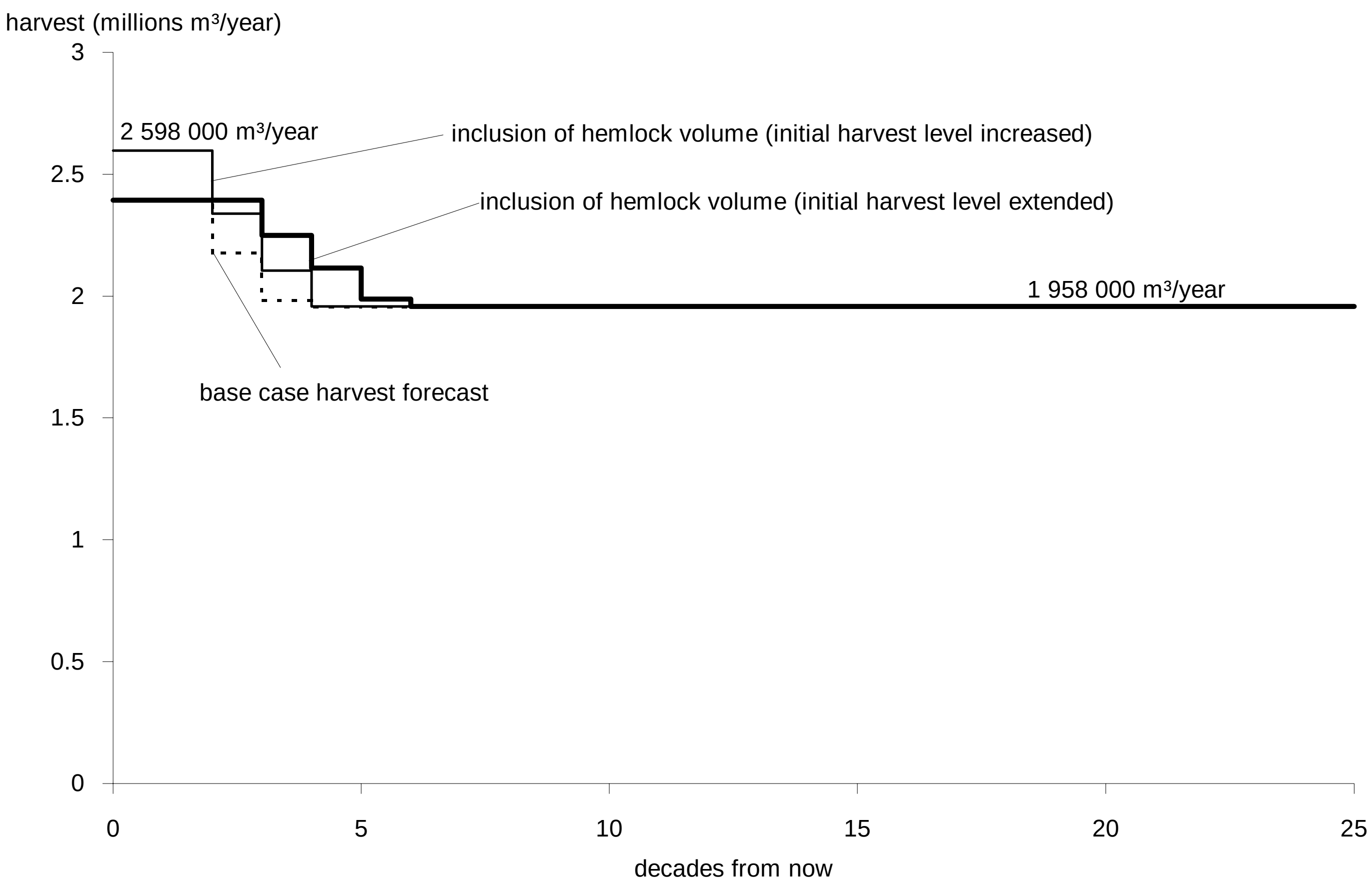

Figure 22. Harvest forecast with inclusion of decadent hemlock volumes — Kamloops TSA, 1995.

5.9 Uncertainty of current planning processes

A Land and Resource Management Planning (LRMP) process has been under way within the Kamloops TSA since 1991. The LRMP process brings together representatives of the various groups using Crown land and resources (stakeholders) and government agency representatives to form a planning team. The planning team makes decisions by consensus and provides final recommendations to Cabinet for the uses of Crown land within the Kamloops TSA. In December of 1994 the planning team completed an agreement-in-principle supported by all but one member (Independent Prospectors) of the planning team. Given the difference in processes it is not possible within the Timber Supply Review to model the exact effects on timber supply of the planning team recommendations. It is possible, however, to provide a close approximation of the impact of the planning team recommendations on the base case harvest forecast. A list of the changes required for this approximation are provided in Appendix A, "Description of Data Inputs and Assumptions."

Implementation of the LRMP recommendations as defined for this sensitivity analysis allows the base case initial harvest level to be maintained for only 1 decade. To avoid severe future timber supply shortfalls, the harvest level then declines by 9% per decade until year 30 when it reaches 1 965 000 cubic metres per year, 7000 cubic metres above the base case long-term level. This harvest level is maintained for 60 years when, at year 100 it can increase to the long-term harvest level of 1 979 000 cubic metres per year, 1% above the base case long-term level.

The reduction in the amount of time the current harvest level can be maintained is caused by the combination of: an approximate 4% reduction in the timber harvesting land base, management of both caribou habitat zones on a 150-year harvest cycle, and a requirement that 10% of the standard integrated resource management zone be older than 200 years at all times. Factors that increase the timber supply relative to the base case include a relaxation of the green-up cover requirements for visual quality objectives (VQO)*, and the rehabilitation of approximately 16 000 hectares of roads, trails and landings back to full site productivity. In the short term, downward pressures on timber supply result in the ability to maintain the initial harvest level for only 1 decade, while in the medium to long term the upward pressures on timber supply allow for harvests above the base case level.

Visual quality objective (VQO)
Defines a level of acceptable landscape alteration resulting from timber harvesting and other activities. A number of visual quality classes have been defined on the basis of the maximum amount of alteration permitted.

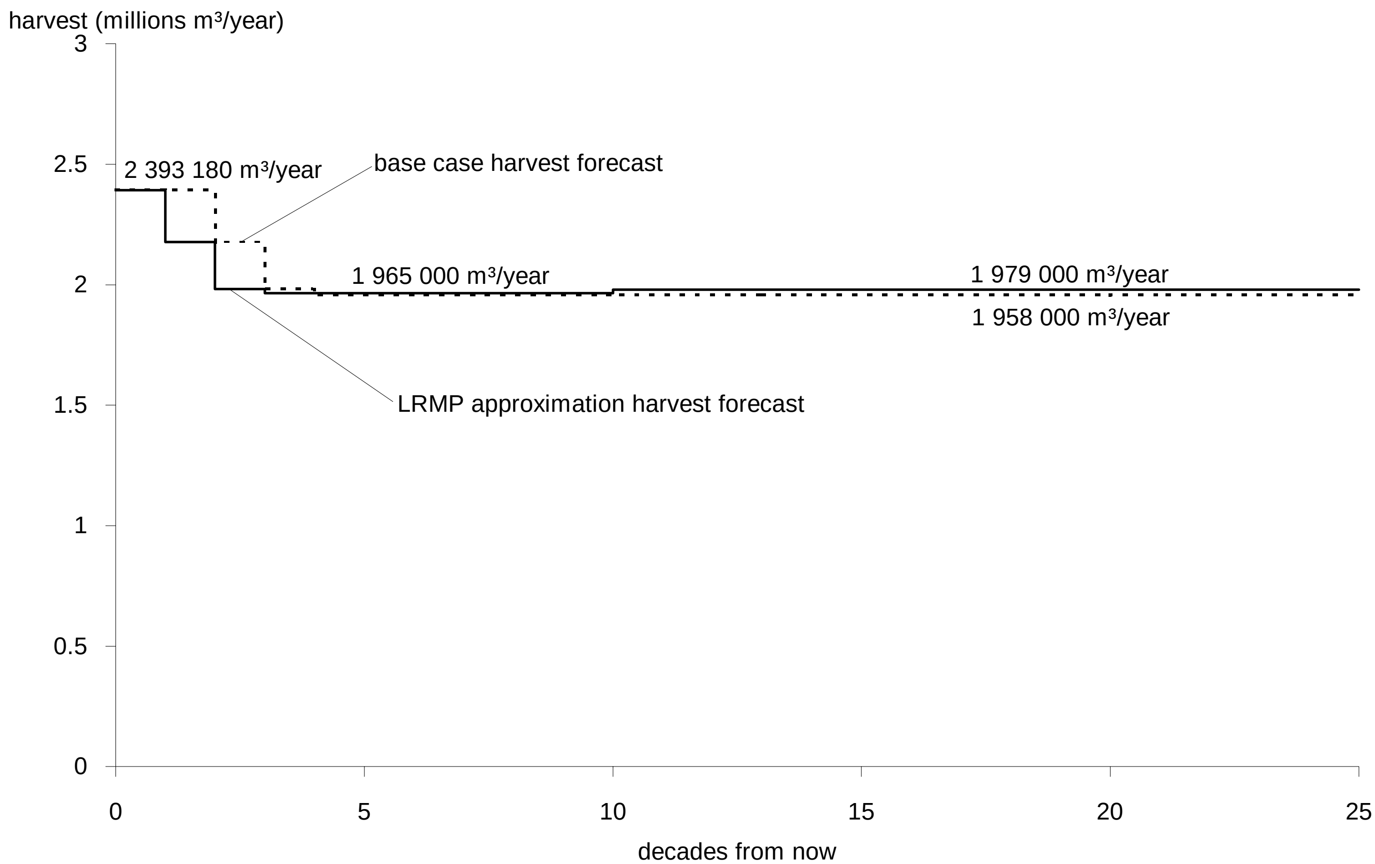

Figure 23. Harvest forecast approximating the effects of the LRMP recommendation — Kamloops TSA, 1995.

6 Summary and Conclusions

This analysis shows that under current forest management in the Kamloops TSA, the current harvest level of 2 393 180 cubic metres per year can be maintained for 20 years. To avoid severe timber supply shortages further into the future, the harvest rate must then drop by 9% per decade until reaching the long-term harvest level of 1 958 000 cubic metres per year in year 40.

Several important factors may affect the base case timber supply forecast in the short term. Immediate reductions in the current harvest level may be required if existing stand volumes are lower than was estimated, green-up forest cover requirements are more restrictive, the amount of time trees require to reach green-up heights is longer, or if minimum harvestable ages are longer than in the base case.

While approximately 60% of the Kamloops TSA timber harvesting land base contains stands of mature timber, a significant portion is currently unavailable for harvest because forest cover within the area being managed for visual quality (the landscape management zone) does not currently meet visual quality objectives. This zone comprises 22% of the timber harvesting land base and contains 24% of the mature timber. The first 20 years of harvest, therefore, must come almost entirely from the remaining land base. Increasing the maximum allowable area that does not meet visual green-up requirements within the landscape management zone by 5% would allow the current harvest level to be maintained for an additional 20 years, and increase the long-term harvest level by 7%.

Increases in timber supply over the next few decades that could allow for an extension or increase in the current harvest level may result if, compared to the base case: minimum harvestable ages are shorter; existing stand volumes are greater the amount of time trees take to reach green-up heights is shorter; the timber harvesting land base is larger; or if decadent, over-mature hemlock volumes are included within the existing stand yield curves.

The long-term harvest level is most sensitive to uncertainties about managed-stand volume estimates, the length of time required to reach green-up heights, the amount of area required to meet green-up forest cover requirements, and the amount of area in the timber harvesting land base.

An approximation of the Kamloops Land and Resource Management Plan (LRMP) December 1994 planning team recommendations showed that the initial harvest level could be maintained for 1 decade and that the long-term harvest level would increase by about 1% compared to the base case.

7 References

B.C. Ministry of Forests. 1992. User's guide for TIPSY: a table interpolation program for stand yields - Version 2.1.3. Research Branch. Victoria, B.C.

B.C. Ministry of Forests. 1992. Variable density yield prediction user guide. Inventory Branch. Victoria, B.C.

B.C. Ministry of Forests. 1993. User guide for FREDDIE - site index estimation program. Research Branch. Victoria, B.C.

8 Glossary

Allowable annual cut (AAC)
The allowable rate of timber harvest 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 7* of the *Forest Act.*

Class A lakes
Class A lakes have significant values for fisheries, recreation, wildlife, or commercial interests such as fish camps. These are small (1-40 hectares) to medium-sized lakes (40-200 hectares) with a low ability to sustain pressure on the fisheries resource. Management guidelines include no commercial harvesting within the lakeshore management zone, and a Visual Quality Objective of preservation within the lakeshore visual management zone.

Clearcut harvesting
A harvesting method whereby all trees that meet utilization standards are harvested. The harvested site is then regenerated to acceptable standard by appropriate means including planting and natural seeding.

Cutblock adjacency
The desired spatial relationship among cutblocks as specified in integrated resource management guidelines. They can be approximated by specifying the maximum allowable proportion of a forested landscape that does not meet green-up requirements.

Environmentally sensitive areas
Areas with significant non-timber values or fragile or unstable soils, or where there are impediments to establishing a new tree crop, or areas where timber harvesting may cause avalanches.

Forest cover objectives
Desired distributions of areas by age or size class groupings. These objectives can be used to reflect desired conditions for wildlife, watershed protection, visual quality and other integrated resource management objectives.

Forest inventory
Assessment of British Columbia's timber resources. It includes computerized maps, a database describing the location and nature of forest cover, including size, age, timber volume, and species composition, and a description of additional forest values such as recreation and visual quality.

Free-growing
An established seedling of an acceptable commercial species that is free from growth-inhibiting brush, weed and excessive tree competition.

Green-up
The time needed after harvesting for a stand of trees to reach a desired condition (e.g., top height) to ensure maintenance of water quality, wildlife habitat, soil stability or aesthetics.

Management assumptions
Approximations of management objectives, priorities, constraints and other conditions needed to represent forest management actions in a forest planning model. These include, for example, the criteria for determining the timber harvesting land base, the specification of minimum harvestable ages, utilization levels, integrated resource guidelines and silviculture and pest management programs.

8 Glossary

Mean annual increment (MAI)
Stand volume divided by stand age. The age at which average stand growth, or MAI, assumes its maximum is called the culmination age. Harvesting all stands at this age results in a maximum average harvest over the long term.

Non-merchantable forest types
Stands that are accessible and otherwise available for harvesting but are assumed to be non-merchantable due to stand characteristics such as small piece size, incidence of decay, species composition and low stocking.

Not satisfactorily restocked (NSR)
An area not covered by a sufficient number of tree stems of desirable species. Stocking standards are set by the B.C. Forest Service, Silviculture Branch. If the expected regeneration delay (the period of time between harvesting and the date by which an area is occupied by a specified minimum number of acceptable well-spaced trees) has not elapsed, the land is defined as current NSR. If the expected delay has elapsed, the land is classified as backlog NSR.

Selection management
A silvicultural system used to maintain or create areas containing a wide range of tree ages or sizes. The time interval between harvests in such areas is fairly short (usually less than 30 years) and during these harvests either single scattered trees or small groups of trees are removed from across the entire area.

Timber harvesting land base
The portion of the total land area of a management unit considered to contribute to, and be available for, long-term timber supply. The harvesting land base is defined by deducting non-contributing areas from the total land base according to specified management assumptions.

Timber supply area (TSA)
An integrated resource management unit established in accordance with *Section 6* of the *Forest Act.*

Unsalvaged losses
The volume of timber killed or damaged annually by natural causes (e.g., fire, wind, insects and disease) and not harvested.

Visual quality objective (VQO)
Defines a level of acceptable landscape alteration resulting from timber harvesting and other activities. A number of visual quality classes have been defined on the basis of the maximum amount of alteration permitted.

Appendix A

Description of Data Inputs and Assumptions

Introduction

The following tables and commentary outline the methods and inputs used to derive the timber harvesting land base, and to construct the timber supply model for the Kamloops Timber Supply Review analysis. This information represents current forest management in the area. Current management is defined as the set of land use decisions and forest and stand management practices currently implemented and enforced. Future forest management objectives that may be intended, but are not currently implemented and enforced are not included in this appendix. The purpose of the Timber Supply Review is to provide information on the effects of current management on both short- and long-term timber supply in each timber supply area in the province. Any changes in forest management objectives and practices will be included in subsequent timber supply analyses after the Timber Supply Review project has been completed.

A.1 Management Zone and Analysis Unit Definitions

A.1.1 Definition of management zones

The timber harvesting land base in the Kamloops TSA is divided into management zones on the basis of differences in forest cover guidelines and management practices. Although all zones are managed according to the principles of integrated resource management each zone has its priority management consideration as follows:

- Selection harvest management zone

  Priority management consideration: selection harvesting of dry-fir species types;
- Ungulate winter range zone

  Priority management consideration: maintaining the winter range resource for ungulates;
- Caribou management zone - late winter

  Priority management consideration: maintaining the winter range resource for woodland caribou;
- Landscape management zone

  Priority management consideration: managing for Visual Quality Objectives (VQOs);
- Caribou management zone - early winter / transitional

  Priority management consideration: maintaining the early-winter / transitional range resource for woodland caribou;
- Community watershed management zone

  Priority management consideration: managing for water quality and quantity;
- Standard management zone

  Priority management consideration: managing for the long-term optimum harvest of timber while protecting basic resources.

Where zones overlap, the zone with the most stringent guidelines will apply. Management within the selection zone is assumed to meet the requirements of all other zones.

A.1.2 Definition of analysis units

An analysis unit (AU) represents a group of similar stands. Generally an AU contains stands that possess similar tree species compositions and similar timber growing capabilities. In the inventory file the major combinations of species are called type groups. Timber growing capability, or site quality, is indicated by a site class, which is an interval into which the site index range is divided for the purpose of classification and use. The site index is an expression of the forest site quality of a stand, at a specified age and height.

For the Kamloops TSA, inventory type groups were amalgamated into 22 analysis units The analysis units were assigned based on: 1) leading species type; 2) separating good/medium site classes from poor/low within each species type (based on NSITE or SSITE), and; 3) by further subdividing some species types into ages greater than 141 years, and those less than 141 years of age. The reason for the age division is because significant differences have been noted in the yield projections for some stands identified as less than 141 years of age (<141) versus greater than 140 years of age (>140). Differences in yields have been attributed to the misclassification of actual site indices of mature stands and a history of harvesting the most productive stands within each site class. Thus, analysis units which displayed significant differences in yields and contained significant area were divided along these age breaks.

A.1 Management Zone and Analysis Unit Definitions

Forest inventory zone(FIZ) was used to delineate between the wet-fir and dry-fir (selection) analysis units for inventory type groups 1 and 5. Where the FIZ is D, these type groups would be classified as dry-fir and be managed under a selection harvest system. Where the FIZ is G, these type groups would be classified as wet-fir and be managed according to the zone they are in.

Table A-1. Analysis units

Forest management zone	Analysis unit	Species group	Inventory type group	Age	Site class
Selection Harvest	1	Fir/Dry	1, 5, 6, 32		G,M,P
	2	Fir/Wet	1-5, 7,8,27,34	<141	G,M
	3	Fir/Wet	1-5, 7,8,27,34	≥141	G,M
	4	Fir/Wet	1-5, 7,8,27,34	<141	P
	5	Fir/Wet	1-5, 7,8,27,34	≥141	P
	6	Cedar	9-11	<141	G,M
	7	Cedar	9-11	≥141	G,M
	8	Cedar	9-11	<141	P
	9	Cedar	9-11	≥141	P
Ungulate Winter Range	10	Hemlock	12-17	<141	G,M
	11	Hemlock	12-17	≥141	G,M
	12	Hemlock	12-17	<141	P
	13	Hemlock	12-17	≥141	P
	14	Balsam	18-20	<141	G,M
	15	Balsam	18-20	≥141	G,M
	16	Balsam	18-20	<141	P
	17	Balsam	18-20	≥141	P
	18	Spruce	21-26	<141	G,M
	19	Spruce	21-26	≥141	G,M
	20	Spruce	21-26		P,L
	21	Pine	28-31		G,M
	22	Pine	28-31		P,L
	2	Fir/Wet	1-5, 7,8,27,34	<141	G,M
	3	Fir/Wet	1-5, 7,8,27,34	≥141	G,M
	4	Fir/Wet	1-5, 7,8,27,34	<141	P
	5	Fir/Wet	1-5, 7,8,27,34	≥141	P
	6	Cedar	9-11	<141	G,M
	7	Cedar	9-11	≥141	G,M
	8	Cedar	9-11	<141	P
	9	Cedar	9-11	≥141	P
Caribou Winter Range	10	Hemlock	12-17	<141	G,M
	11	Hemlock	12-17	≥141	G,M
	12	Hemlock	12-17	<141	P
	13	Hemlock	12-17	≥141	P
	14	Balsam	18-20	<141	G,M
	15	Balsam	18-20	≥141	G,M
	16	Balsam	18-20	<141	P
	17	Balsam	18-20	≥141	P
	18	Spruce	21-26	<141	G,M

(continued)

G = Good; M = Medium; P = Poor L = Low

A.1 Management Zone and Analysis Unit Definitions

Table A-1. Analysis units

Forest management zone	Analysis unit	Species group	Inventory type group	Age	Site class
Caribou Winter Range	19	Spruce	21-26	≥141	G,M
	20	Spruce	21-26		P,L
	21	Pine	28-31		G,M
	22	Pine	28-31		P,L
Caribou Transitional / Early Winter Range	2	Fir/Wet	1-5, 7,8,27,34	<141	G,M
	3	Fir/Wet	1-5, 7,8,27,34	≥141	G,M
	4	Fir/Wet	1-5, 7,8,27,34	<141	P
	5	Fir/Wet	1-5, 7,8,27,34	≥141	P
	6	Cedar	9-11	<141	G,M
	7	Cedar	9-11	≥141	G,M
	8	Cedar	9-11	<141	P
	9	Cedar	9-11	≥141	P
	10	Hemlock	12-17	<141	G,M
	11	Hemlock	12-17	≥141	G,M
	12	Hemlock	12-17	<141	P
	13	Hemlock	12-17	≥141	P
	14	Balsam	18-20	<141	G,M
	15	Balsam	18-20	≥141	G,M
	16	Balsam	18-20	<141	P
	17	Balsam	18-20	≥141	P
	18	Spruce	21-26	<141	G,M
	19	Spruce	21-26	≥141	G,M
	20	Spruce	21-26		P,L
	21	Pine	28-31		G,M
	22	Pine	28-31		P,L
Landscape Management	2	Fir/Wet	1-5, 7,8,27,34	<141	G,M
	3	Fir/Wet	1-5, 7,8,27,34	≥141	G,M
	4	Fir/Wet	1-5, 7,8,27,34	<141	P
	5	Fir/Wet	1-5, 7,8,27,34	≥141	P
	6	Cedar	9-11	<141	G,M
	7	Cedar	9-11	≥141	G,M
	8	Cedar	9-11	<141	P
	9	Cedar	9-11	≥141	P
	10	Hemlock	12-17	<141	G,M
	11	Hemlock	12-17	≥141	G,M
	12	Hemlock	12-17	<141	P
	13	Hemlock	12-17	≥141	P
	14	Balsam	18-20	<141	G,M
	15	Balsam	18-20	≥141	G,M
	16	Balsam	18-20	<141	P
	17	Balsam	18-20	≥141	P
	18	Spruce	21-26	<141	G,M
	19	Spruce	21-26	≥141	G,M
	20	Spruce	21-26		P,L

(continued)

G = Good; M = Medium; P = Poor L = Low

A.1 Management Zone and Analysis Unit Definitions

Table A-1. Analysis units (concluded)

Forest management zone	Analysis unit	Species group	Inventory type group	Age	Site class
Landscape Management	21	Pine	28-31		G,M
	22	Pine	28-31		P,L
Community Watershed	2	Fir/Wet	1-5, 7,8,27,34	<141	G,M
	3	Fir/Wet	1-5, 7,8,27,34	≥141	G,M
	4	Fir/Wet	1-5, 7,8,27,34	<141	P
	5	Fir/Wet	1-5, 7,8,27,34	≥141	P
	6	Cedar	9-11	<141	G,M
	7	Cedar	9-11	≥141	G,M
	8	Cedar	9-11	<141	P
	9	Cedar	9-11	≥141	P
	10	Hemlock	12-17	<141	G,M
	11	Hemlock	12-17	≥141	G,M
	12	Hemlock	12-17	<141	P
	13	Hemlock	12-17	≥141	P
	14	Balsam	18-20	<141	G,M
	15	Balsam	18-20	≥141	G,M
	16	Balsam	18-20	<141	P
	17	Balsam	18-20	≥141	P
	18	Spruce	21-26	<141	G,M
	19	Spruce	21-26	≥141	G,M
	20	Spruce	21-26		P,L
	21	Pine	28-31		G,M
	22	Pine	28-31		P,L
Standard Management	2	Fir/Wet	1-5, 7,8,27,34	<141	G,M
	3	Fir/Wet	1-5, 7,8,27,34	≥141	G,M
	4	Fir/Wet	1-5, 7,8,27,34	<141	P
	5	Fir/Wet	1-5, 7,8,27,34	≥141	P
	6	Cedar	9-11	<141	G,M
	7	Cedar	9-11	≥141	G,M
	8	Cedar	9-11	<141	P
	9	Cedar	9-11	≥141	P
	10	Hemlock	12-17	<141	G,M
	11	Hemlock	12-17	≥141	G,M
	12	Hemlock	12-17	<141	P
	13	Hemlock	12-17	≥141	P
	14	Balsam	18-20	<141	G,M
	15	Balsam	18-20	≥141	G,M
	16	Balsam	18-20	<141	P
	17	Balsam	18-20	≥141	P
	18	Spruce	21-26	<141	G,M
	19	Spruce	21-26	≥141	G,M
	20	Spruce	21-26		P,L
	21	Pine	28-31		G,M
	22	Pine	28-31		P,L

G = Good; M = Medium; P = Poor L = Low

A.1 Management Zone and Analysis Unit Definitions

Table A-2. shows the timber harvesting land base for each management zone by analysis unit.

Table A-2. Timber harvesting land base area by management zone and analysis unit

	Management zone (hectares)							
Analysis unit	**Selection**	**Caribou late winter**	**Landscape**	**Caribou transitional**	**Community watersheds**	**Ungulate**	**Standard**	**Total (hectares)**
1	134457.80	-	-	-	-	-	-	134457.80
2		1582.80	50439.97	4767.77	4084.52	13384.99	60736.04	134996.10
3		678.07	13693.40	1269.64	866.44	2469.05	15606.90	34583.50
4		126.49	6891.48	840.90	821.83	1884.58	8310.11	18875.39
5		11.81	560.33	69.85	105.64	122.88	532.21	1402.72
6		401.79	1708.40	493.54	113.82	405.97	2466.70	5590.22
7		2477.97	4005.77	2463.23	15.40	488.33	7358.65	16809.35
8		99.95	1388.37	252.93	65.55	172.82	1635.71	3615.33
9		1157.57	3718.21	1240.89	59.61	468.75	6328.56	12973.59
10		335.98	902.26	755.68	5.35	250.52	2177.40	4427.19
11		345.60	793.68	442.08	1.04	91.48	1207.76	2881.64
12		182.98	492.77	373.57	7.89	45.74	911.92	2014.87
13		556.31	1738.90	688.57	12.29	150.30	2159.61	5305.98
14		4117.79	5650.13	5311.86	1876.06	1056.82	17214.22	35226.88
15		4041.51	1792.26	2451.36	135.08	198.05	5712.42	14330.68
16		2822.91	1670.03	2143.92	388.13	385.75	5977.45	13388.19
17		4057.56	2022.15	4104.26	43.66	267.89	6475.11	16970.63
18		6464.81	14598.44	9777.77	3785.23	3895.52	35552.56	74074.33
19		3558.69	5327.80	3652.84	1262.77	898.54	19773.07	34473.71
20		12975.53	9647.40	12830.43	1872.90	1248.90	29186.65	67761.81
21		2017.37	52562.67	3385.61	18822.67	14652.31	106075.07	197515.70
22		71.07	12066.50	231.94	3782.69	2318.18	16985.24	35455.62
Total (hectares)	134457.80	48084.56	191670.92	57548.64	38128.57	44857.37	352383.36	867131.20

Note: Before additions to the land base for NSR, timber licence reversions, and TFL take back area.

A.2 Definition of the Timber Harvesting Land Base

The timber harvesting land base was determined by first deducting from the total TSA area, all areas considered to be currently unavailable for timber harvesting. Additions to the land base such as NSR and timber licences were then added back in to establish the current timber harvesting land base. Harvesting operations will subsequently result in the removal of some land base because of long-term productivity losses associated with future roads, trails, and landings. All these categories are summarized below in Table A-3. and Table 1 of the main report.

Table A-3. Timber harvesting land base, Kamloops TSA, 1994

Classification	**Area (hectares)**		**Per cent of total area**	**Per cent of productive forest area**
Total land base		2 117 718	100.00	
Non-Crown land		283 908	13.41	
Non-forest land		392 692	18.54	
Total productive forest		1 441 118	68.05	100.00
Reductions to productive forest:				
Inoperable areas	101 386		4.79	7.04
Non-commercial cover	3 366		0.16	0.23
Environmentally sensitive	104 606		4.94	7.26
Deciduous types	46 135		2.18	3.20
Low site	32 902		1.55	2.28
Problem forest types	165 743		7.83	11.50
Riparian areas	10 483		0.50	0.73
Tod Mountain	32		0.00	0.00
Roads, landings, and trails	27 513		1.30	1.91
Not satisfactorily restocked	73 739		3.48	5.12
Woodlots	7 021		0.33	0.49
Lakeshore Management Areas	965		0.05	0.07
Hudson's Bay Heritage Trail	96		0.00	0.01
Total current reductions	573 987	-573 987	-27.10	-39.83
Current productive land base		867 131	40.95	60.17
Additions to productive forest:				
Not satisfactorily restocked	69 920		3.30	4.85
Timber Licence reversions	11 639		0.55	0.81
TFL take back area	2 142		0.10	0.15
Total additions	83 701	83 701	3.95	5.81
Total productive land base		950 832	44.90	65.98
Future reductions to productive forest				
Future roads, landings, and trails	60 536	-60 536	-2.86	-4.20
Long-term productive land base		**890 296**	42.04	61.78

A.2 Definition of the Timber Harvesting Land Base

A.2.1 Reductions to the TSA land base

A.2.1.1 Non-Crown, non-forest areas

All areas not designated as being ownership 62C (Crown forest management unit available for long-term integrated resource management), 69C (Miscellaneous reserves available for long-term integrated resource management), or 61C (UREP) were excluded from the timber harvesting land base. The Land Act Reserves located on the Bonaparte Plateau (areas A-D) were removed from the timber harvesting land base under this category. In addition, any area with a type identity of 8 (no typing available) was excluded. Non-forested and non-commercial (brush) areas, designated on the inventory file as type identity 6 and 5 respectively, were also excluded from the timber harvesting land base.

A.2.1.2 Inoperable areas

Areas that are currently considered inoperable, due to steepness of terrain and other factors, were removed from the timber harvesting land base.

A.2.1.3 Environmentally sensitive areas

Table A-4. summarizes the area reductions prescribed for environmentally sensitive areas (ESAs).

Table A-4. Per cent area reductions for ESAs

ESA code	ESA description	Per cent area reduction
ESA1	High rating for soil sensitivity, regeneration concern, avalanche concern, recreation values, or watershed values	90%
h_2	Moderate watershed values	60%
all other ESA2	Moderate rating for soil sensitivity, regeneration concern, avalanche concern, recreation values or watershed values	40%

ESAs for areas of critical importance to wildlife were not netted out of the land base as they are modelled through forest cover constraints for the management zones for ungulate winter range and caribou late and early winter ranges.

A.2 Definition of the Timber Harvesting Land Base

A.2.1.4 Problem forest types

Some stands are not currently utilized because they either cannot be harvested economically or they contain mostly non-commercial tree species. Examples include older stands that contain low net timber volumes or poor quality trees and stands dominated by deciduous species. Areas of low site quality and where lodgepole pine stands fail to reach a specified height at a certain age are also excluded. Pulpwood Agreement 16 (PA16) requires different exclusions for some problem forest types, as shown in Table A-5. below.

Table A-5. Reductions for problem forest types

	Criteria						
Type group or species	**New site class**	**New site index**	**Age class**	**New height class**	**Stocking class**	**Crown closure class**	**Per cent excluded**
9-34	P				Resid		100
12,14,15,17	All		8,9				100 where H volume ≥ 60%
1-27, 32-34			≥6	1,2			100
28-31			≥5	1,2 (<19m)			100
18-24			8,9	2,3		0,1,2,3	100
28-31	P						100% of stands classified as 310 or 420
28-31 in PA16 TSB 2			≥5		3		60
28-31 in PA16 TSB 4			≥5		3		10
28-31 in PA16			≥5		4		90
Immature Pl and S not in PA 16		<5					100
Immature Pl and S in PA 16	L						100
All immature species except Pl and S	L						100
All mature species	L						100
35,36,40,41,42	All						100

A.2 Definition of the Timber Harvesting Land Base

A.2.1.5 Heritage and recreation trails

A total of 95.7 hectares was removed from the net land base to account for the designated portion of the Hudson's Bay Brigade trail. Areas were determined by delineating a 200 metre buffer (100 metres either side) around the trail, which is approximately 8.7 km in length. Table A-6. shows the area reductions by analysis unit.

Table A-6. Area reductions for the Hudson's Bay Brigade Trail

Analysis unit	Total (hectares)
1	13.7
8	1.7
15	80.3
Total	95.7

A.2.1.6 Tod Mountain

72.2 hectares was excluded from the gross land base to account for an area removed by Order in Council for development and improvements at Sun Peaks Resort.

A.2.1.7 Woodlot licences

7021 hectares was removed from the land base to account for woodlot areas within the Kamloops TSA which were not properly identified on the inventory file.

A.2.1.8 Lakeshore management areas

For all Class A lakes in the Kamloops TSA there is a 200 metre buffer within which harvesting is not permitted. The total operable land base within these buffers was calculated and excluded from the overall net land base for the Kamloops TSA. Since many Class A lakes fall within the Land Act Reserve and have already been netted out of the land base, there were only 22 lakes which were analyzed at this stage. Table A-7. summarizes the total operable area by analysis unit that falls within the buffers of those 22 lakes. An additional 5.2 hectares will be taken out of the NSR areas.

Table A-7. Area reductions for Class A Lakes

Analysis unit	Total (hectares)
1	285.2
2	16.1
4	49.7
8	154.4
10	11.8
11	61.4
12	18.7
14	293.3
15	74.6
Total (hectares)	965.2

A.2 Definition of the Timber Harvesting Land Base

Lake buffers for Class B and C lakes are not excluded from harvesting, but are managed, in part, according to visual quality objectives of retention and partial retention, respectively. The buffer areas for B and C lakes were not directly netted out of the net operable land base, but instead were added to the total area contributing to the landscape management zone, where the same forest cover requirements apply.

A.2.1.9 Exclusion for riparian areas

21 map sheets were analysed to determine the total area to be excluded from the net land base to account for riparian areas. In accordance with the *Kamloops TSA Riparian Management Area Guidelines* there is no harvesting within 20 metres on either side of R1 streams, 10 metres on either side of R2 streams, and 10 metres around lakes and swamps. The total area within these riparian buffer areas was calculated for each map sheet, and an overall percentage of 2.43% of the gross land base was determined. Applying the TSA gross to net ratio, it was concluded that 1.16% of the net land base would be excluded to account for riparian areas.

A.2.1.10 Existing roads, trails and landings

Past timber harvesting operations have resulted in a loss of productive forest land. However, many of the existing roads, trails, landings and related disturbances are too small to meet inventory typing criteria and therefore are not accounted for in the inventory file. To account for this loss in the area available for timber harvesting a 12.8% reduction was applied to all areas younger than 21 years (the areas assumed to have a harvesting history). A reduction of 1.0% is applied to all areas greater than 20 years to account for roads established in these areas to access the currently logged sites.

A.2.1.11 Not satisfactorily restocked areas

All areas designated as NSR as derived from the History Records System (HRS) and the Major Licence Silviculture Information System were excluded from the land base (the additions are described in Section A.2.2).

A.2 Definition of the Timber Harvesting Land Base

A.2.2 Additions to the productive forest

A.2.2.1 Not satisfactorily restocked areas

Only the portion of the NSR area, initially removed from the land base, which is available for timber production, is added back into the land base. All NSR, both current and backlog, is assumed to be restocked within 10 years. Table A-8. summarizes the total area of current and backlog NSR existing in the timber harvesting land base for the Kamloops TSA. 5.2 hectares was removed from analysis unit 22 within the standard management zone to account for lakeshore management buffers.

Table A-8. Not satisfactorily restocked (NSR) areas by management zone

	Management zone (hectares)							
Analysis unit	Selection	Caribou late winter	Landscape	Caribou transitional	Community watersheds	Ungulate	Standard	Total (hectares)
1	22580.04	-	-	-	-	-	-	22580.04
2	-	613.57	1372.53	725.54	454.70	294.49	2550.18	6011.00
4	-	65.94	147.50	77.97	48.87	31.65	274.07	646.00
6	-	222.11	496.86	262.65	164.60	106.61	923.17	2176.00
8	-	46.44	103.89	54.92	34.42	22.29	193.03	455.00
10	-	36.24	81.06	42.85	26.85	17.39	150.61	355.00
12	-	24.09	53.89	28.49	17.85	11.56	100.12	236.00
14	-	623.17	1393.99	736.89	461.81	299.09	2590.06	6105.00
16	-	374.31	837.31	442.62	277.39	179.65	1555.73	3667.00
18	-	1551.03	3469.56	1834.07	1149.41	744.43	6446.50	15195.00
20	-	350.53	784.10	414.49	259.76	168.24	1456.88	3434.00
21	-	689.92	1543.32	815.83	511.28	331.13	2867.52	6759.00
22	-	235.38	526.54	278.34	174.43	112.97	973.12	2300.80
Total (hectares)	22580.04	4832.73	10810.55	5714.65	3581.36	2319.50	20080.99	69919.84

Note: 2341 hectares of NSR area in the Clearwater Forest District, and 1500 hectares in the Kamloops Forest District were not added back into the timber harvesting land base because the forest districts determined the areas would not be restocked.

A.2.2.2 Timber licence reversions

Timber licences within the Kamloops TSA are assumed to fully revert to the Crown over the next 30 years. The gross area of timber licences was subject to the identical netdowns as was the remainder of the TSA. The net area of timber licences which will revert to the Crown each decade is shown in Table A-9. Table A-10. shows the area of timber licences already reverted to the Crown but identified as NSR on the inventory.

Table A-9. Timber licence reversions by decade by management zone

	Management zone (hectares)							
Analysis unit	**Selection**	**Caribou late winter**	**Landscape**	**Caribou transitional**	**Community watersheds**	**Ungulate**	**Standard**	**Total (hectares)**
1	-	-	-	-	-	-	-	-
2	-	3	20	2	-	61	182	269
3	-	14	30	7	-	17	56	124
4	-	1	3	-	-	3	35	41
5	-	-	8	-	-	-	2	11
6	-	3	12	2	-	8	6	30
7	-	53	235	27	2	13	93	422
8	-	-	1	-	-	1	1	3
9	-	19	57	7	1	27	38	150
10	-	3	17	1	-	-	14	35
11	-	12	109	5	1	10	42	180
12	-	1	6	1	-	1	5	13
13	-	16	108	11	1	-	66	203
14	-	-	5	2	-	-	65	72
15	-	-	4	-	-	-	159	164
16	-	-	3	-	-	-	35	39
17	-	-	3	-	-	-	80	83
18	-	30	86	12	-	7	163	297
19	-	8	37	5	-	6	426	481
20	-	8	38	3	-	-	428	477
21	-	20	72	9	-	14	117	232
22	-	1	1	1	-	-	-	3
Total (hectares)	-	192	856	96	6	168	2012	3330

A.2 Definition of the Timber Harvesting Land Base

Table A-10. Timber licence NSR reversions by management zone

Analysis unit	Management Zone (hectares)							Total (hectares)
	Selection	Caribou late winter	Landscape	Caribou transitional	Community watersheds	Ungulate	Standard	
1	-	-	-	-	-	-	-	-
2	-	1	10	1	-	30	90	133
3	-	7	15	4	-	8	28	62
4	-	-	1	-	-	1	17	21
5	-	-	4	-	-	-	1	6
6	-	1	6	1	-	4	3	15
7	-	26	116	13	1	7	46	209
8	-	-	-	-	-	-	-	1
9	-	10	28	3	-	13	19	74
10	-	1	9	1	-	-	7	17
11	-	6	54	3	1	5	21	89
12	-	1	3	-	-	-	2	7
13	-	8	54	5	1	-	33	100
14	-	-	3	1	-	-	32	36
15	-	-	2	-	-	-	79	81
16	-	-	2	-	-	-	17	19
17	-	-	1	-	-	-	39	41
18	-	15	42	6	-	3	81	147
19	-	4	18	2	-	3	211	238
20	-	4	19	2	-	-	212	236
21	-	10	36	4	-	7	58	115
22	-	-	1	-	-	-	-	2
Total (hectares)		95	424	47	3	83	997	1649

A.2.2.3 TFL take back area

Approximately 2718.3 hectares from TFL 35 has been reassigned to the Kamloops TSA land base. This area was not identified on the inventory file and was removed from the land base when the netdowns were done. It was determined that approximately 80% (2141.67 hectares) of the area would contribute to the timber harvesting land base. The area was assumed to be wholly within the ungulate winter range zone. The area was assumed to be evenly distributed within the following age class/polygon divisions: age class 1 (8 polygons), 2(2), 3(10), 4(10), 5(52), 6(46), 7(20), 8(19). It was assumed that the primary species was Douglas-fir on medium sites.

A.2.3 Future roads, trails and landings

As future harvesting occurs there will be associated losses in productive forest area due to roads, trails and landings. All existing stands currently over 20 years old will be subject to a 7.6% loss. The total deduction of 7.6% is based on the *Soil Conservation Guidelines for Timber Harvesting - Interior B.C.* and is comprised of the following:

1. roads and landings - 7%;
2. skid roads and trails - 1.6%;
3. 1.0% was subtracted as age class 2+ areas experienced a 1.0% reduction when accounting for existing access roads.

The area that will eventually be lost is not immediately excluded from the land base. The B.C. Forest Service timber supply model simply reduces the areas by 7.6% the first time all stands over 20 years old are harvested.

A.3 Volume Exclusions

A.3.1 Volume exclusions for mixed species types

Table A-11. summarizes the per cent volume exclusion of less desirable or unmerchantable species to be excluded from mixed species types.

Table A-11. Volume exclusions for mixed species types

Inventory type group	Volume excluded from type group	Per cent volume exclusion
1-34	deciduous volume component	100%
1-34	hemlock volumes, age class 8 & 9	100%

A.3.2 Unsalvaged volume losses

Unsalvaged losses are timber volumes destroyed or damaged by natural causes such as fire, insects and wind. Estimated annual losses are deducted from the gross timber supply to determine the projected net volumes that will be harvested over time. Table A-12. shows the estimated average annual loss for the Kamloops TSA. Estimates of unsalvaged losses are based on the district forest health records, and the best available knowledge and information. Wildlife trees are maintained in all management zones and are accounted for in this table under miscellaneous.

Table A-12. Unsalvaged volume losses

Cause of loss	Annual unsalvaged loss in cubic metres/year
Insects	19 100
Wind damage	1 000
Fire	8 000
Miscellaneous	15 300
Total	43 400

A.4 Forest Management Assumptions

A.4.1 Utilization levels

The utilization level defines the maximum allowable stump height, and the minimum merchantable diameter by species, used to calculate merchantable volume. A 30 cm stump height is assumed for all species and a 10 cm top is assumed for all species except cedar of age class 8 and 9 for which a 15 cm top is assumed. The utilization level currently practiced in the Kamloops TSA is a 12.5 cm minimum diameter at breast height (DBH) for lodgepole pine, and a 17.5 cm minimum DBH for all other species.

A.4.2 Minimum harvestable ages for each analysis unit

Table A-13. lists the minimum harvestable age for each analysis unit. Minimum harvestable ages are based on the forest district cutting priorities weighted by area for each species type in each district and do not necessarily reflect biological culmination ages. Impacts of different harvest age assumptions on timber supply were evaluated using sensitivity analysis.

Table A-13. Minimum harvestable age by analysis unit

Analysis units	Minimum harvestable age (years)
2,3,21,22	81
4 - 20	101

A.4.3 Harvest profile

Table A-14. lists the current harvest profile for the Kamloops TSA.

Table A-14. Harvest profile

Analysis units	Per cent of total harvest
1	15.6
2,3	11.6
4,5	1.1
6,7	3.2
8,9	1.2
10,11	2.8
12,13	1.9
14,15	8.0
16,17	4.7
18,19	22.4
20	5.0
21	18.1
22	4.7
Total	100%

A.4.4 Resource unit forest cover requirements

Table A-15. specifies the forest cover requirements needed to achieve the forest management objectives for each zone. There are two types of forest cover guidelines:

1. Guidelines for green-up, stating the maximum percentage of area having trees less than a specified minimum height or age; and
2. Guidelines for mature forest cover, stating the minimum percentage of area having trees older than a specified age or taller than a specified height.

Selection harvesting is assumed to satisfy all other forest cover requirements.

Table A-15. Forest cover requirements by management zone

	Green-up forest cover guidelines				Mature forest cover guidelines			
	Maximum % younger than minimum tree height/age		Minimum tree height/age		Minimum % area older than mature cover height/age		Minimum mature cover height/age	
Management zone	**Gross area**	**Net operable area**	**Ht (m)**	**Age (yrs)**	**Gross area**	**Net operable area**	**Ht (m)**	**Age (yrs)**
Selection	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Ungulate Winter Range		20	3	16	40	28.4	20	77
Caribou Late Winter		33	3	22		12		≥200
Caribou Early winter		31.9	3	21	50	30.1	≥19.5	92
Landscape	9.5	10.7	6	25	20	6.6	20	82
Community Watershed	22	23.9	5.4	23	20	9.3	20	84
Standard		27.9	3	17	20	6.9	20	84

A.4.4.1 Forest cover guideline for green-up

The green-up tree age years are based on area-weighting the time required to achieve the minimum tree height (top height) for each analysis unit within the specified zone. The average site indices were obtained from ministry site index curves and inventory file information.

The ungulate winter range zone is primarily below the snow pack, therefore a 3 metre green-up height is specified for this zone. In order to meet clearcut harvesting guidelines—a maximum of 5 hectare blocks with 300 metre buffers—no more than 20% of the net operable land base may be below the green-up height.

A.4 Forest Management Assumptions

Based on the *Kamloops Regional Timber Harvesting Guidelines* and operational considerations, visual recovery for the landscape zone was assumed to occur at 6 metres. The mid-point of each VQO category was used to estimate the maximum area in visible harvesting in plan view (preservation was considered 0-1% visibility range). The per cent in the table is a weighted average (by area) for preservation, retention, and partial retention only. The modification VQO range, when applied to the net land base has no impact. The final percentage was then adjusted based on *Procedures for Factoring Recreation Resources into Timber Supply Analyses.* The Kamloops and Clearwater Forest District staff developed a weighted average forest cover requirement based on knowledge of the proportion of the visually sensitive area in each VQO class, and how forest outside the timber harvesting land base contributes to visual quality.

An Equivalent Clearcut Area (ECA) of 22% of the gross land base applies to the upper 60% of all community watersheds. The upper 60% (snowpack area) will be considered hydrologically recovered upon reaching 7 metres in height. The lower 40% of the watershed will be managed according to the standard management zone with a 3 metre green up height allowing for a weighted average of 5.4 metres across the zone. The ECA percentage of 22 was adjusted upwards to account for those areas within the watersheds which contribute to hydrologic recovery but will not be harvested (i.e., ESAs, problem forest types, etc.). To account for the dispersion of these types throughout the zone the same methodology as was used for the landscape zone was employed.

The standard management zone assumes a 4-pass harvesting sequence in the Kamloops Forest District and a 3-pass harvesting sequence in Clearwater Forest District. Therefore, using a weighted average between the two districts, no more than 27.9% of the net operable land base may be less than 3 metres tall.

The caribou late winter management zone occurs entirely within the Clearwater District, where a 3-pass harvesting sequence is assumed. Therefore, no more than 33% of the net operable land base may be less than 3 metres tall.

The caribou early winter management zone assumes a 4-pass harvesting sequence in the Kamloops Forest District and a 3-pass harvesting sequence in the Clearwater Forest District. Therefore, using a weighted average between the two districts, no more than 31.9% of the net operable land base may be less than 3 metres tall.

A.4.4.2 Mature forest cover guideline

The primary management concern for the maintenance of mature forest cover is the provision of ungulate thermal cover. Within the standard management zone the basic provision for thermal cover requires that at least 20% of the gross area be above 20 metres in height. This also applies to the community watershed and landscape zones.

The late winter caribou management zone is managed on a 150 year rotation, with a requirement that at least 12% of the net operable land base is older than 200 years in order to maintain lichen production. Fifty per cent of the early winter caribou management zone must be greater than or equal to 19.5 metres in height. The ungulate winter range management zone requires than at least 40% of the gross area be a minimum of 20 metres in height.

The above percentages are adjusted based on the area within each zone which already satisfies the mature height criteria and will not be harvested.

A.4 Forest Management Assumptions

A.4.5 Basic silviculture and regeneration assumptions

Table A-16. shows the species that are regenerated once harvesting and basic silviculture activities take place, and the expected regeneration delay following harvesting.

Table A-16. Regeneration assumptions

	Managed stand (per cent)								
Analysis units	Fir	Spruce	Pine	Balsam	Cedar	Hemlock	Regen delay (years)	Stocking at regen delay (sph)	Stocking at time zero (sph)
2,3	60	15	25				2	1200	1400
4,5	25	10	65				3	1100	1300
6,7	15	45	10		20	10	2	1200	1400
8,9	25	20	45		10		3	1400	1650
10,11		75	10		15		2	1200	1400
12,13	10	45	25		25		2	1100	1300
14,15		80		20			2	1400	1650
16,17		60	15	25			2	1200	1400
18,19		60	25	15			3	1400	1650
20		70	10	20			2	1000	1175
21	10	10	80				3	1200	1400
22		10	90				5	1200	1400

A.4.6 Immature plantation history

For this analysis it is assumed that all stands < 21 years (harvesting history) will be assigned to a managed stand yield curve.

A.4.7 Selection management

To model selection harvesting of stands it was assumed that there would be a 40% volume removal on the first pass. This would then be followed by a 30-year re-entry period, with 25% of the volume removed in each entry. The management of selection stands would be based upon a 120 year rotation. Therefore, on the first pass the yield curve used would be 40% of the VDYP yield curve. During subsequent passes, the yield is assumed to be the MAI of the VDYP curve at age 120 multiplied by 30 years.

A.4 Forest Management Assumptions

A.4.8 Operational adjustment factors

Table A-17. outlines the Operational Adjustment Factors and site indices used to generate the managed stand yield curves from the TIPSY model.

Table A-17. Operational Adjustment Factors (OAFs)

Analysis unit	Site index	OAF 1	OAF 2
2	19.83	15	5
3	16.24	15	5
4	15.22	15	5
5	12.02	15	5
6	19.23	15	5
7	16.26	15	5
8	14.28	15	5
9	13.35	15	5
10	19.24	15	5
11	14.91	15	5
12	14.06	15	5
13	12.09	15	5
14	15.49	15	5
15	12.54	15	5
16	12.23	15	5
17	10.02	15	5
18	17.25	15	5
19	15.98	15	5
20	10.28	15	5
21	17.39	15	5
22	11.82	15	5

A.4.9 Yield estimates for existing stands

A batch version of the variable density yield prediction (VDYP, version 4.2b) model, developed by the Inventory Branch of the B.C. Forest Service, was used to predict volume yields for existing stands. The batch VDYP model provides a complete volume curve for every forest stand in the timber harvesting land base, based on the species composition, height, age, stocking and geographic location of the stand. These curves are then aggregated into analysis unit curves by averaging the individual curves, weighted by the area of each stand that makes up the analysis unit.

A.4 Forest Management Assumptions

Table A-16. Yield estimates for existing stands, by analysis unit

Age	Volume (cubic metres per hectare)										
	Fir/Dry selection G/M/P	Fir/Wet G/M <141	Fir/Wet G/M >141	Fir/Wet P <141	Fir/Wet P >141	Cedar G/M <141	Cedar G/M >141	Cedar P <141	Cedar P >141	Hemlock G/M <141	Hemlock G/M >141
10	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0.03	0	0	0	0.01	0
30	0.05	4.98	0.32	0.07	0	7.24	0.60	0.36	0.18	5.71	0.14
40	0.95	34.32	9.36	5.82	0.10	52.57	20.2	12.73	5.43	61.74	6.77
50	3.92	71.45	33.10	25.65	2.84	94.82	48.09	43.26	28.32	122.84	17.21
60	9.00	108.15	59.73	49.73	18.17	134.30	74.48	73.46	52.44	177.03	27.99
70	14.91	143.53	85.89	73.93	37.39	169.64	98.64	100.58	74.38	225.34	38.14
80	20.83	177.23	111.12	97.19	56.39	202.19	121.25	125.58	94.77	268.63	47.65
90	26.63	208.83	134.99	119.28	74.47	226.21	136.26	145.21	110.23	302.31	55.02
100	32.25	237.98	157.64	140.24	91.67	245.81	147.39	161.79	122.88	330.37	61.21
110	37.68	264.51	179.07	160.07	107.98	262.01	155.47	175.95	133.31	354.01	66.45
120	42.52	287.61	197.84	177.60	122.77	274.51	160.44	187.47	141.36	373.42	70.55
130	47.06	309.32	215.83	194.17	136.85	293.97	173.26	203.20	153.93	398.31	76.44
140	51.12	328.23	232.12	208.73	149.49	312.81	186.45	218.46	166.45	420.78	82.17
150	54.75	345.21	246.87	221.64	160.93	330.40	198.96	232.74	178.30	441.06	87.53
160	57.99	360.45	260.15	233.04	171.25	346.87	210.82	246.12	189.49	459.23	92.53
170	60.84	374.10	272.02	242.96	180.48	362.25	222.04	258.57	200.03	475.55	97.16
180	63.68	386.69	283.88	252.66	189.36	377.00	233.06	270.72	210.42	490.56	101.71
190	66.35	397.99	295.08	261.54	197.65	390.96	243.69	282.29	220.45	504.30	106.09
200	68.96	409.19	305.90	270.34	205.76	404.59	253.97	293.60	230.15	517.26	110.31
210	71.46	419.80	316.22	278.70	213.45	417.68	263.89	304.51	239.52	529.32	114.38
220	73.84	429.86	326.05	286.64	220.81	432.84	275.30	317.04	250.18	540.57	118.80
230	76.10	439.40	335.42	294.19	227.80	447.57	286.61	329.50	260.85	551.11	123.16
240	78.24	448.45	344.34	301.39	234.48	461.92	297.76	341.76	271.35	561.03	127.40
250	80.29	457.05	352.87	308.20	240.89	475.79	308.70	353.82	281.69	570.41	131.54
260	80.34	457.55	353.33	308.93	242.35	476.82	309.15	354.96	282.31	574.93	131.87
270	80.38	457.97	353.75	309.59	243.64	477.77	309.57	355.99	282.88	579.13	132.16
280	80.42	458.32	354.13	310.19	244.82	478.59	309.96	356.94	283.40	583.01	132.43
290	80.44	458.60	354.48	310.72	245.91	479.35	310.32	357.80	283.90	586.60	132.68
300	80.46	458.82	354.79	311.19	246.91	480.04	310.65	358.62	284.36	589.95	132.91
310	80.47	458.98	355.07	311.61	247.83	480.68	310.95	359.38	284.79	593.07	133.11
320	80.47	459.07	355.31	311.97	248.68	481.28	311.23	360.05	285.19	595.96	133.30
330	80.46	459.11	355.53	312.26	249.43	481.82	311.49	360.69	285.57	598.68	133.48
340	80.45	459.07	355.72	312.51	250.11	482.32	311.72	361.27	285.92	601.19	133.64
350	80.42	458.98	355.89	312.70	250.72	482.78	311.93	361.82	286.25	603.56	133.80

continued

Table A-16. Yield estimates for existing stands (concluded)

	Volume (cubic metres per hectare)										
Age	Hemlock P <141	Hemlock P >141	Balsam G/M <141	Balsam G/M >141	Balsam P <141	Balsam P >141	Spruce G/M <141	Spruce G/M >141	Spruce P/L	Pine G/M	Pine P/L
10	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0.16	0
30	0.59	0.03	3.06	0.28	0.06	0	0.10	0.05	0	14.21	0.04
40	10.87	1.58	25.29	5.95	4.98	0.13	8.86	5.97	0.07	55.45	0.88
50	46.40	7.25	59.42	23.67	22.25	5.44	37.94	30.18	0.97	98.58	19.67
60	88.40	14.63	93.59	49.19	45.91	17.83	88.15	74.09	5.18	136.88	47.57
70	126.80	22.14	128.18	79.48	75.12	39.69	134.89	118.66	20.31	170.92	73.86
80	161.97	29.54	157.29	103.74	98.67	59.24	176.51	158.30	45.80	201.33	98.21
90	190.83	35.76	182.35	124.81	119.16	76.90	212.80	192.46	74.10	229.19	121.31
100	215.69	41.21	204.81	143.74	137.61	92.88	244.52	222.10	101.69	254.71	143.06
110	237.25	46.01	225.12	160.87	154.37	107.43	272.23	247.82	126.92	278.23	163.58
120	255.62	50.00	243.39	176.33	169.54	120.66	296.34	270.00	149.88	300.09	182.02
130	277.42	54.99	263.67	193.15	186.14	134.70	318.73	291.17	171.92	320.74	201.54
140	297.19	59.78	282.81	209.36	202.04	148.26	337.88	309.99	192.18	334.61	214.63
150	315.33	64.26	300.71	224.76	217.11	161.20	354.51	326.65	210.77	345.46	225.14
160	331.94	68.42	317.54	239.40	231.42	173.55	368.98	341.43	227.80	353.32	233.10
170	347.04	72.28	333.40	253.36	245.02	185.38	381.52	354.55	243.41	358.22	238.47
180	360.90	76.10	348.35	266.68	257.96	196.71	392.47	366.34	257.72	360.17	241.30
190	373.47	79.76	362.45	279.42	270.30	207.57	401.93	376.90	270.84	359.19	241.57
200	386.31	83.30	376.13	291.65	282.22	218.03	410.90	386.58	283.07	361.71	244.46
210	398.68	86.70	389.12	303.39	293.66	228.11	419.05	395.40	294.41	364.49	247.45
220	410.40	90.29	401.56	314.66	304.65	237.83	426.47	403.44	304.93	367.34	250.40
230	421.37	93.81	413.52	325.49	315.21	247.20	433.21	410.79	314.70	370.14	253.23
240	431.70	97.23	425.00	335.91	325.39	256.25	439.35	417.53	323.79	372.85	255.89
250	441.52	100.56	435.95	345.95	335.15	265.01	444.97	423.72	332.26	375.41	258.37
260	447.15	101.04	437.91	347.93	336.90	266.90	448.71	427.35	337.83	377.40	260.49
270	452.39	101.49	439.74	349.79	338.55	268.69	452.08	430.60	342.97	379.25	262.41
280	457.17	101.90	441.46	351.52	340.09	270.37	455.11	433.51	347.71	380.95	264.15
290	461.53	102.29	443.05	353.14	341.53	271.94	457.74	436.10	352.07	382.51	265.70
300	465.60	102.66	444.56	354.66	342.89	273.43	460.04	438.40	356.10	383.93	267.07
310	469.43	103.00	445.96	356.08	344.15	274.83	462.09	440.44	359.80	385.20	268.26
320	473.05	103.31	447.28	357.42	345.33	276.15	463.90	442.26	363.21	386.33	269.28
330	476.48	103.62	448.52	358.67	346.44	277.40	465.51	443.85	366.33	387.32	270.13
340	479.73	103.88	449.67	359.84	347.47	278.57	466.92	445.26	369.17	388.17	270.82
350	482.82	104.15	450.72	360.93	348.43	279.69	468.16	446.48	371.74	388.88	271.34

A.4.10 Yield estimates for managed stands

Yield tables applied to managed stands are shown in Table A-17. following. These managed stand yield tables are based on the Table Interpolation Program for Stand Yields, version 2.1.3, developed by the Research Branch of the B.C. Forest Service. To generate tables for the analysis, the establishment percentages in Section A.4.5, "Basic silviculture and regeneration assumptions" were used, as well as the average site indices, operational adjustment factors and establishment assumptions in Section A.4.8, "Operational adjustment factors."

Table A-17. Yield estimates for managed stands

	Volume (cubic metres per hectare)										
Age	Fir/Dry selection G/M/P	Fir/Wet G/M <141	Fir/Wet G/M >141	Fir/Wet P <141	Fir/Wet P >141	Cedar G/M <141	Cedar G/M >141	Cedar P <141	Cedar P >141	Hemlock G/M <141	Hemlock G/M >141
10	8.86	0	0	0	0	0	0	0	0	0	0
20	17.72	0.50	0	0	0	0.20	0	0	0	0.20	0
30	26.58	12.75	4.00	4.55	0	5.00	1.60	1.80	1.35	4.65	0.50
40	26.58	44.45	15.50	29.35	6.50	36.70	8.40	16.30	11.25	34.55	5.40
50	26.58	102.00	42.10	63.15	23.50	113.50	48.250	38.20	27.80	115.30	24.75
60	26.58	171.80	81.10	99.85	42.10	196.75	108.50	74.55	57.30	202.15	76.00
70	26.58	227.85	126.45	135.50	69.05	269.45	170.75	111.75	90.15	276.00	136.95
80	26.58	279.80	172.45	172.75	92.75	336.30	228.70	150.15	123.95	348.55	192.70
90	26.58	324.25	210.10	208.50	114.60	393.95	281.20	187.10	155.65	402.10	244.00
100	26.58	362.10	242.95	237.15	136.35	439.35	326.80	222.25	187.75	441.75	294.90
110	26.58	396.40	272.05	261.05	155.50	478.50	365.35	252.25	218.35	472.75	337.40
120	26.58	425.95	298.50	281.90	177.75	512.15	398.20	275.70	245.00	497.45	369.85
130	26.58	450.35	320.25	300.40	197.65	539.65	425.55	295.65	264.80	517.35	395.05
140	26.58	471.55	338.75	316.25	214.45	562.85	449.10	312.60	282.30	531.80	416.30
150	26.58	490.00	356.55	329.75	227.70	584.70	470.35	328.30	296.50	545.15	433.90
160	26.58	506.40	372.80	341.15	239.20	601.70	489.60	341.50	308.75	552.70	448.35
170	26.58	518.25	386.55	350.90	249.50	617.05	505.40	353.15	320.40	559.45	460.40
180	26.58	527.40	399.30	360.25	257.85	629.15	518.75	362.70	330.70	563.55	471.65
190	26.58	535.95	410.30	368.60	265.85	638.55	530.35	371.35	339.60	565.20	479.75
200	26.58	542.25	419.35	374.95	272.75	647.25	538.60	378.40	347.50	567.30	486.45
210	26.58	548.40	426.55	381.35	279.45	654.25	545.50	385.40	354.30	568.05	492.20
220	26.58	553.50	433.40	385.95	285.00	662.15	552.35	391.65	359.85	569.85	496.70
230	26.58	558.00	439.00	390.05	289.95	670.15	559.70	397.55	365.40	572.25	498.65
240	26.58	561.75	444.00	394.15	294.80	677.85	566.60	401.85	370.40	574.65	499.45
250	26.58	565.65	448.85	397.00	298.55	684.00	572.35	405.75	374.85	575.85	501.00
260	26.58	568.20	453.60	399.70	302.30	689.85	578.15	408.95	378.80	577.50	501.50
270	26.58	571.20	457.60	401.55	305.05	694.85	583.25	411.50	381.55	578.25	502.50
280	26.58	574.20	461.00	403.80	307.55	699.30	587.80	414.25	384.15	579.30	501.85
290	26.58	577.20	463.80	404.75	309.95	704.05	591.30	416.10	386.45	581.70	501.80
300	26.58	579.00	466.50	406.10	311.50	708.55	594.75	417.75	388.65	583.95	501.65

continued

A.4 Forest Management Assumptions

Table A-17. Yield estimates for managed stands(concluded)

Age	Volume (cubic metres per hectare)										
	Hemlock P <141	Hemlock P >141	Balsam G/M <141	Balsam G/M >141	Balsam P <141	Balsam P >141	Spruce G/M <141	Spruce G/M >141	Spruce P/L	Pine G/M	Pine P/L
10	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0
30	1.00	0	1.00	0.10	0.15	0	6.50	3.50	0	20.80	0
40	7.95	2.75	6.20	1.70	1.80	0.30	25.25	15.50	0.30	65.70	7.20
50	22.60	10.30	31.30	5.60	6.85	1.80	75.50	53.00	1.40	116.60	30.70
60	61.80	24.10	88.40	23.40	22.95	5.50	146.50	111.00	4.20	163.90	54.20
70	107.15	56.55	154.80	63.80	59.50	16.15	212.50	174.00	17.80	215.40	87.00
80	153.80	92.40	212.50	113.90	104.75	40.70	270.75	229.25	46.20	255.90	115.00
90	195.15	129.45	264.40	163.80	151.25	74.75	328.25	281.25	82.50	289.50	137.00
100	235.65	162.90	320.80	206.30	191.50	112.30	370.25	329.25	121.00	317.90	158.60
110	275.40	192.90	360.60	245.30	228.90	149.25	397.75	365.00	157.50	341.40	177.00
120	304.45	224.20	390.20	286.90	266.75	180.95	418.00	389.25	190.30	359.50	196.90
130	329.35	254.65	412.30	324.60	305.15	210.80	433.75	408.00	221.20	374.70	216.40
140	349.25	278.85	427.00	352.90	332.75	237.80	446.75	422.50	251.10	387.70	233.30
150	367.40	299.50	440.50	373.80	356.65	269.05	457.00	433.75	284.60	399.30	247.80
160	383.25	314.50	450.30	391.00	374.15	297.90	464.00	443.25	311.90	408.70	258.80
170	397.00	328.30	459.10	403.50	389.10	319.10	470.00	450.75	333.60	416.80	267.70
180	408.80	339.55	465.00	414.20	400.35	339.30	472.50	456.00	351.70	422.50	276.30
190	419.15	349.10	470.00	422.90	409.90	353.25	472.75	460.75	366.90	428.00	283.70
200	427.75	357.80	474.00	429.80	418.45	366.35	473.75	463.00	380.20	432.40	289.10
210	435.10	365.40	475.20	435.60	426.00	376.60	473.50	463.00	390.60	436.70	295.30
220	442.50	373.35	474.50	441.50	431.85	385.00	472.75	463.00	400.10	440.10	299.60
230	449.35	380.40	473.80	445.40	437.55	392.40	470.75	462.75	408.70	442.50	303.80
240	454.45	387.10	473.10	447.50	441.40	398.95	469.75	461.50	415.40	444.70	307.90
250	458.00	392.50	471.40	449.60	444.40	404.65	468.50	460.50	422.00	446.00	311.00
260	461.15	397.30	469.70	451.60	446.55	409.35	467.25	459.25	426.80	447.90	313.90
270	463.30	401.40	468.00	453.50	448.55	413.20	465.00	457.75	432.50	448.10	315.90
280	465.50	405.10	466.30	452.80	450.40	416.90	463.50	455.75	436.40	448.40	317.90
290	467.60	408.25	463.60	452.00	449.85	419.75	462.00	454.25	439.30	448.60	319.80
300	468.70	409.70	461.80	450.30	448.30	421.75	460.50	452.00	441.30	448.70	320.70

A.4.11 Yield estimates for inclusion of hemlock volumes

Yield tables applied to existing stands were shown in Table A-16. and exclude hemlock volumes for those analysis units which are greater than 140 years of age. The following table shows the yield estimates if hemlock volumes are not excluded. These yield estimates were used in the sensitivity analysis for hemlock volume inclusion. Only those analysis units greater than 140 years are shown here.

Table A-18. Yield estimates for existing stands greater than 140 years - hemlock included

	Volume (cubic metres per hectare)								
Age	Fir/Wet G/M >141	Fir/Wet P >141	Cedar G/M >141	Cedar P >141	Hemlock G/M >141	Hemlock P >141	Balsam G/M >141	Balsam P >141	Spruce G/M >141
10	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
30	0.32	0	0.67	0.18	1.01	0.07	0.28	0	0.05
40	9.64	0.10	33.03	6.89	16.88	3.20	5.96	0.13	6.12
50	34.94	2.96	82.14	39.53	63.37	22.52	23.75	5.44	31.33
60	64.19	19.15	127.22	73.93	109.36	58.61	49.51	17.86	76.76
70	92.92	39.54	167.44	104.85	151.12	94.05	80.17	39.81	122.77
80	120.53	59.77	204.26	133.19	189.15	126.69	104.73	59.50	163.64
90	146.44	79.00	228.73	154.43	218.93	153.56	126.06	77.28	198.76
100	170.89	97.24	246.90	171.65	243.82	176.66	145.21	93.37	229.18
110	193.93	114.57	260.26	185.68	264.77	196.63	162.53	108.02	255.53
120	214.06	130.28	268.88	196.49	281.82	213.44	178.15	121.33	278.22
130	233.52	145.30	289.18	213.38	304.51	233.80	195.17	135.46	299.96
140	251.13	158.80	309.36	229.90	325.46	252.56	211.56	149.11	319.26
150	267.07	171.03	328.30	245.40	344.79	269.89	227.12	162.13	336.35
160	281.42	182.08	346.01	259.92	362.53	285.79	241.91	174.55	351.50
170	294.24	191.96	362.49	273.46	378.65	300.31	256.00	186.45	364.93
180	307.00	101.45	378.29	286.57	393.75	314.00	269.46	197.84	377.01
190	319.01	210.29	393.19	299.02	407.63	326.62	282.31	208.77	387.80
200	330.66	218.92	407.92	311.23	421.72	339.45	294.66	219.28	397.72
210	341.79	227.11	422.15	323.02	435.30	351.93	306.51	229.42	406.76
220	352.39	234.93	438.58	336.49	448.21	364.03	317.89	239.19	415.02
230	362.51	242.37	454.84	349.95	460.41	375.76	328.83	248.62	422.57
240	372.15	249.46	470.77	363.19	471.94	387.15	339.35	257.72	429.50
250	381.37	256.26	486.31	376.20	482.74	398.05	349.49	266.53	435.86
260	382.23	258.00	488.29	377.98	487.38	403.77	351.53	268.45	439.61
270	383.04	259.55	490.02	379.66	491.68	409.18	353.43	270.27	442.99
280	383.79	260.98	491.54	381.24	495.70	414.25	355.21	271.97	446.01
290	384.49	262.30	492.89	382.71	499.50	418.91	356.87	273.58	448.69
300	385.14	263.52	494.13	384.07	503.07	423.21	358.44	275.09	451.08
310	385.74	264.65	495.29	385.31	506.46	427.26	359.90	276.51	453.21
320	386.29	265.70	496.38	386.45	509.66	431.07	361.26	277.86	455.10
330	386.80	266.66	497.41	387.52	512.69	434.68	362.55	279.13	456.77
340	387.27	267.52	498.36	388.52	515.58	438.13	363.75	280.32	458.24
350	387.70	268.31	499.27	389.47	518.33	441.39	364.87	281.46	459.53

A.4 Forest Management Assumptions

A.4.12 Approximation of LRMP recommendations

In order to approximate the effects on timber supply of the LRMP Planning Team recommendations (December, 1994) it is necessary to alter some of the forest management assumptions which were used to develop the base case harvest forecast. It is important to note that while this timber supply analysis examines effects within the Kamloops TSA, the LRMP Planning Team makes recommendations on the TSA as well as the TFL areas. Therefore, the following changes apply only to the TSA portion of the Kamloops LRMP. As well, it is only possible to approximate the effects of LRMP Planning Team recommendations on timber supply since the data and assumptions used for the timber supply review were compiled in advance of the LRMP Planning Team recommendations.

Additional land base assumptions would require a 3.9% reduction to the timber harvesting land base.

- Community Watersheds: A re-evaluation of the ESA netdown within community watersheds has shown that an additional 3800 hectares would be netted out due to an implementation of terrain analysis recommendations.
- Recreation/Tourism Areas: Fine filter areas would require an additional 356 hectares to be netted out.
- Protected Areas: It was estimated that an additional 33 000 hectares would be netted out of the timber harvesting land base.

Areas lost to future roads, trails, and landings are reduced.

- The area lost to future roads, trails, and landings was reduced from 7.6% of stands greater than 20 years of age to 5.6%. It was assumed that rehabilitation of good and medium sites would input 16 300 hectares back into the timber harvesting land base at full productivity.

Changes to forest management practices.

- Green-up periods within the landscape management zone were reduced from 6 metres(25 years) to 4 metres(20 years) and the percentage of area allowed below green-up was increased from 10.7% to 13.4%.
- The Caribou late winter and early winter zones are now both managed on 150 year rotations, and the requirement for 12% of the caribou late winter zone to above 200 years of age has been removed.
- To account for biodiversity 10% of the standard management zone must always be above 200 years of age.