Merritt 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 review is examining 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 to be completed by the end of 1994. An important part of these analyses, however, 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 this TSA as part of the provincial Timber Supply Review. Two of these documents provide detailed technical information on the results of timber supply and socio-economic analyses. Another paper summarizes this information to provide a focus for public discussions of possible timber harvest levels. The fourth report outlines the Chief Forester's decision and 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 Merritt Timber Supply Area (TSA). This 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 this report only examines 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.**

The Merritt TSA consists of approximately 1.12 million hectares, of which about half a million hectares are considered available for timber harvesting under current management practices. The present AAC for the TSA is 1 204 250 cubic metres per year, excluding woodlot licences and non-replaceable timber sale licences.

While much of the TSA is managed according to integrated resource guidelines, approximately 31% of the land base available for timber harvesting has special management requirements for wildlife habitat and visual quality. Specific forest cover objectives have been established to account for these values. About 19% of the area available for harvesting is managed under a selection management regime.

The base case harvest forecast for the Merritt TSA has a starting harvest level of 1 204 250 cubic metres per year. Given current management assumptions, the initial harvest level can be maintained for 110 years. This is because of an abundance of mature forest. Approximately 77% of the TSA's timber harvesting land base is or soon will be available for harvest. After 110 years, the harvests begins to decline by 7% per decade until the long-term harvest level of 925 000 cubic metres per year is reached 140 years from now.

Much of the data and assumptions used in the analysis are subject to varying degrees of uncertainty. Sensitivity analyses were used to determine how data and assumptions impact the results of the timber supply analysis. Since there is an abundance of mature forest within the TSA, the first 8 decades of the harvest forecast is unaffected by any of the changes examined in the sensitivity analyses.

Increasing or decreasing to the volume estimates for existing stands, the size of the timber harvesting land base, or the amount of area covered by mature forests has the greatest impact on the length of time the starting harvest level can be maintained. The long-term harvest level is sensitive to volume estimates for regenerated stands, increasing or decreasing the size of the timber harvesting land base, longer or shorter regeneration delays, and increasing or decreasing green-up cover guidelines.

Table of Contents

Tables

Table of Contents

Figures

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, social and 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 conducting 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 upon 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 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 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 these 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 because 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 on which they are based remains relevant. Thus, it is important that re-analysis occur 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 throughout 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.

**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.*

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 (called *harvest forecasts**). These projections are made using different sets of assumed values or conditions for the factors discussed above. The third step is interpreting and reporting results.

Following are the sections of this report which document the timber supply analysis for the Merritt TSA:

- Section 1 - description of the Merritt TSA;
- Section 2 - data preparation and formulation;
- Section 3 - analysis methodology;
- Section 4 - analysis results;
- Section 5 - sensitivity of the results to uncertainties in the data and assumptions;
- Section 6 - summary and conclusions;
- Section 7 - references;
- Section 8 - glossary of terms; and
- Appendix - technical details about the data and assumptions.

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.

Harvest forecast
The flow of potential timber harvests over time. A harvest forecast is usually a measure of the maximum timber supply that can be realized, over time, for a specified land base and set of management assumptions. It is a result of forest planning models and is affected by the size and productivity of the land base, the current growing stock, and management objectives, constraints and assumptions.

1 Description of the Merritt TSA

The Merritt TSA comprises approximately 1.12 million hectares. It is situated within the Kamloops Forest Region and administered from the Forest District office in Merritt (Figure 1).

The TSA is characterized by the mountainous terrain of the Cascade Mountains to the west and the Thompson Plateau to the east. The two main river systems are the Tulameen-Similkameen in the south and Coldwater-Nicola in the north. Forests available for timber harvesting are dominated by stands of lodgepole pine, Douglas-fir, and spruce. The ecosystems in the area are prone to frequent and large fires.

The economy is dependent on several industries including forestry, ranching, mining, and tourism. Commercial harvesting of timber began in earnest around 1970. The forest industry today provides a substantial source of revenue and is the primary employer in the area. As well as forestry, the Merritt TSA has an outstanding beef raising industry. Mining is also a dominant activity, with mines located north of Merritt and in Princeton. Tourism and recreation is becoming increasingly important in the area because of its excellent outdoor recreational opportunities and its accessibility to the large population centres of both the Lower Mainland and the Okanagan Valley.

Figure 1. Map of the Merritt Forest District within the Kamloops Forest Region.

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 1993. This file contains 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 represents the entire land base of the TSA. It includes data for 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 (such non-contributing areas specific to the Merritt TSA are described below). Before this land base file is used to make timber supply projections, data for these non-contributing areas are removed to arrive at a file that represents the timber harvesting land base*.

This reduced data file is derived through a computer process that identifies information for non-contributing areas and removes it from the file. When making these reductions, care is taken to ensure that only single reductions are 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 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. The timber supply is managed within that integrated resource context, and the timber supply analysis 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 logging 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.

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

- areas not managed directly by the B.C. Forest Service — these include non-Crown land, areas managed by other agencies (for example, parks, recreations areas) and forest land not administered as part of the TSA (for example, woodlot licences or Tree Farm Licence (TFL)*.
- non-forest areas — areas not capable of growing productive forest (for example: rock, swamp, and alpine areas).
- 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.

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.

Tree Farm Licence (TFL)
Provides rights to harvest timber, and outlines responsibilities for forest management, in a particular area.

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 timber harvesting may cause avalanches.

2 Information Preparation

- non-merchantable forest types* — forest types of poor timber quality or low timber volume that cannot be economically harvested as sawlogs. This includes sites with low timber growing potential (low site index*) and pine stands with a very high density of trees per hectare.
- specified no harvest areas — these areas include: portions of the Pennask Local Resource Use Plan, Stoyoma Mountain Wilderness, heritage and recreation trails, and lakeshore management areas. Harvesting in these areas is not currently allowed.
- streamside buffers — a 1.5% area reduction was applied to account for areas of land adjacent to major streams.
- roads, skid trails, and landings — to account for the loss of productive forest land that has occurred during past timber harvesting and development, 11.3% of all areas currently younger than 21 years and 1.0% of all areas greater than 20 years are removed. As harvesting occurs, the British Columbia Forest Service timber supply model deducts future losses related to timber harvesting.
- not satisfactorily restocked (NSR) areas* — these areas are initially removed, but once replanted the portion of the total NSR area still considered available for timber is added back into the timber harvesting land base.

Table 1 summarizes the areas represented by these categories, and shows the area of the timber harvesting land base. A more detailed description of these categories and the rationale for the removals and additions is provided in Appendix A, "Description of Data Inputs and Assumptions."

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.

Site index
A measure of site productivity. Site indices are based on tree height as a function of stand age and are usually expressed graphically as site index curves. A number of site index curves have been developed for British Columbia's major commercial tree species.

Not satisfactorily restocked
An area not covered by a sufficient number of tree stems of desirable species. Stocking standards are set by the 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, Merritt TSA 1994.

Classification	Area (ha)	Area (ha)	% of total area	% of productive forest area
Total land base		**1 115 914**	100.00	
Not-managed by the B.C. Forest Service		-206 632	18.52	
Non-forest		-96 770	8.67	
Total productive forest managed by Forest Service (Crown forest)		812 512	72.81	100.00
Reductions to Crown forest:				
Non-commercial cover	3 157		0.28	0.39
Environmentally sensitive	59 768		5.36	7.36
Deciduous forest types	6 703		0.60	0.82
Non-merchantable forest types	174 877		15.67	21.52
Pennask LRUP	107		0.01	0.01
Stoyoma Mountain Wilderness	1 339		0.12	0.16
Heritage trails	1 039		0.09	0.13
Lakeshore management	2 826		0.25	0.35
Lakeshore VQOs*	380		0.03	0.05
Streamside buffers	7 962		0.71	0.98
Existing roads, landings, and trails	11 731		1.05	1.44
Not satisfactorily restocked	31 131		2.79	3.83
Total current reductions	301 020	-301 020	-26.98	-37.05
Initial timber harvesting land base		511 492	45.84	62.95
Additions:				
Not satisfactorily restocked	15 985[a]			
Rehabilitation*	956			
Total additions	16 941	16 941	1.52	2.09
Total current timber harvesting land base		528 433	47.35	65.04
Future reductions:				
Future roads, landings, and trails	37 640	-37 640	-3.37	-4.63
Long-term timber harvesting land base		490 793	43.98	60.40

[a] Only portion of the NSR is scheduled for restocking. The remaining area 15 146 ha - is assumed not to contribute to the timber harvesting land base.

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.

Rehabilitation
Removing all non-commercial cover, preparing the site and stocking it with acceptable commercially valuable species.

2 Information Preparation

Figure 2 summarizes the land base categories for the Merritt TSA. The figure shows that almost three-quarters (73%) of the TSA is Crown forest land and that approximately 63% of that land is available for timber harvesting. Overall, the initial timber harvesting land base, hereafter referred to as the timber harvesting land base, accounts for about 46% of the total TSA area (Table 1).

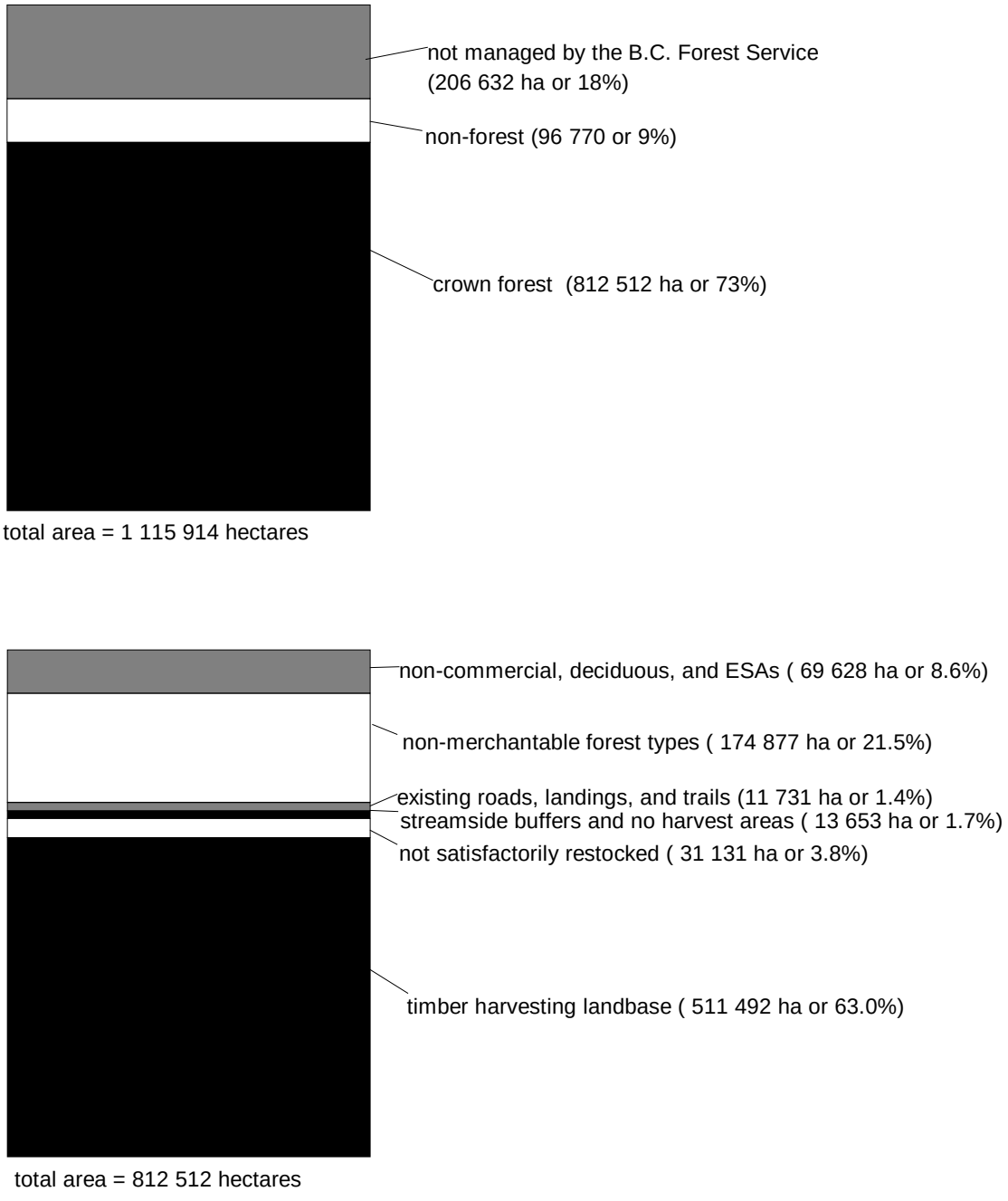

Figure 2. Classification of the total and Crown forest land bases, Merritt TSA.

2 Information Preparation

Figure 3 shows the timber harvesting land base by species group and maturity. A stand is considered mature if it is older than the minimum harvestable age (80 years for stands predominately lodgepole pine and 100 years for all other species). Areas to be selectively harvested are included for completeness. Overall, 77% of the land base consists of mature stands. The leading lodgepole pine types make up approximately 52% of the mature area and 67% of the total timber harvesting land base.

Figure 4 shows the current stand age class distribution of the timber harvesting land base in the Merritt TSA. Selectively harvested areas have not been included in the age class distribution because stands managed by these methods consist of trees that are all different ages. At present, 66% of the timber harvesting land base is greater than 100 years of age with those stands between the ages of 80 and 100 years making up approximately 11% of the TSA. Therefore, a large portion (77%) of the Merritt TSA timber harvesting land base is above the minimum harvestable ages used in this analysis.

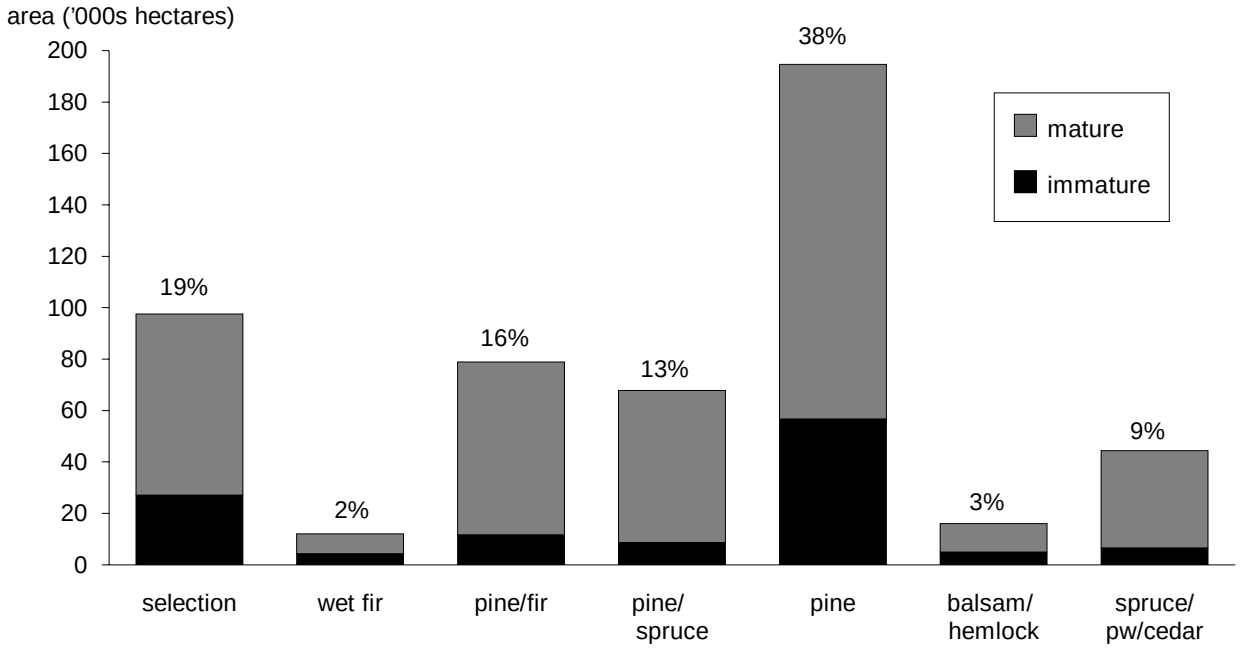

Figure 3. Area by dominant tree species and maturity, Merritt TSA timber harvesting land base.

2 Information Preparation

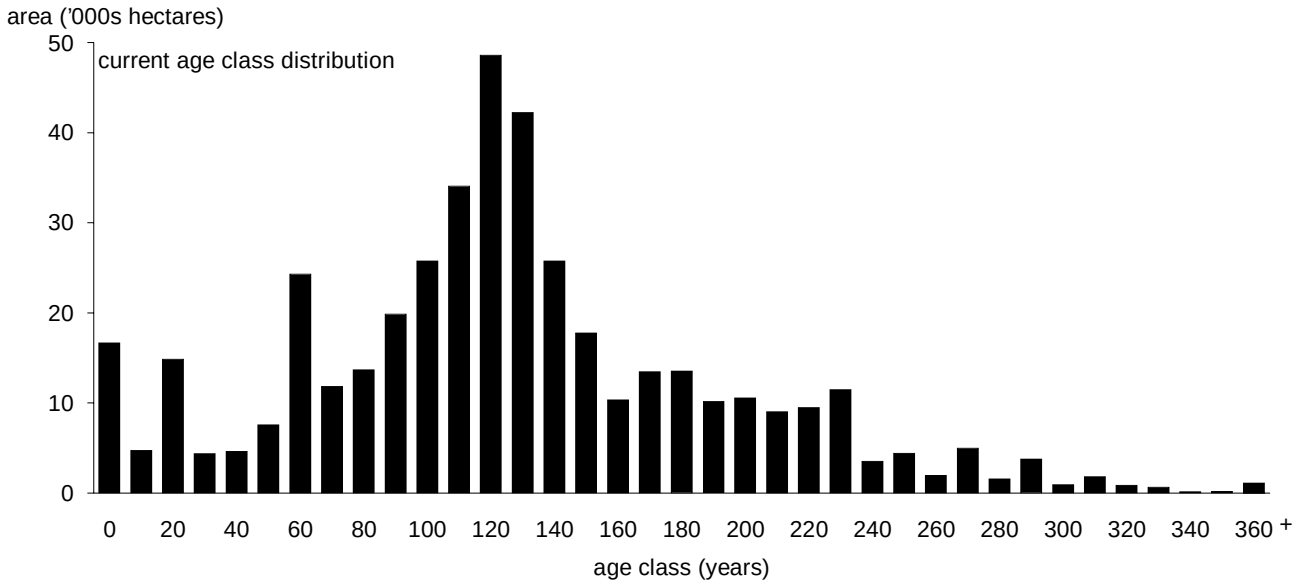

Figure 4. Current age class distribution, Merritt TSA timber harvesting land base.

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 establishes minimum size limits for trees and logs that must be harvested and removed from a site. Utilization levels specify a maximum stump height and minimum diameters at the tree base and top.

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

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 for the area. Staff in the Kamloops Forest Region and Merritt Forest District defined these practices as described in the following management assumptions*.

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 harvest ages, utilization levels, integrated resource guidelines and silviculture and pest management programs.

2 Information Preparation

- Basic silviculture levels — reforestation activities required to establish free-growing stands* of acceptable species after harvesting, as well as the basic silvicultural systems used in the TSA. In the Merritt TSA most areas are managed using a clearcut harvesting* system followed by planting or natural regeneration.
- Selection management — about 19% of the timber harvesting land base is ecologically suited to management by selection harvesting. It is assumed that these areas will be entered every 40 years with approximately one-third of the volume being removed on each entry. This allows the stand to be completely harvested every 120 years. Stands managed this way will contain trees of various ages (referred to as uneven-aged).
- Forest health and unsalvaged losses — expected timber losses to fire, pests (insects, disease, wind damage and animals). In the Merritt TSA unsalvaged losses are estimated to be 116 910 cubic metres per year. (These losses have been subtracted from all of the harvest forecasts shown in this report.)
- Utilization levels — minimum tree and log size limits to be removed from the site.
- Minimum harvestable ages — the time it takes for stands to grow to merchantable size. The minimum harvestable age defines the lower limit for harvesting. Actual harvest age depends on many factors, including the ages of other stands, limits on the overall harvest level, and forest cover requirements.
- Rate of restocking current and backlog NSR — schedule of restocking by species and area are presented in Appendix A, "Description of Data Inputs and Assumptions."
- Cutblock adjacency* and green-up* — guidelines that specify the spatial distribution of cutblocks and the amount of time (green-up period) required for regenerated stands to reach some desired condition before adjacent mature timber may be harvested. Green-up guidelines allow no more than a specified percentage of the forest to be younger than the green-up age.
- Forest cover objectives — specify the desired distribution of areas by age class groupings. These objectives are used to specify 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."

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.

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

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

2 Information Preparation

2.4 Management zones

In the Merritt TSA, the definition of specific areas into management zones 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 future forests of the 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 certain resource values, such as wildlife, visual quality, or timber are particularly important. As well, areas where selection management is to be practiced were delineated. The timber harvesting land base was divided into four different management zones. Figure 5 summarizes the area breakdown by management zone and the following description of the management zones explains the emphasis of forest management for each zone.

- Ungulate winter range zone — to maintain or enhance forage production by dispersing the harvest and to maintain forest cover for snow interception. The cover requirements ensure that at any time no more than 20% of the area may be under cover of stands below 3 metres in height (14 years of age) and that at least 7.5% of the area be under cover of stands at least 20 metres in height (88 years of age). A significant portion of the ungulate winter range is managed by selection harvest. These areas were included in the selection management zone.
- Landscape management zone — the primary goal in this zone is to maintain visual quality along corridors where people live, work, recreate, and travel. The forest cover requirements indicate that at any time no more than 11.2% of the area may be less than 5.5 metres in height (23 years of age) and that at least 13.4% of the area be under cover of stands taller than 20 metres in height (92 years of age).
- Selection management zone — this zone is made up of areas which are managed under selection harvesting methods. Normal forest cover requirements do not apply as only small cleared patches are created during harvest and it is assumed that these types of harvesting systems will satisfy the forest cover requirements specified for the other management zones.
- Integrated resource management zone — the emphasis of this zone is for a long-term management regime which integrates all resource values. The cover requirements ensure that at any time no more than 36.4% of an area be covered by stands below 3 metres in height (16 years of age) and that at least 13.5% of the area be covered by stands taller than 20 metres (93 years of age) at any one time.

2 Information Preparation

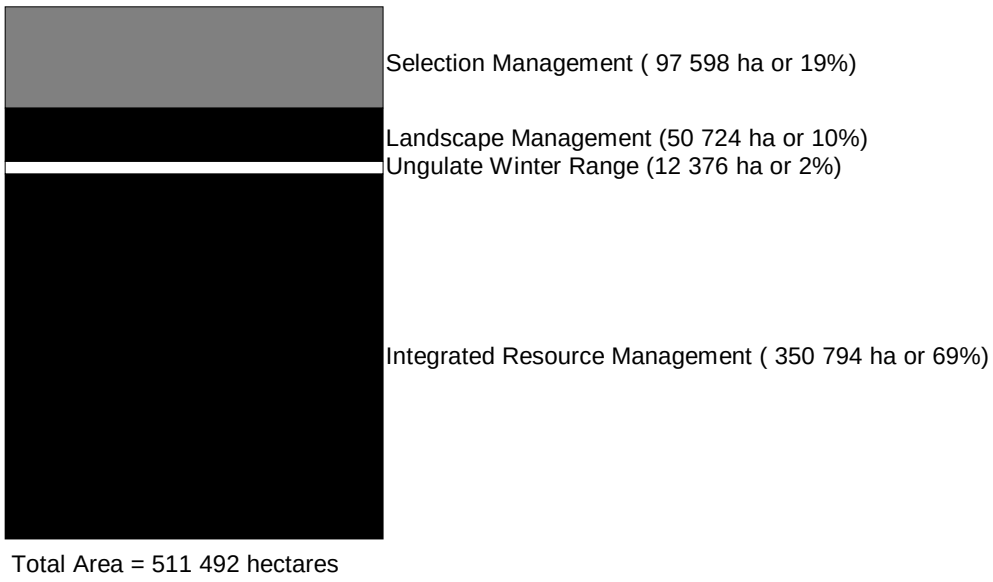

Figure 5. Management zones, Merritt TSA timber harvesting land base.

3 Analysis Methods

The purpose of this analysis was to examine both the short- and long-term timber harvesting opportunities in the Merritt 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. Because the harvest flow remains constant from years 200 to 400, only the results for the first 250 years are shown graphically in this report.

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. However, the Forest Service model differs from most other models in that it 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 cutblock adjacency 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 older than a certain age to provide wildlife habitat. The B.C. Forest Service simulation model examines 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 when 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 the results of the timber supply analysis for Merritt 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." The base case provides only a part of the timber supply picture in Merritt TSA and should not be viewed in isolation of the sensitivity analysis.

4.1 Harvest forecast

The harvest forecast based on current management assumptions for the Merritt TSA is referred to as the base case harvest forecast and is shown in Figure 6. The current harvest level of 1 204 250 cubic metres per year can be maintained for 11 decades. The harvest level then declines by 7% per decade, reaching the long-term harvest level of 925 000 cubic metres per year in 140 years time.

The harvest flow illustrated in Figure 6 is based on maintaining the current harvest level for as long as possible, followed by an orderly decline to the long-term level, without significant shortfalls below the long-term level. This objective is applied consistently for all of the harvest forecasts in this report.

4 Results

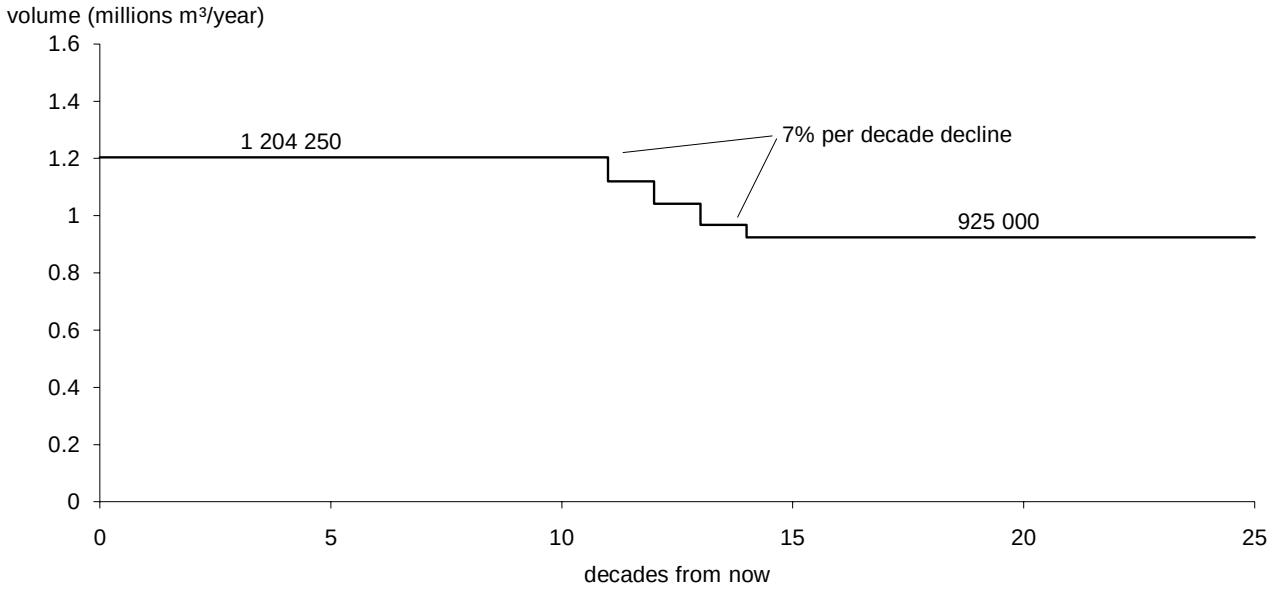

Figure 6. The base case harvest forecast, Merritt TSA.

The long-term level ensures that growing stock* is maintained at a near constant level once most of the initial forest is replaced by a second-growth forest. The stability of the growing stock volume over time serves as an indicator that the long-term harvest level shown in Figure 6 is close to the maximum that can be maintained. Figure 7 shows the projected timber growing stock and the impact that the harvest flow shown in Figure 6 has on it. The current total growing stock of 102 million cubic metres is projected to decline over the next 140 years to an approximate long-term level of 50 million cubic metres. The initial decline in growing stock reflects the transition of the timber harvesting land base from an area consisting largely of older forests to an area of younger, managed forests.

The available growing stock from stands of harvestable age, excluding those required to meet mature cover criteria, is also shown in Figure 7. Beginning at about 85 million cubic metres (82% of the total growing stock), the available timber volume declines to an average of 21 million cubic metres (42% of the total growing stock). The growing stock volumes shown do not include volume from the selection management areas of the TSA because of the method used to estimate yields for these areas. The initial volume of total growing stock within the selection management zone is estimated to be about 18 million cubic metres. This volume declines to approximately 5 million cubic metres over the long term.

Growing stock
The volume estimate for all standing timber, of all ages, at a particular time.

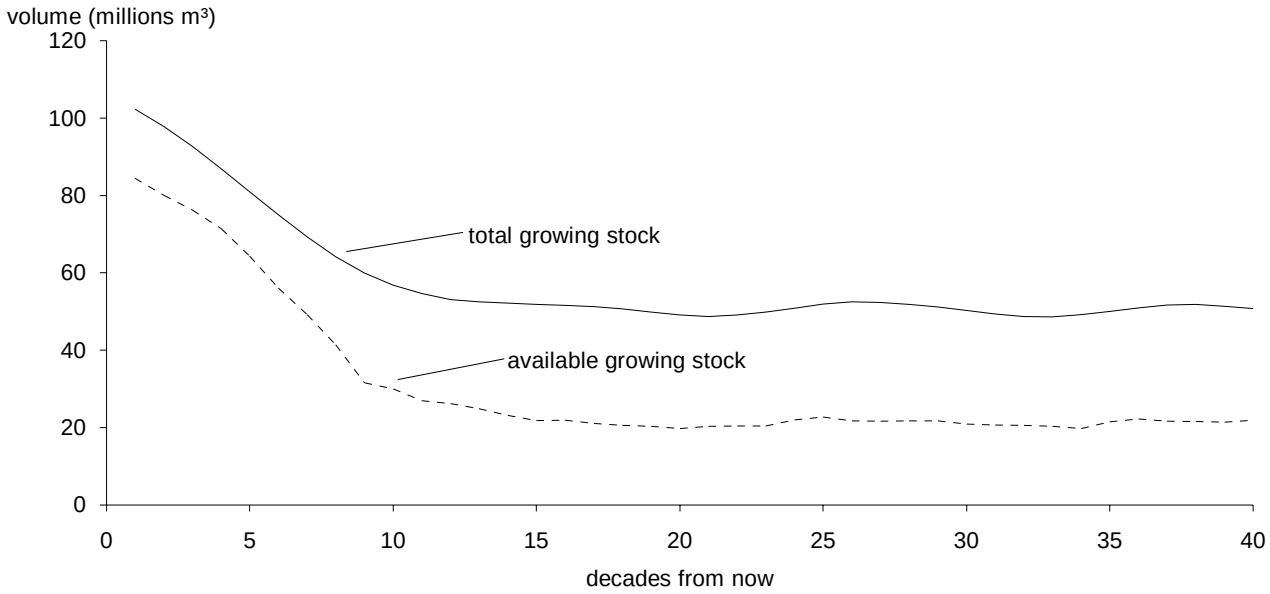

Figure 7. The base case growing stock over time, Merritt TSA.

It is important to note that the long-term harvest level of 925 000 cubic metres per year is less than the maximum average growth rate of the Merritt TSA land base. The theoretical level of approximately 1 151 000 cubic metres per year, is not achievable for several reasons. Losses from fire and other causes must be deducted from the theoretical maximum, reducing the maximum to about 1 034 000 cubic metres per year (the base case long-term level is approximately 90% of this level). As well, stands are not necessarily harvested at the age that maximizes volume yield over the long term 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. **The forecasts are for discussion purposes only and are not intended to suggest a particular AAC.**

4.2 Age class distribution over time

Figure 8 shows the changes that occur in the age class distribution over the 250 year planning horizon under the base case harvest forecast. Selection management areas have not been included in the age class distribution as stands managed by these methods do not have a defined age. Stands under selection management consist of trees that are all different ages and thus do not fall into a single age class.

Initially, 30% of the timber harvesting land base consists of stands over 140 years of age and 24% consists of stands less than 80 years of age. A large amount of area (46%) falls within the range of 80 to 140 years. The current age class distribution indicates that approximately 77% of the timber harvesting land base for the Merritt TSA is or will soon be available for harvest. Over the planning horizon, the age class distribution gradually becomes more balanced. As Figure 8 shows, the forest cover guidelines for mature cover result in approximately 5% of the area remaining above 140 years at all times.

4 Results

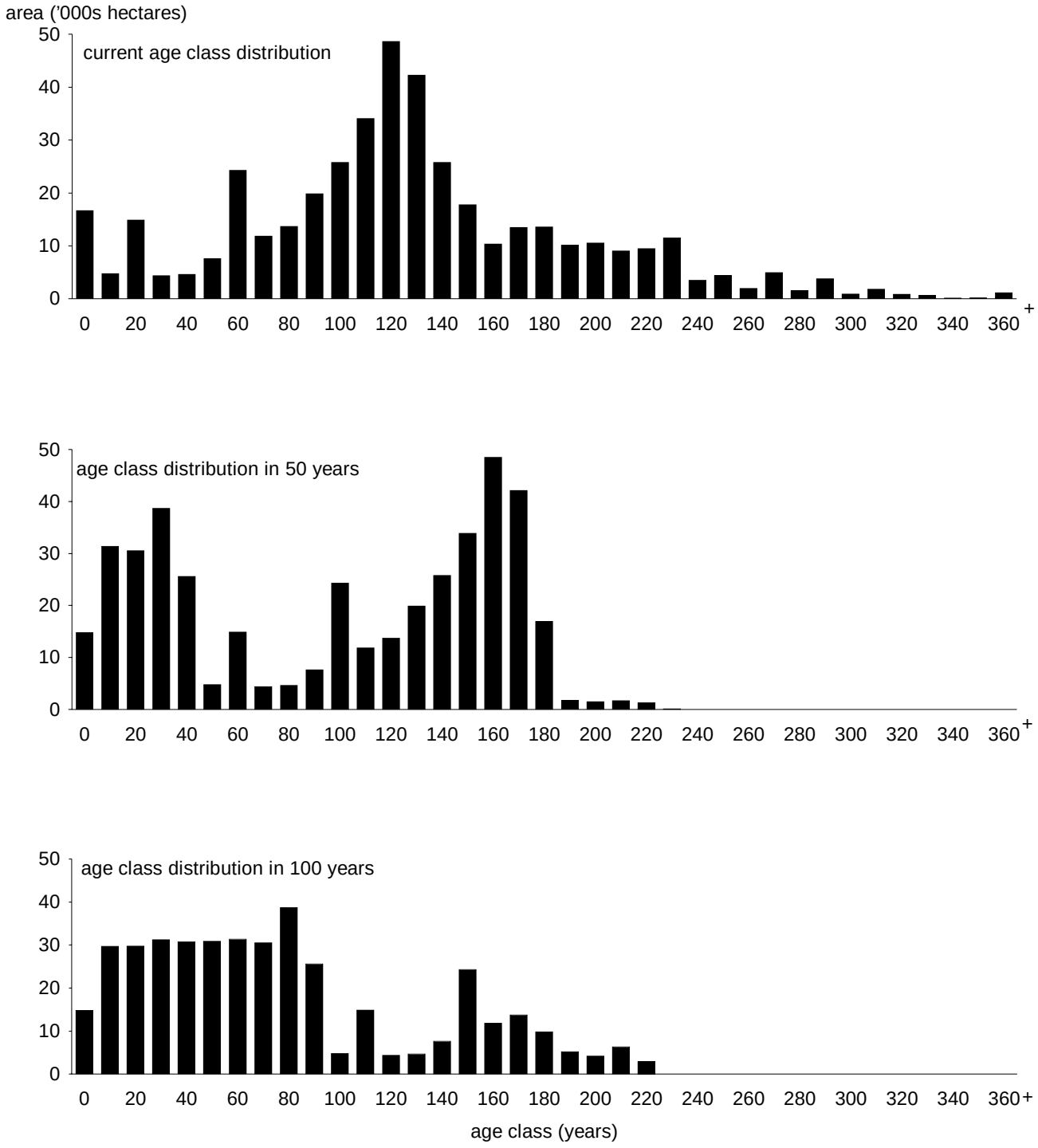

Figure 8. Age class distribution over time for the timber harvesting land base, Merritt TSA.

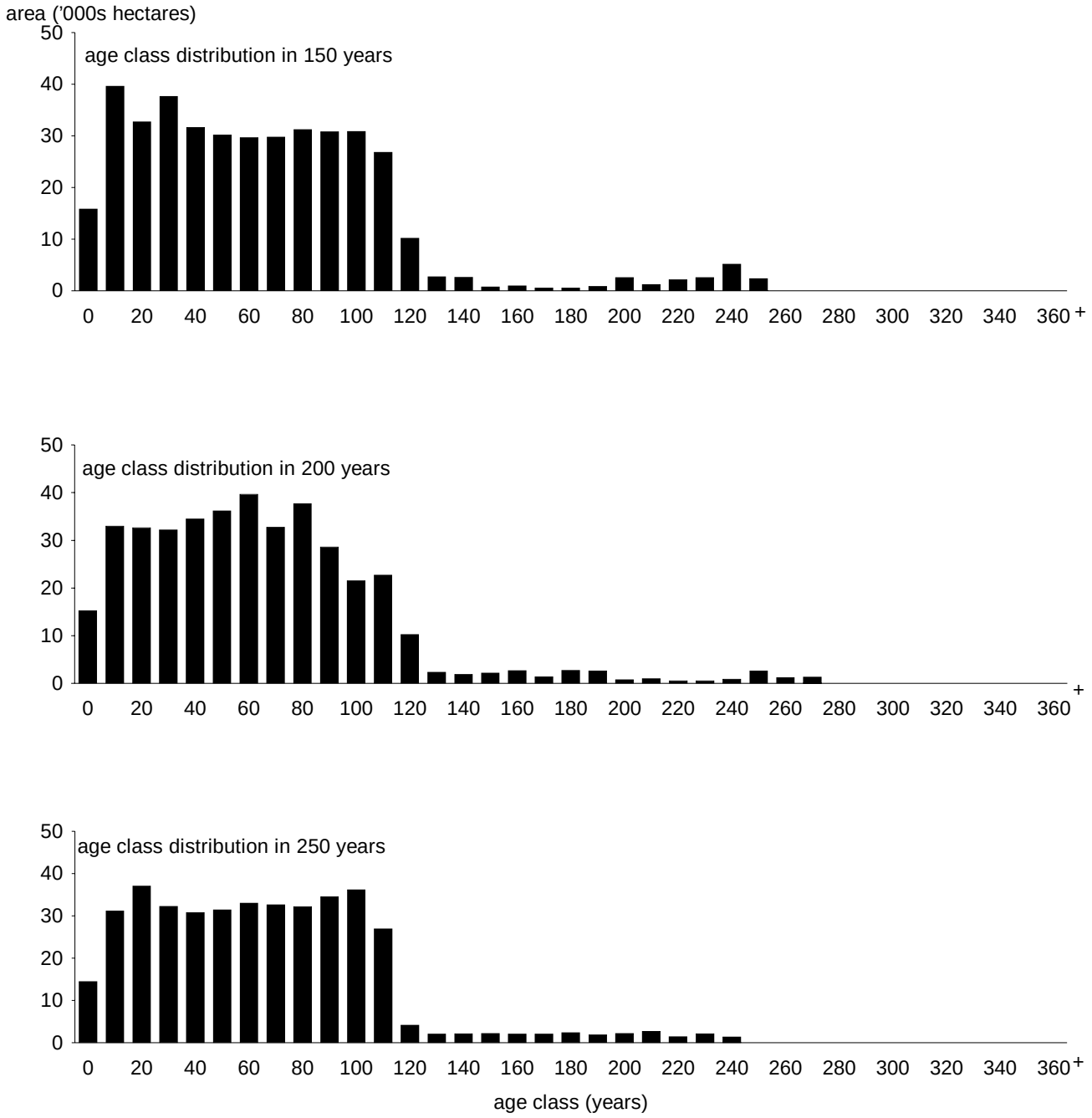

Figure 8. Age class distribution over time for the timber harvesting land base, Merritt TSA. (concluded)

4 Results

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

Figure 9 shows the total area harvested each year by clearcutting and selection harvesting methods. Initially, the average area harvested by clearcutting is approximately 3225 hectares per year. The average area harvested peaks in decades 11, 14, and 15, corresponding to declining average harvest ages and lower average yields from harvested stands, as shown in Figures 10 and 11. A shift to harvesting of second-growth stands begins around decade 10. This harvesting of younger stands with lower volumes requires that more area be harvested to meet the same harvest level as in the previous decade. Over the long term, average area harvested by clearcutting is approximately 3370 hectares per year.

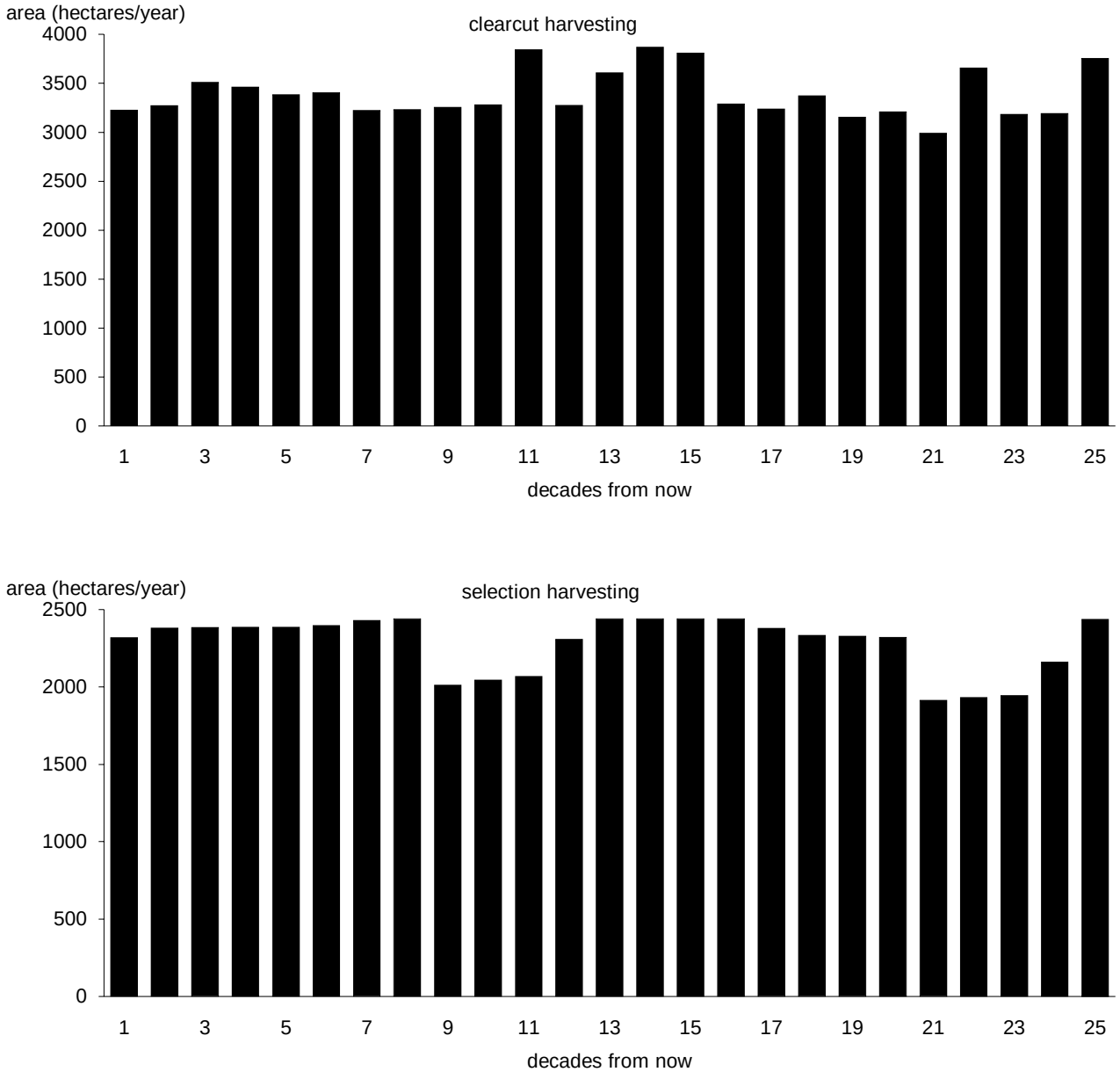

Figure 9. Area harvested annually for the base case, Merritt TSA.

4 Results

It is important to note the difference between clearcut and selection harvesting methods. Under selection management, which involves the harvesting of individual trees or small patches of trees, only a portion of the volume is removed. Thus the volume per hectare harvested is much lower than in clearcut areas where essentially all the volume is removed. As a result, clearcutting requires less area be disturbed relative to selection stands to meet the same total harvest volume. Initially 14% of the volume harvested comes from selection stands but, as Figure 9 shows, 42% of the total area harvested is from selection management areas. The average area harvested by selection methods starts at approximately 2320 hectares and remains relatively constant. Over the long term, the average area harvested each year is about 2250 hectares.

The trend in average harvest ages for clearcut-harvested stands is shown in Figure 10. Again, selection management stands are not included because the trees that make up these stands are all different ages and do not fall into a single age class. The average harvest age starts at about 245 years and declines to about 180 years by decade 4. It then remains relatively steady as the balance of existing forest is harvested and regenerated to a managed forest. As the shift to harvesting second-growth stands occurs, the average harvest age declines beginning in decade 10 to reach the long-term average harvest age of about 120 years in decade 14.

Figure 11 shows the changes in average volume harvested per hectare over time for clearcut-harvested areas. The average yield over the first 10 decades is about 340 cubic metres per hectare. After this point, the harvest shifts to second growth-stands with a corresponding drop in volume per hectare. The long-term average volume per hectare harvested is approximately 280 cubic metres.

4 Results

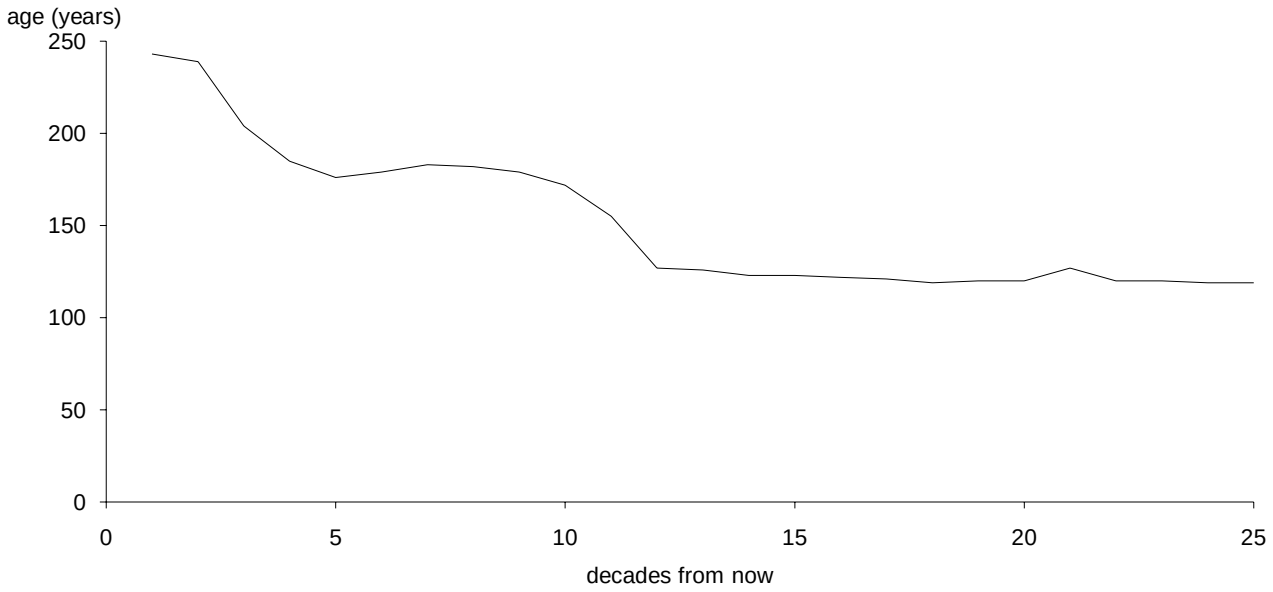

Figure 10. The base case average harvest age over time, Merritt TSA.

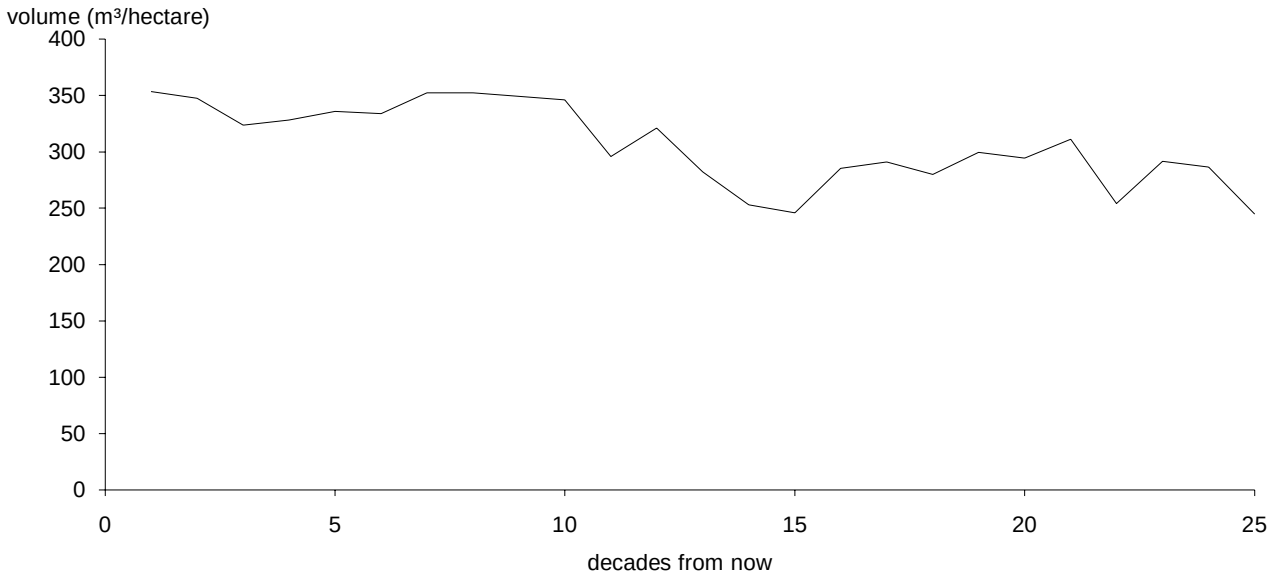

Figure 11. The base case average volume per hectare harvested over time, Merritt TSA.

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 values 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 that become apparent from new information are not missed.

Another important way of dealing with uncertainty is to assess its potential effects on values of interest, for example, timber supply. Every decision either implicitly or explicitly incorporates an attitude towards uncertainty. If we believe that existing information accurately reflects reality, we are being neutral to uncertainty, believing essentially that any inaccuracies probably balance out. Ignoring uncertainty is implicitly neutral. If maximizing timber supply were the goal, someone with an optimistic position 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 assist in the provision of input by people with different attitudes towards forest management and uncertainty.

Sensitivity analysis is one way of evaluating how uncertainty could affect analysis results, and ultimately, decision-making. One purpose of sensitivity analysis is to highlight which variables most affect results. For example, it is possible that small inaccuracies in estimating some variables could have large effects on timber supply, or that fairly large inaccuracies in other variables could have negligible effects. Sensitivity analysis can therefore highlight priorities for collecting information for future analysis. It can also clarify whether current best estimates provide safe bases for decisions, or whether high uncertainty about important variables means more conservative decisions may be wiser.

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

5.1 Changes in harvest flow over time

For a given set of forest management assumptions, many different harvest flows are possible. The base case harvest forecast in this analysis has a starting harvest level of 1 204 250 cubic metres per year. After decade 11 the harvest rate drops by 7% per decade to reach the long-term harvest level of 925 000 cubic metres per year 140 years from now. This section examines three alternative harvest flows. Figure 12 shows the effect of decreasing and increasing the initial harvest level from the base case.

Decreasing the initial harvest level so that it is 10% above the base case long-term harvest level allows the initial harvest rate of 1 077 500 cubic metres per year to be maintained for at least 25 decades. Although not shown in Figure 12, the harvest level declines to the long-term level in decade 27.

Since the base case harvest forecast shows the starting harvest level can be maintained for a long time, it might be possible to increase the initial harvest rate above the base case without falling below the long-term harvest level. Figure 12 shows two such alternatives. One alternative examines the maximum potential harvest that can be maintained for the first 3 decades while limiting the rate of decline per decade to 5%. When these constraints are applied, the initial harvest level is 1 483 000 cubic metres per year, 23% above the base case initial level.

5 Timber Supply Sensitivity Analyses

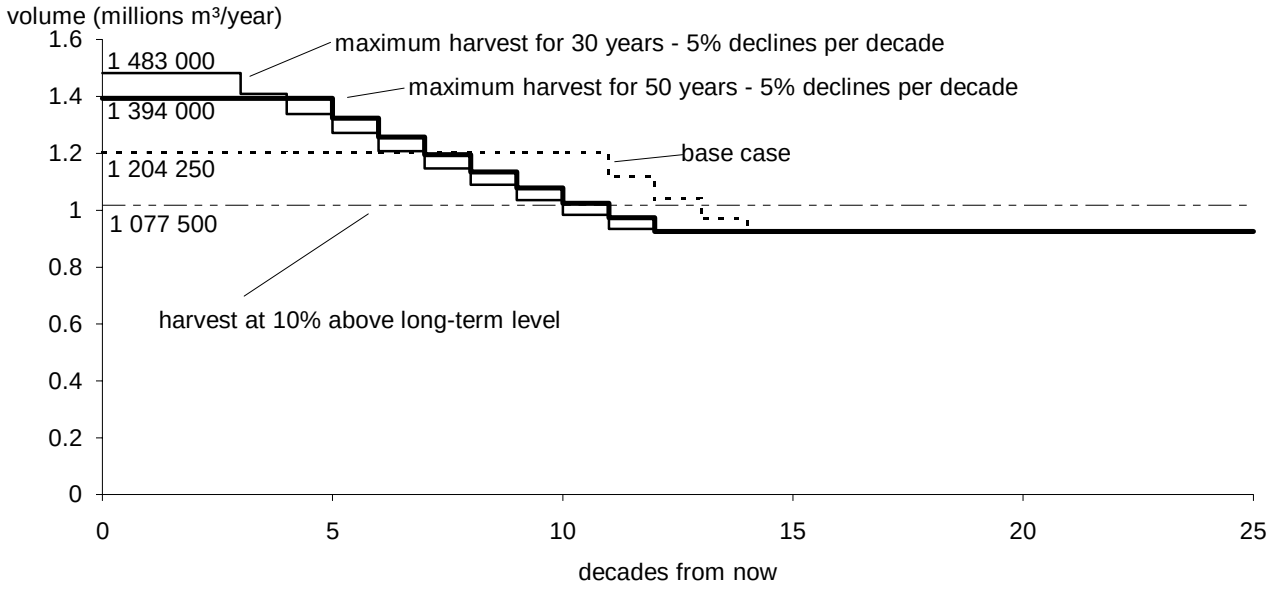

Figure 12. Alternative harvest forecasts, Merritt TSA.

During the first 140 years the total amount harvested is approximately 124 000 cubic metres (0.4%) more than the base case.

The second alternative examines the potential harvest that can be maintained for 50 years while limiting the decline per decade to 5%. In this case, the initial harvest level is 1 394 000 cubic metres per year, 16% above the base case starting level. During the first 140 years the total amount harvested is approximately 487 000 metres (1.56%) greater than the base case.

5.2 Minimum harvestable ages

In the base case, the minimum harvestable ages (outside the selection management zone) were set at 80 years for lodgepole pine types and 100 years for all other species. Given these ages, the average minimum harvestable age, area weighted, for the Merritt TSA is approximately 84 years. If harvests were to occur at the maximum mean annual increment* (MAI) age, the average weighted harvest age would be about 108 years. Actual harvest ages in most cases are higher, as indicated in Figure 10 where the long-term average harvest age is approximately 120 years. The effects of varying minimum harvestable ages by 20 years are shown in Figure 13.

If minimum harvestable ages are increased by 20 years, the average weighted minimum harvestable age increases to 104 years. The initial harvest level of 1 204 250 cubic metres per year can be maintained for 10 decades, 10 years shorter than the base case. The long-term harvest level however, shows a slight increase to 927 000 cubic metres per year, when compared to the base case harvest forecast. Extending the minimum harvestable age has two primary effects. First, there is less timber available for harvest immediately. Since the current age class distribution of the Merritt TSA (Figure 4) shows that approximately 66% of the timber harvesting land base is covered by stands older than 100 years and 30% older than 140 years, there is no short-term effect on harvest flow by extending minimum harvestable ages. Second, the amount of time which passes before regenerated stands become available for harvest increases.

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.

As shown in Figure 13, the starting harvest level cannot be maintained for as long as the base case and the rate of decline to the long-term harvest level increases from 7 to 9% per decade. However, the extension of minimum harvestable ages allows more stands to be harvested closer to the age which maximizes the total volume harvested over the long term. Therefore, the long-term harvest level shows a small increase, 2000 cubic metres per year, over the base case.

The results of reducing minimum harvestable ages by 20 years are not shown in Figure 13 because the harvest flow does not differ from the base case. Normally, lower minimum harvestable ages increase short-term timber availability by reducing the amount of time before second-growth stands can be harvested. However in this case, forest cover requirements for green-up and mature forest cover place greater limits on the timber supply than minimum harvestable ages. As a result, if minimum harvestable ages were 20 years younger, harvest levels would not be affected.

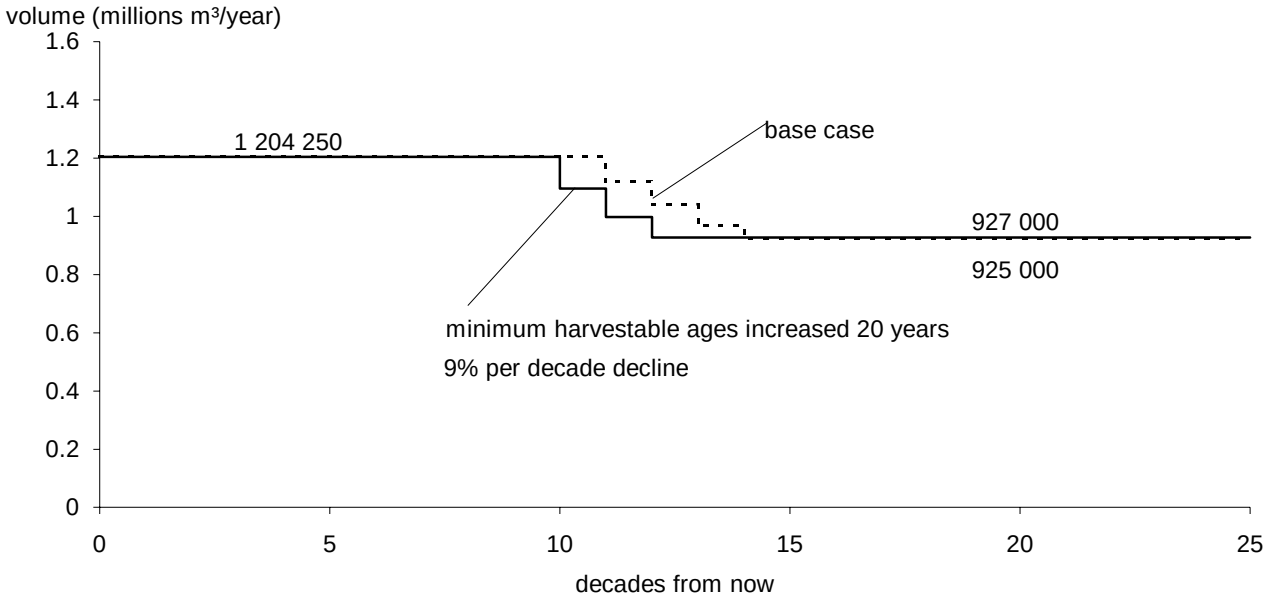

Figure 13. Harvest forecast with minimum harvestable ages increased by 20 years, Merritt TSA.

5.3 Existing stand volume estimates

Volume estimates from the Variable Density Yield Prediction (VDYP) model were used in the base case for existing stands. Uncertainty associated with these estimates stems from such factors as: the statistical process used to develop the VDYP model, the inventory classification procedures, and the potential for changes in 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 assumed for the base case, the initial harvest level can be maintained for 150 years, 4 decades longer than the base case. The harvest level then declines by 7% per decade to the long-term level 18 decades from now. 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 for a longer period of time.

If volume estimates for existing stands are 10% lower than was assumed for the base case, the initial harvest level can be maintained for 70 years, 4 decades shorter than the base case. The harvest level then declines by 7% per decade to the long-term level 10 decades from now. Note that in both cases, changes in estimates of existing stand volumes do not affect the long-term harvest level.

5 Timber Supply Sensitivity Analyses

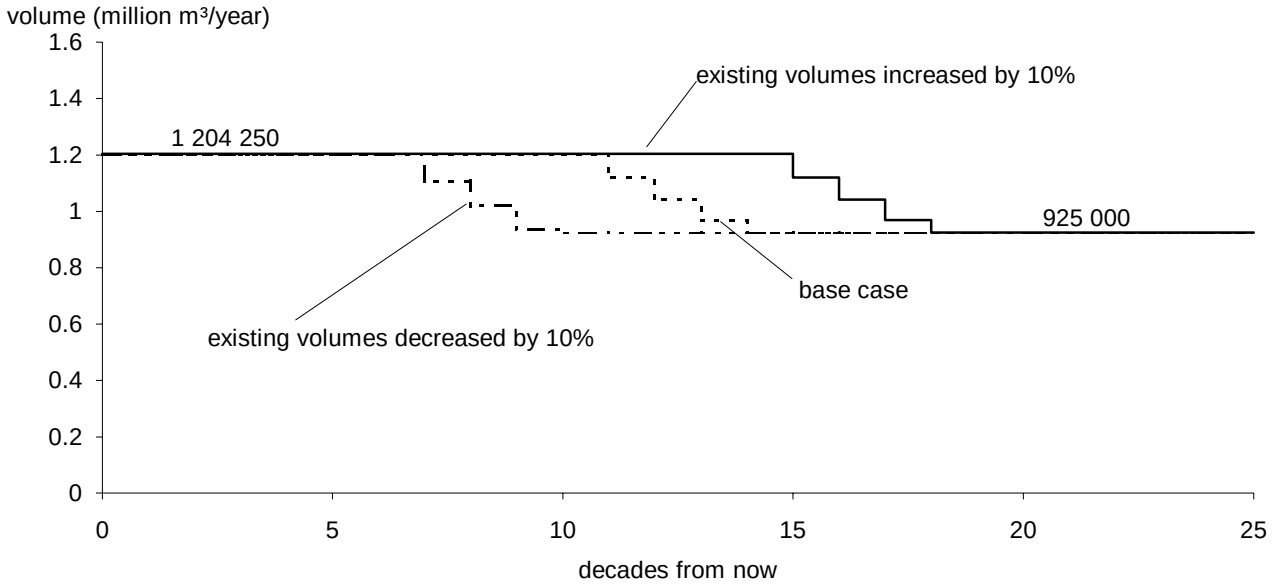

Figure 14. Harvest forecasts with existing volumes changed by 10%, Merritt TSA.

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 (outside of the selection management zone). Future stand yields are expected to be higher than existing stand yields because of better stand management techniques, such as density control and planting of higher quality stock. In general, the yields estimated from the TIPSY model are 18% higher than those estimated from the VDYP model using maximum mean annual increment ages and 21% higher using minimum harvestable ages. However, estimates of future volumes have a degree of uncertainty because most of the stands on which these projections are made have not reached a harvestable age. Reductions in productivity may occur due to soil degradation or increased incidence of pests or increased use of smaller or lower quality timber. Increases in yields may occur because of intensive silviculture. 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% lower, the initial harvest level can be maintained for 10 decades, followed by a decline of 7% per decade to a long-term harvest level of 824 000 cubic metres per year, 11% below the base case long-term level in decade 15.

If future stand volumes are 10% higher than those of the base case, the initial harvest level can be maintained for an additional decade and the long-term harvest level increases to 1 030 000 cubic metres per year, 11% higher than the base case. An additional effect of increased regenerated stand volume estimates may be that regenerated stands can be harvest sooner. If minimum harvestable ages are reduced by 20 years in conjunction with an increase in future stand yields, there is no change from the harvest forecast shown in Figure 15. As indicated in Section 5.2, "Changes in harvest flow over time," cover constraints are more binding than minimum harvestable ages during these decades.

5 Timber Supply Sensitivity Analyses

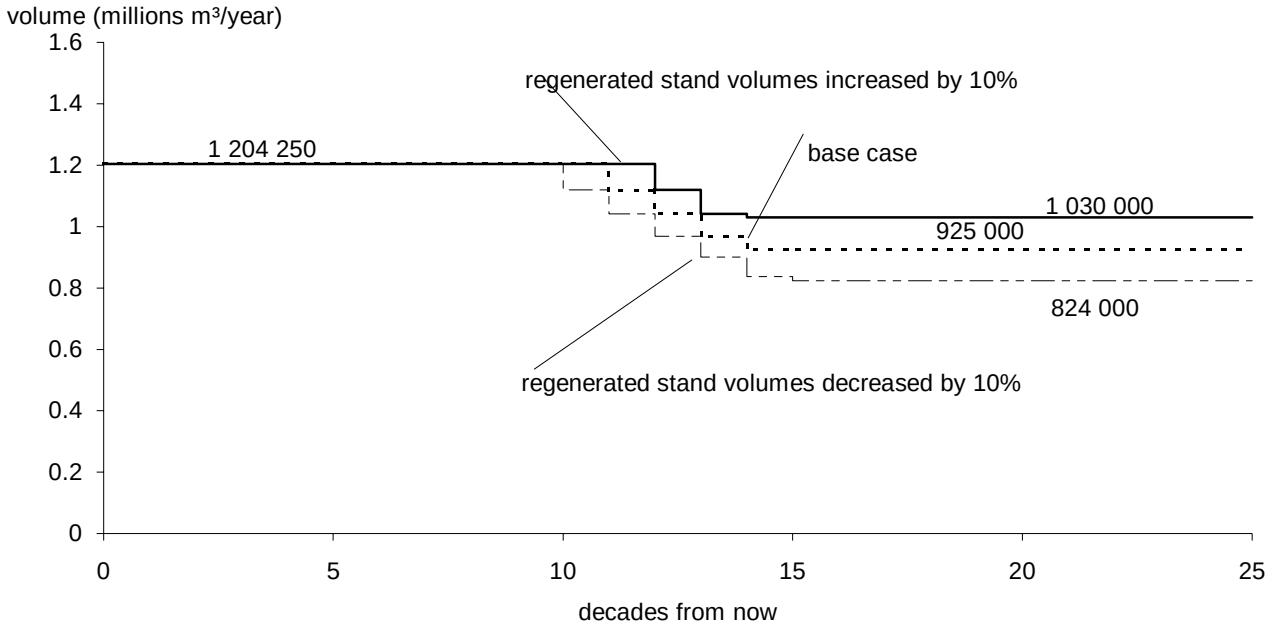

Figure 15. Harvest forecasts with regenerated volumes changed by 10%, Merritt TSA.

5.5 Regeneration delays

The regeneration delay* is the period of time between harvest and occupation of an area by a specified minimum number of acceptable well-spaced trees. The regeneration delay affects how soon stands will reach the prescribed green-up and mature cover ages as well as the amount of time it takes for regenerated stands to become available for harvest. The period of regeneration delay may be less than estimated due to factors such as improved planting stock, higher quality planting, or immediate planting after harvest. Conversely, this period may increase due to insects and disease, poor planting quality, or competition from brush. The regeneration delays used for the base case can be found in the Appendix. This sensitivity analysis examines the effects of extending regeneration delays to 10 years and of reducing regeneration delays to 0 years, implying the elimination of regeneration delays.

As shown in Figure 16, eliminating the regeneration delay allows an extension of the initial harvest level for 2 decades. The harvest level then declines by 7% per decade until decade 15 when the long-term level of 978 000 cubic metres per year (6% above the base case), is reached. With no regeneration delay, stands achieve green-up and mature cover ages sooner, resulting in an extension of the initial harvest level, and an increase in the long-term harvest level. As a result, areas can be harvested more often.

When regeneration delays are extended to 10 years, the initial harvest level is maintained for 100 years before declining by 8% per decade until decade 13 when the long-term harvest level of 866 000 cubic metres per year (6% lower than the base case) is reached. In this case, stands take longer to achieve green-up and mature cover ages, reducing the amount of area available for harvest.

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.

5 Timber Supply Sensitivity Analyses

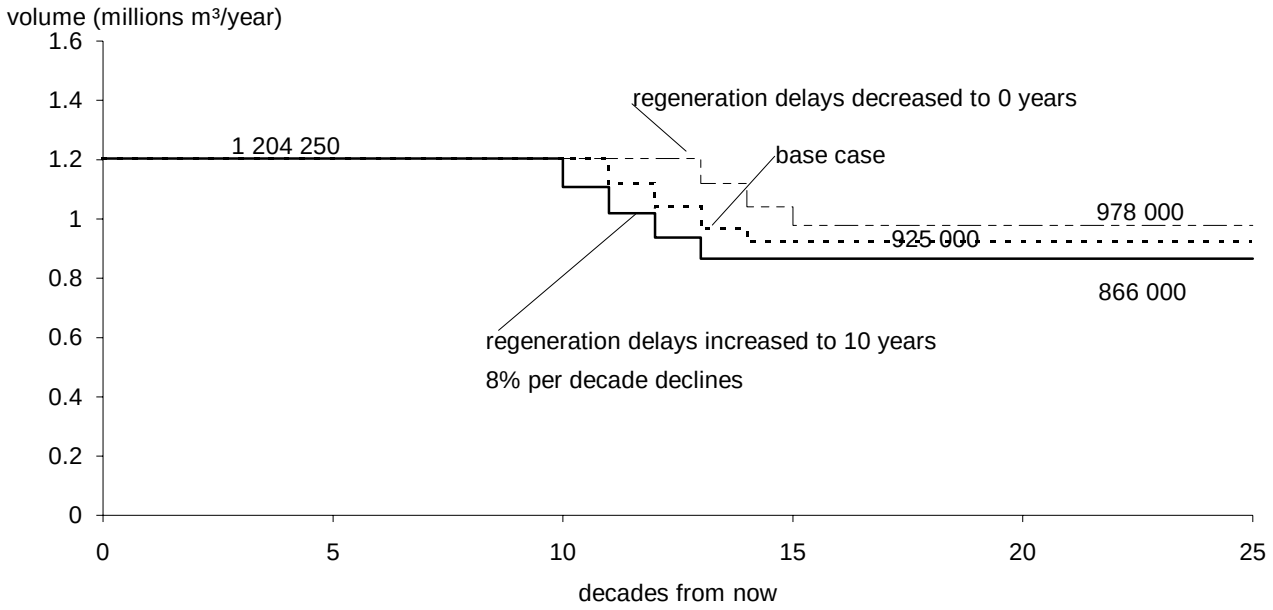

Figure 16. Harvest forecast with regeneration delays increased to 10 years or decreased to 0 years, Merritt TSA.

5.6 Green-up periods and mature age criteria

Forest cover requirements specify desired distributions of areas by age-class groupings. The B.C. Forest Service timber supply model simulates forest cover guidelines by (i) limiting the area which may be covered by stands younger than a specified age, and (ii) maintaining a desired amount of area covered by stands older than a different specified age. Sensitivity testing of the impact of varying the young and mature age requirements are presented in the following sections.

5.6.1 Green-up periods

Green-up period refers to the estimated number of years required from the time of harvest for a regenerated stand to reach a height that allows adjacent mature timber to be harvested. In the Merritt TSA, green-up heights vary from 3 metres in the ungulate winter range and integrated resource management zones to 5.5 metres in the landscape management zone. Green-up guidelines are not applied to the selection management zone. In the base case, the green-up period ranges from 14 to 23 years. These estimates have an associated degree of uncertainty because it is difficult to determine the stand height that provides the necessary cover for various resource values, such as visual quality or wildlife habitat. In addition, the actual time it takes for a stand to reach these heights may differ from current estimates. To examine the effects of this uncertainty, all green-up periods were increased and decreased by 5 years.

When green-up periods are shorter, mature stands are available for harvest sooner because adjacency requirements are met earlier. As shown in Figure 17, when green-up periods are reduced by 5 years, the initial harvest level can be maintained for an additional decade. Harvest levels then decline by 8% per decade until decade 14 when the long-term harvest level of 938 000 cubic metres per year (1% higher than the base case) is reached.

Increasing the green-up period results in fewer stands being available for harvest. Figure 17 shows that when green-up periods are increased by 5 years, the initial harvest rate can be maintained for the same length of time as in the base case. However, the rate of decline is increased to 9% per decade from 7% and the long-term harvest level decreases by 1% to 914 000 cubic metres per year.

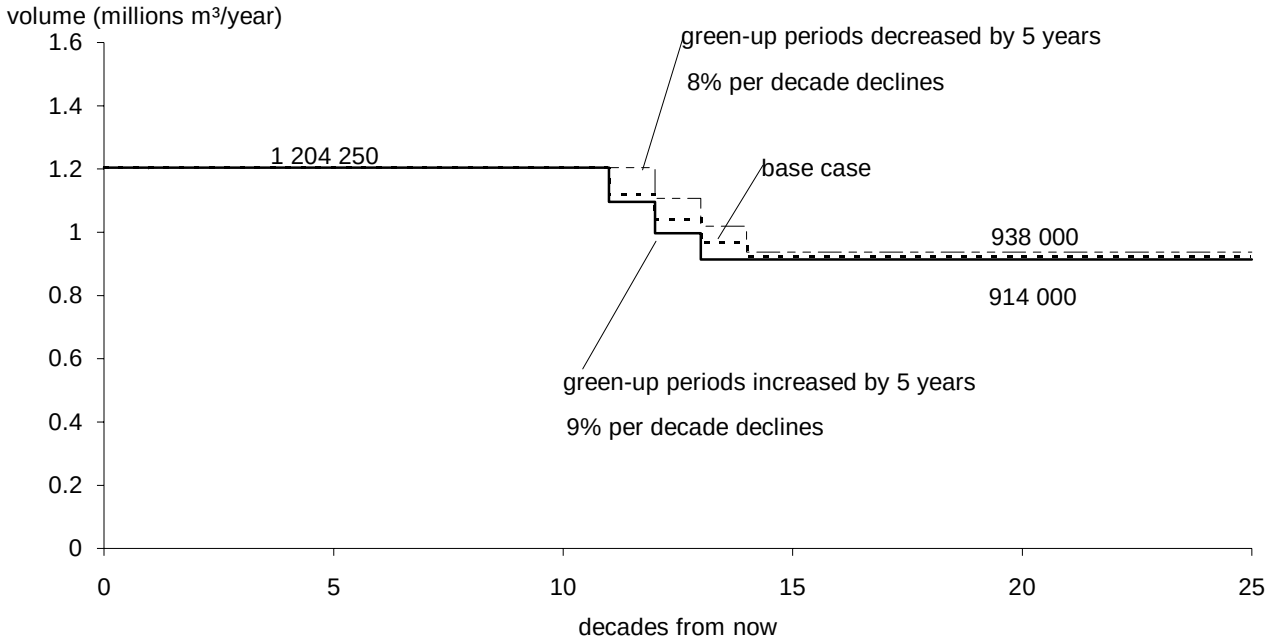

Figure 17. Harvest forecast with green-up periods changed by 5 years, Merritt TSA.

5.6.2 Mature age criteria

The Merritt TSA requires that a certain percentage of the TSA consists of stands whose trees remain above 20 metres in height in order to maintain conditions suitable for ungulate winter range. The ages required to meet this height vary from 88 to 93 years. This guideline is not applied to the selection management zone because it is assumed that there will be sufficient area above 20 metres in height at all times. As was the case with green-up periods, there is some uncertainty surrounding the exact height required for these values and the precise amount of time it takes stands to reach this height. This sensitivity analysis examines the possibility that these age requirements may vary by 10 years.

As illustrated in Figure 18, when mature cover ages are decreased by 10 years, the initial harvest rate can be maintained for 12 decades before declining by 7% per decade to the base case long-term harvest level of 925 000 cubic metres per year.

If mature cover ages are increased by 10 years, the initial harvest level can be maintained for 10 decades. The rate of decline increases to 8% per decade and the long-term harvest level is reduced by 1% to 916 000 cubic metres per year.

5 Timber Supply Sensitivity Analyses

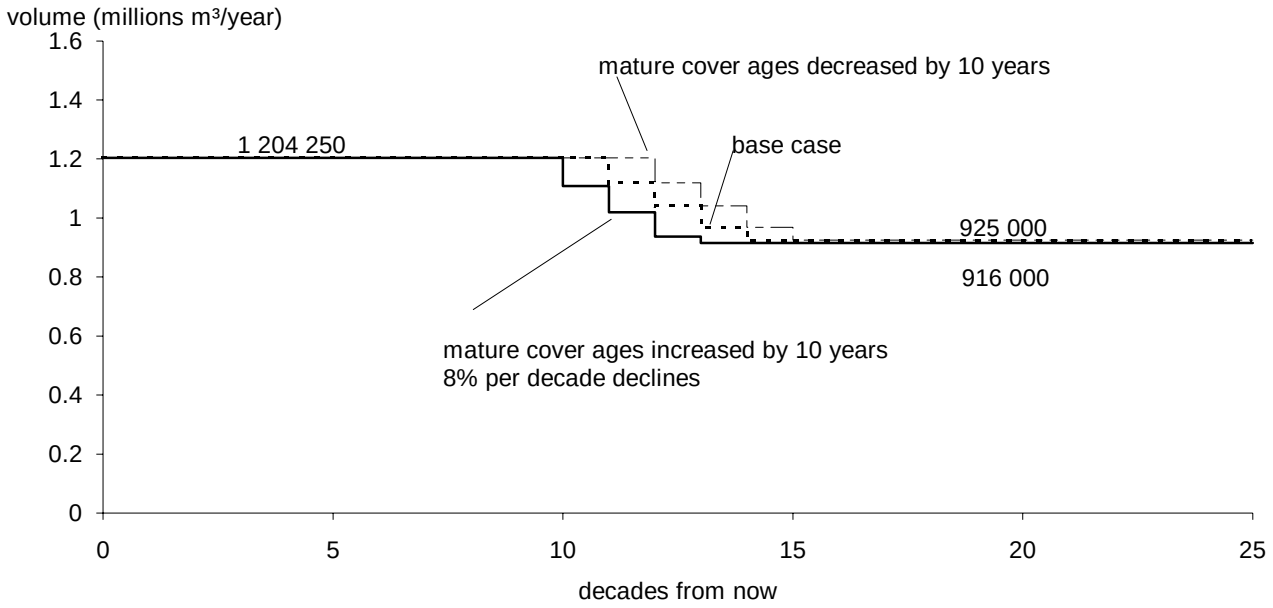

Figure 18. Harvest forecast with mature cover ages changed by 10 years, Merritt TSA.

5.7 Forest cover guidelines

Forest cover guidelines limit the amount of area occupied by stands that are younger than the green-up age and require a minimum amount of area to be covered by stands older than a specified age. These guidelines ensure that cutblocks are distributed spatially. The guidelines applied in the base case retain 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.

5.7.1 Maximum area below green-up ages

Forest cover guidelines, which ensure a minimum amount of area is covered by stands older than green-up age, were increased and decreased in each management zone by 5%. For example, a 20% forest cover guideline is relaxed 5% by increasing to 25% the maximum amount of area that may be covered by stands younger than green-up age. The same guideline is tightened 5% by decreasing to 15% the minimum amount of area that may be covered by stands younger than green-up age. Increasing the percentage 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 19, when green-up forest cover guidelines are relaxed by 5%, the initial harvest level can be maintained for 12 decades before declining by 7% per decade to a long-term level of 954 000 cubic metres per year, 1% above the base case long-term level.

Tightening green-up forest cover guidelines causes the initial harvest level to decline by 8% per decade starting in decade 10. The long-term harvest level is reached in decade 13 and is 4% lower than the base case at 891 000 cubic metres per year.

Although not shown here, the results of constraining the integrated resource management zone in isolation of the other zones was explored. The green-up cover requirements modelled for the base case assume that no more than 36.4% of the area may be covered by stands shorter than 3 metres. This percentage was reduced to evaluate a three-pass (33%), a four-pass (25%), and a five-pass (20%) harvesting system. The results of these sensitivity analyses are not shown graphically because the harvest forecasts for each of these sensitivities did not differ from the base case.

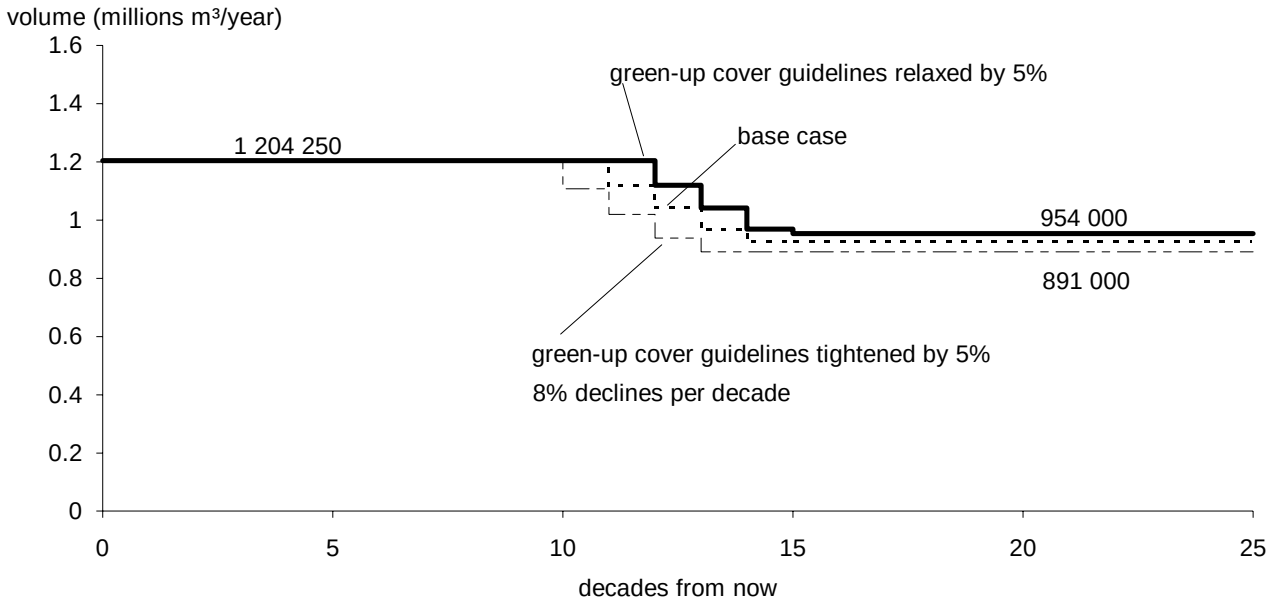

Figure 19. Harvest forecast with green-up cover guidelines relaxed or tightened by 5%, Merritt TSA.

5.7.2 Mature age criteria

To address the uncertainty associated with mature criteria, the amount of area required in mature forest was increased and decreased in each management zone by 10%. For example, a guideline requiring that 13.5% of area be occupied by mature stands would be increased such that the area requirement was 23.5%. It was also decreased by 10% such that only 3.5% of the area would be required to be occupied by mature stands. Increasing this percentage tightens the cover requirement because it requires more of the forest to be older than the mature age at all times. Decreasing the percentage relaxes the cover requirement because it requires less of the forest to be older than the mature age. Figure 20 shows the results.

Relaxing the mature age requirement, (requiring less forest older than the specified age), allows the initial harvest rate to be maintained for 13 decades. The harvest level declines 8% per decade until decade 16, reaching a long-term harvest level (917 000 cubic metres per year) that is 1% lower than the base case long-term level.

Increasing the mature age constraint restricts the timber supply such that the initial harvest level can only be maintained for 8 decades, 3 decades less than the base case. After 8 decades the initial harvest level declines at 7% per decade to the long-term level of 916 000 cubic metres per year, 1% less than the base case.

5 Timber Supply Sensitivity Analyses

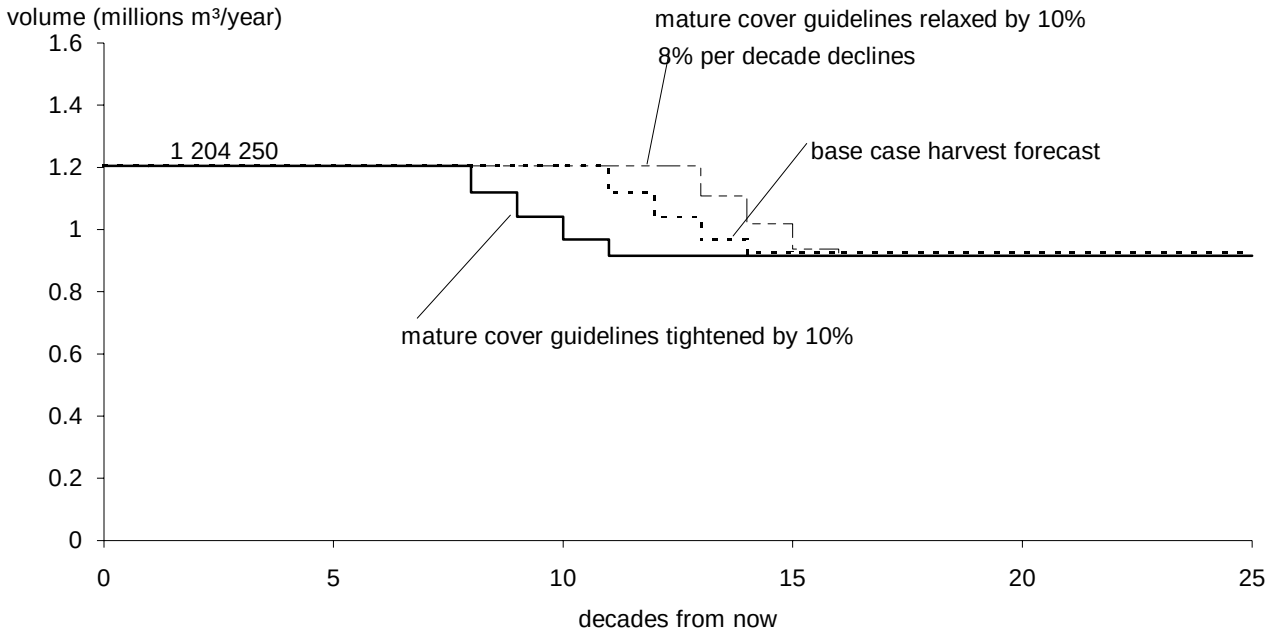

Figure 20. Harvest forecast with mature cover guidelines relaxed or tightened by 10%, Merritt TSA.

5.8 Changes in the area 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. In the Merritt TSA, the timber harvesting land base could be larger or smaller than expected if any of the areas listed in Table 1 are different.

5.8.1 Decrease in the timber harvesting land base

The following sensitivity analysis examines the effect of a smaller timber harvesting land base. 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;
- decisions to protect additional areas, such as those considered through the provincial Protected Areas Strategy are made. (It should be noted that all harvest forecasts in this report assumes these areas are available for timber harvesting.)

Figure 21 shows the effects on harvest flow of decreasing the size of the current timber harvesting land base by 5 and 10%. When the land base is decreased by 5%, the initial harvest level can be maintained for 9 decades, 2 decades less than the base case. The harvest level must then decline by 9% per decade to reach the long-term harvest level of 879 000 cubic metres per year in decade 12. This long-term harvest level is 5% below the base case level.

When the land base is decreased by 10%, the initial harvest level can be maintained for 7 decades, 4 decades less than the base case. The harvest level then declines by 9% per decade to reach the long-term level of 829 000 cubic metres per year in decade 10. This long-term harvest level is 10% below the base case long-term level.

Operability
A classification of the availability of an area for timber harvesting. Operability is determined using the terrain characteristics of the area as well as the quality and quantity of timber on the area.

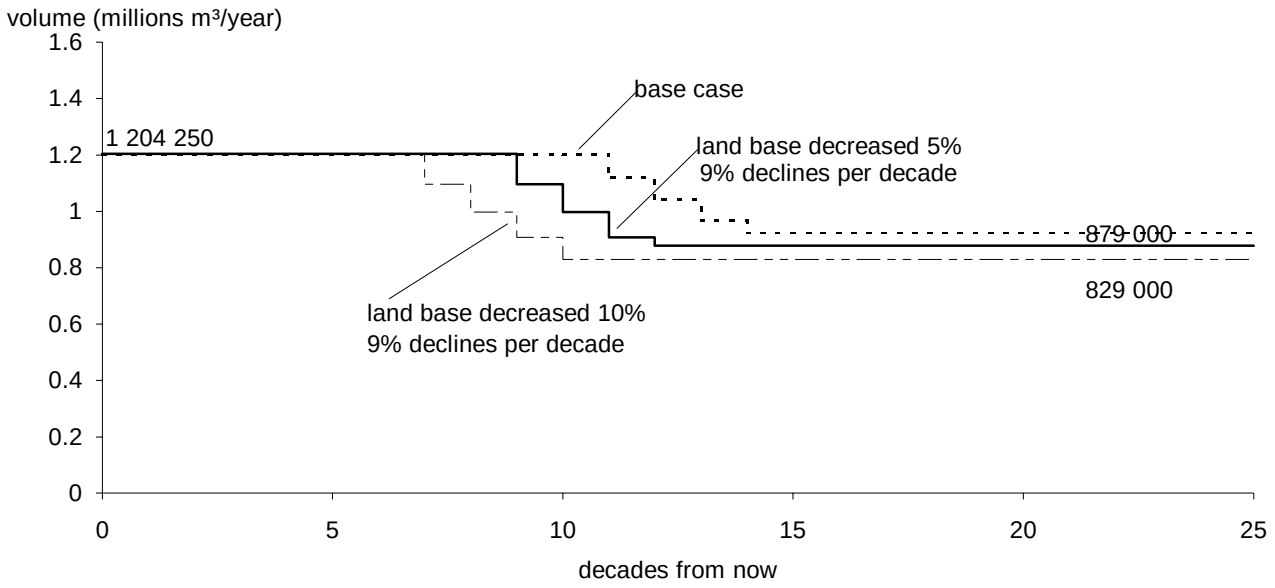

Figure 21. Harvest forecast with decreases in the timber harvesting land base, Merritt TSA

5.8.2 Increase in the timber harvesting land base

The following sensitivity analyses examines the effects of an increase in the size of the timber harvesting land base. The timber harvesting land base could be increased as a result of improved timber harvesting techniques and equipment, or as a result of increases in the value of currently unmerchantable forest types. In the Merritt TSA, there has been interest in accessing small pine types that are currently not included in the timber harvesting land base. Section A.5 in the Appendix outlines the changes in assumptions that were made to incorporate small pine types.

Figure 22 shows the harvest forecast when the small pine areas are managed as an individual unit. That is, the figure displays the possible harvest forecast from only those areas which are now classified as unmerchantable small pine types. If forest management specified that the harvest of these areas were to be maintained for a period of 30 years then the initial harvest level would be 248 000 cubic metres per year. The harvest rate would then decline by 10% per decade to the long-term harvest level of 155 000 cubic metres per year in decade 7.

If the initial harvest level were to be maintained for 50 years then the starting harvest level would be 227 000 cubic metres per year. The long-term harvest level would be reached in decade 8, following 10% declines per decade. This long-term harvest level is the same as when the initial harvest level is maintained for 3 decades. However, it should be noted that when evaluating the small pine types in isolation the effects of harvest from the remaining land base are not accounted for.

5 Timber Supply Sensitivity Analyses

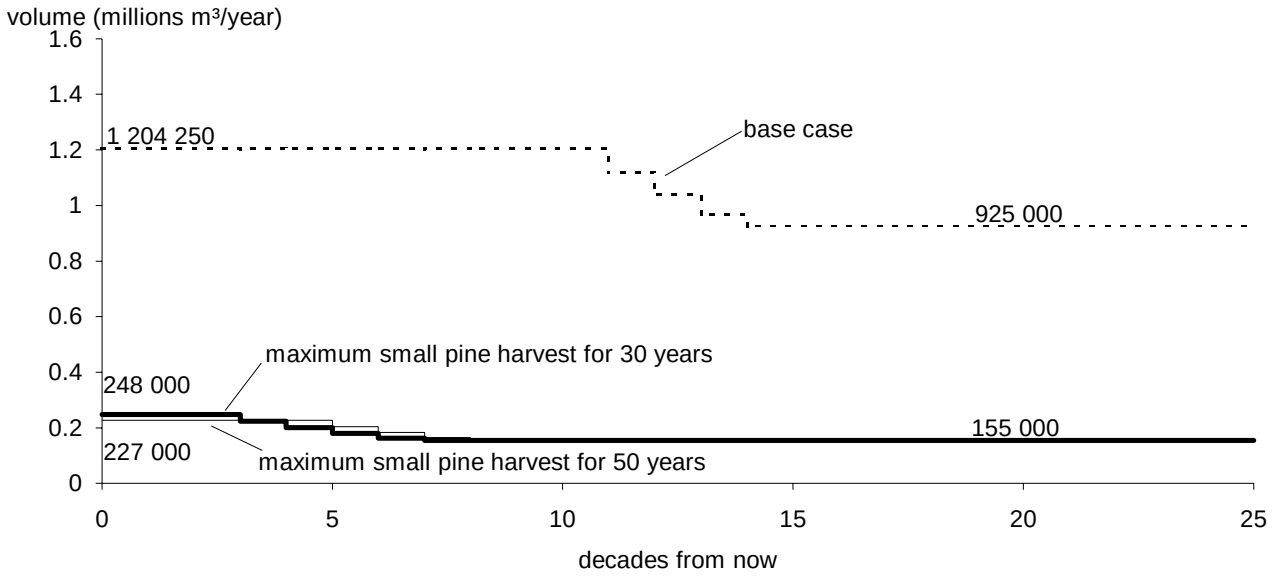

Figure 22. Harvest forecast from small pine areas only, Merritt TSA.

6 Summary and Conclusions

The base case harvest forecast for the Merritt TSA uses a starting harvest level of 1 204 250 cubic metres per year. Given current management assumptions, the initial harvest level can be maintained for 110 years. Harvests then begin to decline by 7% per decade until the long-term harvest level of 925 000 cubic metres per year is reached 140 years from now.

The most significant factor effecting the timber supply forecast is the abundance of mature forest. Approximately 77% of the TSA timber harvesting land base is or soon will be available for harvest. As a result the base case harvest forecast is unaffected by any of the sensitivity analyses for the first 8 decades.

The harvest forecast is most affected by changes in existing stand volumes, which when adjusted by 10%, increase or decrease by 4 decades the time the current harvest can be maintained. Reductions in the current timber harvesting land base also reduce the length of time the current harvest can be maintained. Increasing by 10% the amount of area required to be covered by mature forest creates the most significant change in the current harvest forecast of any forest management sensitivity analysis — reducing by 3 decades, the length of time the current harvest can be maintained.

Given the abundance of mature timber, increasing the current harvest rate for a period of time is possible. If the initial harvest level is maintained for only 30 years the maximum initial harvest is 1 483 000 cubic metres per year, a 23% increase over the base case. Maintenance of the initial level for 50 years allows the initial harvest level to rise by 16% to 1 394 000 cubic metres per year. In both cases, the initial increases cause to an earlier decline to the long-term level than in the base case.

If a portion of the unmanaged problem forest types were included in the timber harvesting land base, the harvest level could increase. If the short-term harvest level were to increase for a period of 30 years, 248 000 cubic metres per year could be harvested from these areas. If the short-term harvest level were to increase for a period of 50 years, 227 000 cubic metres per year could be harvested from these areas. The long-term harvest level from the problem forest types is 155 000 cubic metres per year.

Long-term harvest levels are also shown to be sensitive to changes in volume estimates for regenerated stands, changes in the timber harvesting land base, changes in regeneration delays, and to changes in green-up guidelines.

7 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*.

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 — Integrated management guidelines that specify the desired spatial relationship among cutblocks. 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 timber harvesting may cause avalanches.

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.

Growing stock — The volume estimate for all standing timber, of all ages, at a particular time.

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

Harvest forecast — The flow of potential timber harvests over time. A harvest forecast is usually a measure of the maximum timber supply that can be realized, over time, for a specified land base and set of management assumptions. It is a result of forest planning models and is affected by the size and productivity of the land base, the current growing stock, and management objectives, constraints and assumptions.

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 harvest ages, utilization levels, integrated resource guidelines and silviculture and pest management programs.

7 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 An area not covered by a sufficient number of tree stems of desirable species. Stocking standards are set by the 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.

Operability A classification of the availability of an area for timber harvesting. Operability is determined using the terrain characteristics of the area as well as the quality and quantity of timber on the area.

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.

Rehabilitation Removing all non-commercial cover, preparing the site and stocking it with acceptable commercially valuable species.

Site index A measure of site productivity. Site indices are based on tree height as a function of stand age and are usually expressed graphically as site index curves. A number of site index curves have been developed for British Columbia's major commercial tree species.

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*.

Tree Farm Licence (TFL) Provides rights to harvest timber, and outlines responsibilities for forest management, in a particular area.

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.

8 References

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Appendix A
Description of Data Inputs and Assumptions

Introduction

The following sections outline the methods and inputs used to derive the timber harvesting land base and to construct the timber supply model data set for the Timber Supply Review analysis for the Merritt TSA. For the purpose of the review, this information represents current forest management in the area. *Current forest 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 here. Changes in forest management, when and if they occur, will be included in subsequent timber supply analyses after this Timber Supply Review 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 Merritt 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 management zone

  Priority management consideration: selection harvesting of dry fir species types (inventory type groups);

- Landscape management zone

  Priority management consideration: managing for Visual Quality Objectives (VQOs);

- Ungulate winter range zone

  Priority management consideration: maintaining the winter range resource for ungulates;

- Integrated resource management zone

  Priority management consideration: managing for the long-term optimum harvest of timber.

The above zones are listed in descending order based on the stringency of their guidelines. Where zones overlap, the zone with the most stringent guidelines applies. Management within the selection zone is assumed to meet the requirements of all 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.

Each site class includes a range of site qualities or site indexes, to facilitate classification and use. Site index expresses the site quality of a stand, based on tree heights and age.

For the Merritt TSA, analysis units were assigned using new site class (NSITE) or, where available, special site class (SSITE). Special site is a field corrected site class that can be assigned when the normal site class does not reflect site quality.

The four management zones were divided into analysis units based on several species/site combinations as detailed in Table A-1. Within the species groups, site classes were combined based on the relative area of each site class within the proposed type groups and the similarities of the species site class yield curves. 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

Table A-1. Analysis units

Forest management zone	Analysis units	Inventory type group	Age	Site class
Selection silviculture system	1	1, 6, 7, 32 - 34 Dry Fir/Yellow Pine	< 141	G,M,P,L
	2	1, 6, 7, 32 - 34 Dry Fir/Yellow Pine	> 140	G,M,P,L
Landscape Management	3	2 - 4, 8 Wet Fir	< 141	G,M
	4	2 - 4, 8 Wet Fir	> 140	G,M
	5	2 - 4, 8 Wet Fir	ALL	P,L
	6	5, 29 Pl/Fir	< 141	G,M
	7	5, 29 Pl/Fir	> 140	G,M
	8	5, 29 Pl/Fir	< 141	P,L
	9	5, 29 Pl/Fir	> 140	P,L
	10	25, 30, 31 Pl/Spr	ALL	G,M
	11	25, 30, 31 Pl/Spr	ALL	P,L
	12	28 Pine	ALL	G,M
	13	28 Pine	ALL	P,L
	14	12 - 20 Bal/Hem	< 141	G,M
	15	12 - 20 Bal/Hem	> 140	G,M
	16	12 - 20 Bal/Hem	< 141	P,L
	17	12 - 20 Bal/Hem	> 140	P,L
	18	9-11,21-24, 26,27 Spruce/Pw/Cedar	ALL	G,M
	19	9-11,21-24,26,27 Spruce/Pw/Cedar	< 141	P,L
	20	9-11,21-24,26,27 Spruce/Pw/Cedar	> 140	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 units	Inventory type group	Age	Site class
Ungulate	21	5, 29 Pl/Fir	< 141	G,M
Winter	22	5, 29 Pl/Fir	> 140	G,M
Range	23	5, 29 Pl/Fir	< 141	P,L
	24	5, 29 Pl/Fir	> 140	P,L
	25	2 - 4, 8 Wet Fir	< 141	G,M
	26	2 - 4, 8 Wet Fir	> 140	G,M
	27	2 - 4, 8 Wet Fir	ALL	P,L
Integrated	28	5, 29 Pl/Fir	< 141	G,M
Resource	29	5, 29 Pl/Fir	> 140	G,M
Management	30	5, 29 Pl/Fir	< 141	P,L
	31	5, 29 Pl/Fir	> 140	P,L
	32	25, 30, 31 Pl/Pr	ALL	G,M
	33	25, 30, 31 Pl/Spr	ALL	P,L
	34	28 Pine	ALL	G,M
	35	28 Pine	ALL	P,L
	36	12 - 20 Bal/Hem	< 141	G,M
	37	12 - 20 Bal/Hem	> 140	G,M
	38	12 - 20 Bal/Hem	< 141	P,L
	39	12 - 20 Bal/Hem	> 140	P,L
	40	9-11,21-24, 26,27 Spruce/Pw/Cedar	ALL	G,M
	41	9-11,21-24,26,27 Spruce/Pw/Cedar	< 141	P,L
	42	9-11,21-24,26,27 Spruce/Pw/Cedar	> 140	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 by management zone and analysis unit

Analysis unit	Selection	Landscape	Ungulate	IRM	Total (ha)
Selection < 141	32 338				32 338
Selection > 140	65 260				65 260
Wet Fir G/M < 141		415		3 010	3 425
Wet Fir G/M > 140		1 026		5 707	6 733
Wet Fir P/L		324		1 598	1 922
Pl/Fir G/M < 141		8 257	7 407	30 518	46 183
Pl/Fir G/M > 140		2 919	2 202	10 847	15 968
Pl/Fir P/L < 141		2 955	2 100	8 153	13 208
Pl/Fir P/L > 140		511	666	2 329	3 506
Pl/Spruce G/M		5 212		42 466	47 679
Pl/Spruce P/L		2 247		17 912	20 159
Pine G/M		17 158		138 196	155 354
Pine P/L		3 615		35 671	39 286
Bal/Hem G/M < 141		336		2 507	2 843
Bal/Hem G/M > 140		434		4 294	4 728
Bal/Hem P/L < 141		386		3 014	3 401
Bal/Hem P/L > 140		357		4 749	5 106
Spruce/Pw/Cedar G/M		2 337		20 007	22 344
Spruce/Pw/Ced P/L < 141		250		1 352	1 602
Spruce/Pw Ced P/L > 140		1 984		18 463	20 447
Total ha.	**97 598**	**50 724**	**12 376**	**350 794**	**511 492**

Note: Before additions to the land base for NSR and rehabilitation of problem forest types.

A.2 Definition of the Timber Harvesting Land Base

The timber harvesting land base was determined by deducting all areas considered to be currently unavailable for timber harvesting from the total TSA. Additions to the land base such as NSR and areas to be rehabilitated to productive forest 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, Merritt TSA 1994

Classification	Area (ha.)	Area (ha.)	% of total area	% of productive forest area
Total Land base		1 115 914	100.00	
Non-Crown land		-206 632	18.52	
Non-forest land		-96 770	8.67	
Total productive forest		812 512	72.81	100.00
Reductions to productive forest:				
Non-commercial cover	3 157		0.28	0.39
Environmentally sensitive	59 768		5.36	7.36
Deciduous types	6 703		0.60	0.82
Problem forest types	174 877		15.67	21.52
Pennask LRUP	107		0.01	0.01
Stoyoma	1 339		0.12	0.16
Heritage Trails	1 039		0.09	0.13
Lakeshore Management	2 826		0.25	0.35
Lakeshore VQOs	380		0.03	0.05
Riparian areas	7 962		0.71	0.98
Roads, landings, and trails	11 731		1.05	1.44
Not satisfactorily restocked	31 131		2.79	3.83
Total current reductions	301 020	-301 020	-26.98	-37.05
Current productive land base		511 492	45.84	62.95
Additions to productive forest:				
Not satisfactorily restocked	15 985[a]			
Rehabilitation	956			
Total additions	16 941	+ 16 941	1.52	2.09
Total productive land base		528 433	47.35	65.04
Future roads, landings, and trails	37 640	-37 640	-3.37	-4.63
Long-term productive land base		490 793	43.98	60.40

[a] Only a portion of the NSR is scheduled for restocking. The remaining area - 15 146 ha - is assumed not to contribute to the timber harvesting land base.

A.2 Definition of the Timber Harvesting Land Base

This section provides the information used to define the timber harvesting land base in the order shown in Table A-3.

A.2.1 Reductions to the TSA land base

A.2.1.1 Non-Crown, non-forest areas

All areas not designated as ownership 62C (Crown forest management unit available for long-term integrated resource management), or 69C (Miscellaneous reserves available for long-term integrated resource management) were excluded from the timber harvesting land base. 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 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
ESA(E1 & E2)	All Er1 and Er 2	100% & 90%
ESA(E1)	All other E1 (Major)	90%
ESA(E2)	All other E2 (Minor)	40%

It is assumed for recreation sensitive areas adjacent to lakes that 100% of Er1 and 90% of Er2 areas are not available for timber harvest.

ESAs for areas of critical importance to wildlife (Ew) have been replaced with forest cover constraints on analysis units within the landscape, ungulate winter range and integrated resource management zones.

A.2.1.3 Deciduous, non-merchantable and non-commercial cover

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. Table A-5. lists the problem forest types for the Merritt TSA.

A.2 Definition of the Timber Harvesting Land Base

Table A-5. Reductions for deciduous, non-merchantable and non-commercial cover

Type group or species	Criteria						% area excluded
	new site class	new site index	old site index	age class	new height class	crown closure class	
21 - 26 Spruce leading	Low	< 10		1			100%
28 - 31 Lodgepole leading	Low	< 10		1			100%
21 - 26 Spruce leading		< 10		2 - 3			100%
28 - 31 Lodgepole leading		< 10		2 - 3			100%
1 - 20 Fir/Balsam Leading	Low			1 - 3			100%
27 White Pine	Low			1 - 3			100%
32 - 34 Yellow Pine/Larch	Low			1 - 3			100%
28-31 Lodgepole leading		< 14		4 - 9	< 3		100%
1 - 8 Fir leading			< 18	4 - 9	< 3		100%
9 - 27 Balsam/Spruce			< 19	4 - 9	< 3		100%
33, 34 Larch leading			< 19	4 - 9	< 3		100%
28 - 31 Lodgepole leading			≤ 19.5	4 - 9	< 3	≥ 8	100%
1- 34 All Coniferous			≤ 19.5	4 - 9		≤ 2	100%
12 - 19 Hemlock/Balsam			≤ 21	4 - 9			100%
35 - 42 Deciduous leading							100%

A.2.1.4 Pennask LRUP

The Pennask LRUP net down was based upon the area calculated by a G.I.S. for the four walk-in-lakes detailed by the Merritt Forest District. A total of 107 hectares have taken from the following planning cells, based on the relative size of the individual planning cells: 0603 (27.8 ha), 0604 (17.1 ha), 0605 (22.5 ha), 0606 (39.6 ha).

A.2.1.5 Stoyoma Mountain

The Stoyoma Mountain Wilderness Area proposal, which affects a total of 3507 hectares, was modelled by deducting 840 hectares from the operable land base as well as deducting an additional 499 hectares needed to achieve VQO objectives around the fringe of the wilderness area. This netdown is applied by analysis unit and age class.

Table A-6. Area reductions for Stoyoma Mountain Wilderness

Analysis unit	Age class	Total ha.
Pl/Fir G/M < 141	7	34
Pl/Spruce G/M	7	32
Pl/Spruce P/L	6	32
Pine G/M	8	66
Pine P/L	2	138
	4	152
	8	654
Bal/Hem G/M > 140	8	105
Bal/Hem P/L < 141	4	17.4
	5	38.9
Bal/Hem P/L > 140	8	69.7
Total ha.		**1339**

A.2.1.6 Heritage and Recreation Trails

A total of 1039 hectares have been removed from the following analysis units and age classes to account for designated and non-designated Heritage and Recreation trails. Areas were determined by the length and width of buffer required by each trail.

Table A-7. Area reductions for heritage and recreation trails

Analysis unit	Age class	Total ha.
Selection < 141	6	72.8
Pl/Fir G/M < 141	6	85.8
Pl/Fir G/M > 140	8	131.8
	9	65.8
Pl/Spruce G/M	4	38.7
	6	106.8
	7	68.8
Pl/Spruce P/L	6	41.8
Pine G/M	8	33.7
Pine P/L	2	66.8
	8	132.8
Bal/Hem G/M > 140	8	64.8
	9	85.8
Bal/Hem P/L > 140	8	42.8
Total ha.		**1039**

A.2 Definition of the Timber Harvesting Land Base

A.2.1.7 Lakeshore management areas

The total area in lakeshore management areas was estimated by measuring the lakeshore management areas around a sample of lakes, and extrapolating these areas to other lakes. The reduction is based upon a study of 25 of the approximate 100 upland lakes in the Merritt district. Grassland lakes were not included in the study. The area of all forest types within lakeshore management areas that contribute to the AAC were measured. The sum of these forested areas was divided by the sum of the surface of the lakes to create a ratio of forested area to lake surface area. The total surface area of all upland lakes in the District was then used to create the amount of total forested area (AAC contributing) within the Lakeshore Management area for upland lakes. It is assumed that 100% of this is not available for harvest. The area was assumed to be from Inventory Type Group 28 (Lodgepole pine) and age class 5 or above. The areas were netted out of each age class based on the relative proportion of the area within each age class.

Table A-8. Area Reductions for Lakeshore Management

Inventory type	Age class	Total ha.
28	5	678.2
(Lodgepole Pine)	6	989.1
	7	706.5
	8	423.9
	9	28.3
Total ha.		**2826**

A.2.1.8 Lakeshore Visual Quality areas

The method used to determine the land base reduction for lakeshore visual quality areas is similar to that used for lakeshore management areas (Section A.2.1.7). The net down is based upon a study of upland lakes within the TSA. The forested areas in lakeshore visual quality areas around a sample of lakes were measured (AAC contributing) and compared to the lake surface area to form a ratio of forested area to lake surface area. This ratio was then applied to all upland lakes that would fall within the Montane Spruce and Englemann Spruce - Subalpine Fir biogeoclimatic zones. This was assumed to be mainly inventory type group 28 (pure lodgepole pine) age class 5 and above. Interior Douglas-fir zone lakes were excluded as it assumed that selective logging could be accommodated within this zone to meet the visual quality objective of partial retention. The areas were netted out of the land base based on the relative proportion of the area within each age class.

Table A-9. Area reductions for Lakeshore Visual Quality

Inventory type	Age class	Total ha.
28	5	91.3
(Lodgepole Pine)	6	133.1
	7	95.1
	8	57
	9	3.8
Total ha.		**380.3**

A.2 Definition of the Timber Harvesting Land Base

A.2.1.9 Exclusion for Riparian Areas

The total riparian area was estimated using a Merritt TSA study (1994), undertaken with consultation from the federal Department of Fisheries and Oceans, of all forested areas adjacent to class 2 and 3 streams on 22 inventory map sheets. It was assumed that order 1 streams are intermittent and less than 0.6 m in width and therefore not considered. The sum of the forested areas (AAC contributing) adjacent to the riparian areas was compared to the net productive land base of the individual map sheets to calculate a ratio of riparian influence area to net productive land base. The sum of the riparian areas on these map sheets was used to form a consolidated ratio. These map sheets reflected both plateau and steeper terrain types within the district. This ratio excluded lodgepole pine problem forest types, ESAs, deciduous, and non-commercial types. The ratio was calculated to be 2.01% of the net land base. The corridor of influence was assumed to be 60 metres wide (30 metres on either side of the stream). Seventy-five per cent of this forested area is not available for harvest. Therefore, the final ratio used is 1.51% of the net productive land base.

A.2.1.10 Existing unclassified 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 an 11.3% 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.2.2 Additions to the productive forest

A.2.2.1 Not satisfactorily restocked areas

Only the portion of the NSR areas, initially removed from the land base, which are available for timber production are added back into the land base. All NSR both current and backlog, is assumed to be restocked within 10 years. Table A-10. summarizes the total area of current and backlog NSR existing in the timber harvesting land base for the Merritt TSA. Re-stocking of the remaining NSR area (31 131 - 15 985 = 15 146 ha) is not currently planned. This area is assumed not to contribute to the timber harvesting base.

A.2 Definition of the Timber Harvesting Land Base

Table A-10. Not satisfactorily restocked (NSR) areas

	Zone			
	Landscape	**Ungulate**	**IRM**	**Total**
Backlog NSR				
Wet Fir G/M < 141	0.00	0.00	0.00	0
Wet Fir P/L	27.20	0.00	134.80	162
Pl/Fir G/M < 141	28.36	25.71	104.93	159
Pl/Fir P/L < 141	61.03	43.39	167.93	272
Pl/Spruce G/M	0.00	0.00	0.00	0
Pl/Spruce P/L	87.90	0.00	701.10	789
Pl G/M	36.49	0.00	294.51	331
Pl/P/L	139.67	0.00	1376.33	1516
Bal/Hem G/M < 141	9.53	0.00	72.47	82
Bal/Ham P/L < 141	13.87	0.00	103.13	117
Spr/Pw/Ced G/M	0.00	0.00	0.00	0
Spr/Pw/Ced P/L < 141	191.73	0.00	1019.27	1211
Total backlog	**596**	**69**	**3 974**	**4 639**
Current NSR				
Wet Fir G/M < 141	42.35	0.00	309.65	352
Wet Fir P/L	7.56	0.00	37.44	45
Pl/Fir G/M < 141	131.83	119.47	487.70	739
Pl/Fir P/L < 141	70.90	50.41	194.69	316
Pl/Spruce G/M	181.78	0.00	1458.22	1640
Pl/Spruce P/L	32.20	0.00	256.80	289
Pl G/M	477.88	0.00	3857.12	4335
Pl/P/L	16.68	0.00	164.32	181
Bal/Hem G/M < 141	51.58	0.00	392.42	444
Bal/Ham P/L < 141	5.22	0.00	38.78	44
Spr/Pw/Ced G/M	277.57	0.00	2357.43	2635
Spr/Pw/Ced P/L < 141	51.61	0.00	274.39	326
Total current	**1 347**	**170**	**9 829**	**11 346**
Total all	**1 943**	**239**	**13 803**	**15 985**

A.2.2.2 Rehabilitation of non-commercial areas

Table A-11. represents the continued conversion of problem forest types to immature conifer stands in the Merritt Forest District. The following figures are based upon three years of: (a) rehabilitation of 219 hectares per year of small lodgepole pine stands harvested under TSL A18622 and (b) the rehabilitation of 100 hectares per year of previously logged dry belt fir. It was assumed that the rehabilitation would occur on: 75% of good/medium sites and 25% of poor/low sites.

Table A-11. Rehabilitation of non-commercial brush cover

Analysis units	Species type	PFTs or NC Brush	
		Total area (ha)	Rate of restocking (ha/year)
Dry fir / yellow pine	Fir	300	100
Pure pine	Pl	656	219
Total ha.		**956**	**319**

A.2.3 Future roads, trails and landings

As future harvesting occurs there will be associated losses in productive area due to roads, trails and landings. All existing stands currently over 20 years old will be subject to a 7.7% loss. The total deduction of 7.7% is based on the *Soil Conservation Guidelines for Timber Harvesting - Interior B.C.* and is comprised of the following:

- roads and landings — 6.7%
- skid roads and trails — 2.0%
- 1.0% was subtracted because age class 2+ areas experienced a 1.0% reduction when accounting for existing roads and landings (see Table C-4).

The area that will eventually be lost is not initially excluded from the land base. The B.C. Forest Service timber supply model reduces the areas by 7.7% the first time stands over 20 years old are harvested.

A.3 Volume Exclusions

A.3.1 Volume exclusions for mixed species types

Table A-12. summarizes the per cent volume exclusion of less desirable or unmerchantable species to be excluded from mixed species types.

Table A-12. Volume exclusions for mixed species types

Inventory group	Volume excluded from type group	% Volume exclusion
1-34 (coniferous leading)	deciduous volume component	100%

A.3.2 Unsalvaged volume losses

Unsalvaged losses are timber volumes destroyed or damaged by natural causes such as fire and insects. Estimated annual losses are deducted from the gross timber supply to determine the projected net volumes that will be harvested over time. Table A-13. shows the estimated average annual loss for the Merritt TSA. The volumes apply to the timber harvesting land base, and recognize that some damaged or killed timber is salvaged. Estimates of unsalvaged losses are based on district forest health records, professional knowledge, and the report *Socioeconomic Analysis of Mountain Pine Beetle Management in British Columbia.* (Phero Tech and Deloitte & Touche , March 1993)

Table A-13. Unsalvaged volume losses

Cause of loss	Annual unsalvaged loss in cubic metres/year
Insects	52 630
Wind Damage	18 565
Fire	38 715
Miscellaneous	7 000
Total	**116 910**

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, that are used to calculate merchantable volume. A 10 cm top and a 30 cm stump height is assumed for all species. The utilization level currently practiced in the Merritt TSA is 12.5 cm minimum diameter at breast height for lodgepole pine and 17.5 cm minimum diameter at breast height for all other species.

A.4.2 Minimum harvestable ages for each analysis unit

Table A-14. lists the minimum harvestable age for each analysis unit. Minimum harvestable ages are based on district cutting priorities and do not necessarily reflect biological culmination ages. Impacts of different harvest age assumptions on timber supply were evaluated using sensitivity analysis.

Table A-14. Minimum harvestable age by species type

Species type	Minimum harvestable age (years)
Lodgepole pine types	80
All other types	100

A.4.3 Harvest profile

Table A-15. lists the current harvest profile for the Merritt TSA.

Table A-15. Harvest profile

Species type	Per cent of total harvest volume
Dry Belt Fir and Py	14%
Wet Belt Fir	3%
Lodgepole Pine / Fir	8%
Lodgepole Pine / Spruce	15%
Lodgepole Pine	34%
Balsam / Hemlock	4%
Spruce / Pw / Cedar	22%
	100%

The volume harvested from the selection management zone was constrained so that no more than 14% of the initial harvest level could be taken from this zone. As well, since selection management is primarily an area based harvesting system within the Merritt TSA (ie. basal area removed), the selection management zone was constrained so that no more than 1/120th of the area in the zone could be harvested during any year. This was based on the assumption that the entire area of selection management would be harvested on a 120 year rotation.

A.4.4 Forest cover requirements

Table A-16. specifies the forest cover requirements needed to achieve the forest management objectives for each zone. There are two types of forest cover guidelines:

- Green-up forest cover guidelines, stated in terms of a maximum area that can be less than a green-up age.
- Mature forest cover guidelines, stated in terms of a minimum amount of area that must be over a prescribed age.

A.4 Forest Management Assumptions

Table A-16. also shows the present status of each management zone relative to the forest cover guidelines prior to any harvesting. Current forest cover in all the management zones meets the cover requirements. Selection harvesting is assumed to satisfy all forest cover requirements.

Table A-16. Forest cover guidelines by management zone

	Green-up forest cover guideline					Mature forest cover guideline				
Zone	% Gross area	% Net operable area	Min. Ht (m)	Tree age (yrs)	Current per cent	% Gross area	% Net operable area	Min. Ht (m)	Tree age (yrs)	Current per cent
Landscape	10	11.2	5.5	23	6.7	20	13.4	20	92	73.0
Ungulate	20	20	3	14	2.8	40	7.5	20	88	80.0
IRM	25	36.4	3	16	6.7	20	13.5	20	93	70.4

A.4.4.1 Forest cover guideline for green-up

The green-up ages for each zone is an area-weighted average of the time required to achieve a minimum tree height (top height) for each analysis unit within the specified zone. Site indices used to determine the green-up ages were obtained from ministry site index curves and inventory file information.

Based on the *Kamloops Regional Timber Harvesting Guidelines* and operational considerations, visual recovery for the landscape zone was assumed to occur at five and one-half metres. The mid-point of partial retention (10%) was assumed to be the management objective. Adjustments from the gross to net land base were done using the methodology outlined in *Procedures for Factoring Recreation Resources into Timber Supply Analysis* (MOF Recreation Branch, 1993).

The ungulate winter range zone is primarily below the snow pack, therefore a 3 metre green-up height is indicated for this zone. In order to meet clearcut harvesting guidelines — which specify 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

The IRM zone assumes a management objective that allows no more than 25% of the gross land base to be less than 3 metres in height. This percentage was adjusted to 36.4% based on the ratio of the gross to net forested land base. After reviewing the adjustments made from the gross to net land base it was found that complete interspersion of forested areas outside the timber harvesting land base and those within the harvesting land base is required to achieve the 36.4% cover requirement on the net forested land base. The assumption of complete interspersion may not at all times reflect a reality within this zone. It was therefore important to evaluate the effects of several harvest systems within this zone. Section 5.7, "Green-up and mature age forest cover guidelines" of the main report shows the results when a 3-pass (33%), 4-pass (25%), and a 5-pass (20%) green-up constraint is used for this zone. The results show that uncertainty in the green-up requirement for the IRM zone has no effect on the harvest forecast relative to the base case requirement (36.4%).

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 landscape and IRM zones the basic provision of thermal cover requires that at least 20% of the area be above 20 metres in height. This percentage was then adjusted to account for areas netted out of the land base which met the 20 metre height requirement and satisfied ungulate thermal requirements. Within the ungulate winter range zone the basic percentage requirement of 40% was also adjusted to account for areas netted out of the land base. Further adjustments were also made to account for the large amount of selection harvesting which occurs within this zone. It was assumed that selection harvesting satisfies ungulate thermal cover requirements.

A.4.5 Basic silviculture and regeneration assumptions

Table A-17. shows what species are regenerated once existing areas are harvested and basic silviculture activities take place, and specifies the expected regeneration delay following harvesting.

Table A-17. Regeneration assumptions

Species type	Managed stand %			Regen delay(s) (years)
	Fir	Spruce	Pine	
Wet Fir G/M	57	32	11	4
Wet Fir P/L	43	22	35	4
Pl/Fir G/M	49		51	5
Pl/Fir P/L	40		60	6
Pl/Spruce G/M		50	50	4
Pl/Spruce P/L		40	60	5
Pl G/M		15	85	5
Pl P/L			100	6
Balsam/Hemlock G/M		64	36	3
Balsam/Hemlock P/L		51	49	4
Spruce/Pw/Cedar G/M		64	36	3
Spruce/Pw/Cedar P/L		51	49	4

A.4 Forest Management Assumptions

A.4.6 Immature plantation history

Table A-18. identifies the areas of existing immature forest that have a history of management (i.e. harvest and regeneration) and that should be assigned to a managed stand yield curve.

Table A-18. Immature plantation history

Analysis unit	Area to be allocated to a managed stand (ha) Landscape	Ungulate	IRM	Total area
Wet Fir G/M < 141	41.8	0.0	253.1	294.9
Wet Fir G/M > 140	0.0	0.0	0.0	0.0
Wet Fir P/L	4.8	0.0	91.8	96.6
Pl/Fir G/M < 141	177.9	255.6	1 061.2	1 494.7
Pl/Fir G/M > 140	0.0	0.0	0.0	0.0
Pl/Fir P/L < 141	113.3	45.8	645.1	804.2
Pl/Fir P/L > 140	0.0	0.0	0.0	0.0
Pl/Spruce G/M	208.6	0.0	2 955.9	3 164.5
Pl/Spruce P/L	9.9	0.0	413.9	423.8
Pl G/M	682.7	0.0	8 022.3	8 705.0
Pl P/L	70.0	0.0	1 256.3	1 326.3
Balsam/Hemlock G/M < 141	12.3	0.0	176.8	189.1
Balsam/Hemlock G/M > 140	0.0	0.0	0.0	0.0
Balsam/Hemlock P/L < 141	20.9	0.0	198.7	219.6
Balsam/Hemlock P/L > 140	0.0	0.0	0.0	0.0
Spruce/Pw/Cedar G/M	242.2	0.0	2 115.0	2 357.2
Spruce/Pw/Cedar P/L < 141	25.6	0.0	458.2	483.8
Spruce/Pw/Cedar P/L > 140	0.0	0.0	0.0	0.0
Total ha.	**1 610.0**	**301.4**	**17 648.3**	**19 559.7**

A.4 Forest Management Assumptions

A.4.7 Operational adjustment factors

Table A-19. outlines the Operational Adjustment Factors and site indices used to generate the managed stand yield curves from the TIPSY model.

Table A-19. Operational adjustment factors (OAFs)

Analysis unit	Site index	OAF 1	OAF 2
Wet Fir G/M < 141	18.2	15	5
Wet Fir G/M > 140	15.9	15	5
Wet Fir P/L	14.6	15	5
Pl/Fir G/M < 141	17.1	15	5
Pl/Fir G/M > 140	14.8	15	5
Pl/Fir P/L < 141	14.0	15	5
Pl/Fir P/L > 140	11.8	15	5
Pl/Spruce G/M	16.4	15	5
Pl/Spruce P/L	11.4	15	5
Pl G/M	16.0	15	5
Pl P/L	13.0	15	5
Balsam/Hemlock G/M < 141	15.5	15	5
Balsam/Hemlock G/M > 140	13.4	15	5
Balsam/Hemlock P/L < 141	13.2	15	5
Balsam/Hemlock P/L > 140	10.4	15	5
Spruce/Pw/Cedar G/M	16.4	15	5
Spruce/Pw/Cedar P/L < 141	12.3	15	5
Spruce/Pw/Cedar P/L > 140	10.3	15	5

Note: Stocking was assumed to be:
Fir G/M 1200sph
Fir P/L 1000sph
Spruce G/M 1200sph
Spruce P/L 1000sph
Pine G/M 1400sph
Pine P/L 1200sph

A.4.8 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 forested 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-20. Yield estimates for existing stands

Age	Volume (cubic metres per hectare)						
	Selection < 141	Selection > 140	WFir G/M < 141	WFir G/M > 140	WFir P/L	Pl/Fir G/M < 141	Pl/Fir G/M > 140
10	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
30	1	0	3	1	0	5	1
40	11	2	35	14	4	35	9
50	30	10	73	43	19	73	31
60	52	25	111	76	41	108	58
70	75	42	147	106	63	141	83
80	98	59	180	136	84	171	108
90	119	76	211	163	104	199	132
100	140	92	241	188	122	226	154
110	160	107	268	212	140	250	175
120	177	121	291	233	156	272	194
130	193	134	312	253	170	292	213
140	207	146	331	270	183	308	227
150	220	157	347	286	195	321	240
160	232	166	362	299	205	331	250
170	242	175	375	311	214	339	258
180	252	183	386	323	222	345	265
190	261	191	397	334	230	349	271
200	270	199	408	344	238	354	278
210	278	207	417	354	245	360	285
220	286	214	427	363	252	365	291
230	294	220	436	372	259	370	297
240	301	226	444	380	265	375	302
250	307	232	452	388	271	380	308
260	308	233	453	389	272	381	308
270	308	233	454	390	273	382	309
280	308	233	455	391	274	382	309
290	309	233	457	392	274	383	309
300	309	234	457	393	275	383	310
310	309	234	458	394	276	384	310
320	309	234	459	395	276	384	310
330	309	234	460	395	277	384	310
340	310	234	460	396	277	384	309
350	310	234	461	397	278	384	309

continued

A.4 Forest Management Assumptions

Table A-20. Yield estimates for existing stands

Age	Volume (cubic metres per hectare)						
	Pl/Fir P/L < 141	Pl/Fir P/L > 140	Pl/Spr G/M	Pl/Spr P/L	Pine G/M	Pine P/L	Bal/Hem G/M < 141
10	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0
30	1	0	7	0	5	1	4
40	6	1	35	3	41	8	24
50	25	10	72	15	83	37	60
60	51	27	112	31	122	68	97
70	76	48	150	52	156	97	135
80	99	68	184	78	187	123	167
90	122	87	215	105	216	149	195
100	144	105	243	132	243	173	220
110	164	123	269	158	269	195	243
120	183	139	293	182	292	216	265
130	201	154	315	205	315	236	288
140	215	166	332	225	330	250	309
150	227	176	345	241	341	261	329
160	237	185	356	256	349	269	347
170	244	191	364	268	354	275	364
180	250	197	370	278	356	277	380
190	255	201	373	286	354	276	395
200	261	206	378	295	356	279	410
210	267	211	383	303	359	282	424
220	272	216	388	311	361	284	437
230	278	221	393	318	364	287	450
240	283	225	397	325	367	290	462
250	288	229	401	331	369	292	474
260	288	230	404	336	371	294	477
270	289	231	407	341	373	296	480
280	290	232	410	345	375	298	482
290	290	232	412	350	377	300	485
300	290	233	414	353	378	301	487
310	291	233	416	357	380	302	489
320	291	233	418	360	381	303	491
330	291	233	419	363	382	304	493
340	291	233	421	365	383	305	495
350	290	233	422	367	383	306	496

continued

Table A-20. Yield estimates for existing stands (concluded)

Age	Volume (cubic metres per hectare)					
	Bal/Hem G/M > 140	Bal/Hem P/L < 141	Bal/Hem P/L > 140	Spr/Pw/Ced G/M	Spr/Pw/Ced P/L < 141	Spr/Pw/Ced P/L > 140
10	0	0	0	0	0	0
20	0	0	0	0	1	0
30	1	1	0	0	4	0
40	12	9	1	7	13	0
50	36	35	10	37	27	1
60	66	67	26	82	43	6
70	99	105	51	126	66	24
80	126	135	74	166	103	49
90	150	162	94	201	137	77
100	171	187	113	232	167	104
110	190	210	130	259	194	129
120	207	231	146	283	219	153
130	226	253	162	305	243	175
140	244	274	178	325	264	196
150	261	293	192	342	284	215
160	277	310	206	358	302	232
170	292	327	219	372	318	248
180	306	342	231	385	332	263
190	320	356	243	396	346	276
200	333	371	254	406	358	289
210	346	384	265	416	369	301
220	358	397	276	424	380	311
230	370	409	286	432	389	322
240	381	421	295	440	398	331
250	392	433	305	447	407	340
260	394	437	308	451	413	346
270	396	442	311	456	419	352
280	398	446	314	460	424	357
290	400	450	317	464	429	362
300	402	454	320	467	433	367
310	403	458	322	470	438	371
320	405	461	325	473	442	375
330	406	464	327	476	445	379
340	407	468	329	478	448	382
350	409	471	331	481	451	385

A.4 Forest Management Assumptions

A.4.9 Yield estimates for managed stands

Yield tables applied to managed stands are shown in the following Table. 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" as well as the average site indices, operational adjustment factors and establishment assumptions in Section A.4.7 "Operational Adjustment Factors" were used. Managed stand yield tables were not generated for selection stands. Existing stand volumes listed in Table A-20. were assumed to represent harvestable volumes in selection stands throughout the analysis.

A.4 Forest Management Assumptions

Table A-21. Yield estimates for managed stands

Age	Volume (cubic metres per hectare)					
	WFir G/M < 141	WFir G/M > 140	WFir P/L	Pl/Fir G/M < 141	Pl/Fir G/M > 140	Pl/Fir P/L < 141
0	0	0	0	0	0	0
10	0	0	0	0	0	0
20	0	0	0	0	0	0
30	4	1	1	12	3	2
40	19	7	13	40	21	18
50	65	30	32	79	46	39
60	125	71	64	121	77	69
70	185	118	99	168	108	97
80	236	165	134	208	139	123
90	282	207	171	241	174	150
100	322	245	203	271	201	179
110	354	275	231	299	223	201
120	383	303	254	321	243	219
130	408	327	274	341	261	236
140	431	347	294	360	279	250
150	449	364	310	377	294	264
160	464	381	324	391	306	277
170	476	395	336	404	317	288
180	486	408	347	415	328	297
190	496	418	357	424	337	306
200	504	428	366	433	346	313
210	511	434	374	441	354	320
220	516	441	381	448	361	327
230	520	445	387	454	367	332
240	524	449	391	460	372	337
250	527	453	395	465	377	342
260	529	456	399	469	381	346
270	530	459	402	472	385	350
280	532	461	404	475	388	352
290	533	463	406	477	390	355
300	534	465	408	479	393	358
310	534	465	408	479	393	358
320	534	465	408	479	393	358
330	534	465	408	479	393	358
340	534	465	408	479	393	358
350	534	465	408	479	393	358

continued

A.4 Forest Management Assumptions

Table A-21. Yield estimates for managed stands

Age	Volume (cubic metres per hectare)					
	Pl/Fir P/L > 140	Pl/Spr G/M	Pl/Spr P/L	Pine G/M	Pine P/L	Bal/Hem G/M < 141
0	0	0	0	0	0	0
10	0	0	0	0	0	0
20	0	0	0	0	0	0
30	0	9	0	12	2	4
40	5	31	3	48	19	19
50	19	79	16	99	47	52
60	35	132	33	142	81	104
70	57	186	59	183	112	159
80	78	237	91	226	135	210
90	96	283	120	261	157	256
100	115	321	147	290	177	303
110	131	350	172	313	201	337
120	148	374	194	333	220	364
130	166	392	219	349	236	385
140	181	407	243	362	249	402
150	193	420	262	373	260	416
160	204	430	278	381	269	428
170	214	438	291	390	278	438
180	222	444	303	396	286	445
190	229	449	312	401	293	452
200	236	452	321	405	299	456
210	242	453	328	408	304	459
220	248	454	335	410	309	460
230	254	454	341	412	312	459
240	259	454	346	414	316	459
250	263	453	352	414	318	459
260	267	452	355	416	321	458
270	270	451	358	416	323	457
280	274	450	361	416	325	455
290	276	449	364	416	326	453
300	279	448	365	416	327	452
310	279	448	365	416	327	452
320	279	448	365	416	327	452
330	279	448	365	416	327	452
340	279	448	365	416	327	452
350	279	448	365	416	327	452

continued

A.4 Forest Management Assumptions

Table A-21. Yield estimates for managed stands (concluded)

Age	Volume (cubic metres per hectare)					
	Bal/Hem G/M > 140	Bal/Hem P/L < 141	Bal/Hem P/L > 140	Spr/Pw/ Ced G/M	Spr/Pw/Ced P/L < 141	Spr/Pw/Ced P/L > 140
0	0	0	0	0	0	0
10	0	0	0	0	0	0
20	0	0	0	0	0	0
30	1	1	0	6	0	0
40	9	11	1	24	6	1
50	22	26	7	69	20	7
60	56	58	18	127	41	17
70	99	97	34	186	75	32
80	143	136	61	239	111	58
90	184	171	91	289	146	87
100	222	205	119	332	176	115
110	260	239	146	363	205	142
120	296	271	169	388	236	165
130	322	296	192	407	265	187
140	343	316	214	424	287	209
150	360	332	237	437	305	231
160	375	347	257	448	321	252
170	387	359	274	456	334	269
180	397	370	289	462	345	284
190	406	380	301	467	355	296
200	414	388	311	468	364	307
210	421	395	320	469	372	316
220	425	400	328	469	378	324
230	429	405	335	469	384	331
240	432	409	341	468	389	337
250	435	413	347	467	393	343
260	435	415	352	465	397	348
270	435	415	355	464	399	353
280	434	416	359	462	402	356
290	434	415	362	460	402	360
300	433	415	365	458	402	362
310	433	415	365	458	402	362
320	433	415	365	458	402	362
330	433	415	365	458	402	362
340	433	415	365	458	402	362
350	433	415	365	458	402	362

A.5 Definition of the Small Pine Land Base

There is currently an interest within the Merritt TSA to incorporate into the timber harvesting land base, forest types which were previously described as non-merchantable. These forest types are primarily now classified as "small pine" and include from the non-merchantable forest type description in Table A.5, the following forest types.

Table A-22. Small pine inventory description

Type group or species	Criteria					
	new site class	new site index	old site index	age class	new height class	crown closure class
28 - 31 Lodgepole leading	Low	< 10		1		
28 - 31 Lodgepole leading		< 10		2 - 3		
28-31 Lodgepole leading		< 14		4 - 9	< 3	
28 - 31 Lodgepole leading			≤ 19.5	4 - 9	< 3	≥ 8

Possible harvesting of these "small pine" forest types creates uncertainty about the size of the timber harvesting land base. The degree of this uncertainty was assessed by determining the area in the "small pine" types, and potential changes to forest cover requirements resulting from inclusion of these stands in the harvesting land base. These forest types would add approximately 97 000 hectares to the current timber harvesting land base. In modelling the addition of these areas, it was assumed that they would be managed in a similar fashion to the existing timber harvesting land base. In doing so, adjustments were made to Table A-16. Forest Cover Guidelines by Management Zone. Table A-23. describes these changes. One notable change is that if "small pine" areas were included in the harvesting land base, the green-up forest cover guideline for the IRM zone would allow only 20% of the area below green-up age rather than 25%.

A.5 Definition of the Small Pine Land Base

Table A-23. Forest cover guidelines by management zone - including small pine areas

	Green-Up Forest Cover Guideline				Mature Forest Cover Guideline			
Zone	**% gross area**	**% net operable area**	**Minimum ht (m)**	**Tree age (yrs)**	**% gross area**	**% net operable area**	**Minimum ht (m)**	**Tree age (yrs)**
Landscape	10	10.5	5.5	25	20	14.8	20	105
Ungulate	20	20	3	15	40	7.5	20	97
IRM	20	23.5	3	17	20	14.9	20	105

The effects of uncertainty about the contribution of "small pine" to timber harvests is examined in Section 5.8.2 "Increase in the timber harvesting land base."

Table A-24. describes the existing stand yields for the small pine areas as determined using VDYP (see Section A.4.8).

A.5 Definition of the Small Pine Land Base

Table A-24. Yield estimates for existing small pine stands

Volume (cubic metres per hectare)	
Age	**Small pine**
10	0
20	0
30	0
40	2
50	21
60	47
70	71
80	94
90	117
100	138
110	157
120	176
130	194
140	207
150	217
160	225
170	230
180	233
190	233
200	236
210	238
220	241
230	244
240	247
250	249
260	251
270	253
280	254
290	256
300	257
310	258
320	259
330	260
340	261
350	261

Management and growth of small pine stands was assumed to be the same as that for the pine poor/low analysis unit, including the managed stand yield curve, and regeneration delay. This was because the weighted site index value for the small pine analysis unit was almost the same as that of the pine poor/low analysis unit.