TIMBER SUPPLY BRANCH

TIMBER SUPPLY REVIEW

100 Mile House Timber Supply Area Analysis Report

July 2001

BRITISH COLUMBIA

Ministry of Forests

100 Mile House Timber Supply Area Analysis Report

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Preface

This report contains a timber supply analysis and socio-economic analysis and is part of the provincial Timber Supply Review carried out by the British Columbia Forest Service. The purpose of the review is to examine the short- and long-term effects of current forest management practices on the availability of timber for harvesting in timber supply areas (TSAs) and tree farm licences (TFLs) throughout British Columbia.

To determine allowable timber harvesting levels, 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.**

This report focuses on a single forest management scenario — current management practices. Current management practices are defined by the specifications in management plans for the timber supply area including guidelines for the protection of forest resources, the *Forest Practices Code (FPC) of B.C. Act* and official land-use decisions.

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

In addition to having an up-to-date assessment of timber supply when setting the allowable annual cut (AAC) the chief forester considers short- and long-term implications of alternative harvest levels, capabilities and requirements of existing and proposed processing facilities, and the social and economic objectives of the Crown. The socio-economic analysis provides the chief forester with some of the information necessary for these considerations.

This report is the third of five documents that will be released for each TSA as part of the Timber Supply Review. (The first two documents are the information report and the data package). A fourth document called the public discussion paper will summarize the technical information and will provide a focus for public discussions of possible timber harvest levels. The fifth will outline the chief forester's harvest level decision and the reasoning behind it.

Executive Summary

As part of the provincial Timber Supply Review, the British Columbia Forest Service has examined the availability of timber in the 100 Mile House Timber Supply Area (TSA). The analysis assesses how current forest management practices affect the supply of wood available for harvesting over the short- (next 20 years), medium- (21 to 100 years from the present) and long- (beyond 100 years from the present) terms. It also examines the potential changes in timber supply stemming from uncertainties about forest growth and management actions. **It is important to note that the various harvest forecasts included in the report indicate only the timber supply implications of current practices and uncertainty. As such, the forecasts should be used for discussion purposes only; they are not allowable annual cut (AAC) recommendations.**

The 100 Mile House Timber Supply Area (TSA) covers approximately 1 235 000 hectares in the south central portion of British Columbia. It is bounded by the Fraser River in the south, and extends north to the Quesnel Highlands. About 72% of the 100 Mile House TSA (approximately 885 000 hectares) is considered productive forest area managed by the Crown. Currently about 83% of the productive forest, or 59% of the total TSA (approximately 731 000 hectares), is considered available for timber harvesting under current forest management practices. These practices follow the standards and legislation set out by the *Forest Practices Code* and the agreements made under the Cariboo-Chilcotin Land Use Plan (CCLUP). Within the area available for timber harvesting, most of the forests are dominated by lodgepole pine and interior Douglas-fir, although there are also significant areas dominated by spruce, and deciduous species.

The results of this timber supply analysis suggest that harvest levels can be maintained at the current AAC for the 100 Mile House TSA (1 335 600 cubic metres per year after accounting for woodlot licences issued since the last determination) for the next 100 years. This is followed by a small reduction of 4% to a long-term harvest level of 1 281 600 cubic metres per year. The existing partition of 112 000 cubic metres per year for Pulpwood Agreement (PA) 16 can be maintained for 20 years. The timber contribution from these stand types decreases to almost zero during the third and fourth decades before recovering in the fifth decade.

These results reflect current knowledge and information on forest inventory, growth, and management. However, uncertainty exists about several factors important in defining timber supply. A series of sensitivity analyses showed that these uncertainties can affect timber supply to varying degrees.

The largest potential effects on projected harvests over the short term are associated with uncertainties in estimates of timber volumes in existing stands. An audit conducted in 1999 suggested that the inventory estimate of volumes in the TSA may be 11% higher than estimates based on ground measurements. Further analysis of the audit data suggests that most of the inventory discrepancies may occur in the Interior Douglas-fir (IDF) biogeoclimatic zone and in the Big Bar public sustained yield unit (PSYU). In the IDF zone, which accounts for 49.5% of the timber harvesting land base, inventory estimates may be up to 25% higher than estimates based on ground measurements. If existing stand volumes in the IDF zone are indeed 25% lower than the inventory estimates, this analysis shows that the current AAC can be maintained for only one decade. Timber supply then declines to a mid-term level of 1 125 300 cubic metres per year (about 16% below the base case level). Similar results are obtained when existing stand volumes of all stands in the Big Bar PSYU, which comprise 34.9% of the timber harvesting land base, are reduced by 19% to account for the possible inventory discrepancies.

Short-term timber supply is also affected by the allowable visible disturbance applied to visually sensitive areas. In the base case only 10% of the visually sensitive areas were allowed to be in a disturbed condition. When the level of disturbance was increased to 15%, short-term timber supply was increased by 20 000 cubic metres per year or 1.5%.

Like the short term, medium-term timber supply is affected by uncertainties that affect either the total amount of existing volume, or the ability to access existing volume during the first 100 years. In this TSA, timber supply in the medium term is most affected by changes in: the size of the timber harvesting land base, volumes from existing stands, and forest cover requirements for management of visual quality.

Executive Summary

When the timber harvesting land base was increased by 10%, timber supply was increased by about 10% throughout the analysis horizon. When the timber harvesting land base was decreased by 10%, medium- and long-term timber supply decreased by about 10%. In addition to the impact on short-term timber supply, a decrease in volume from existing stands had a medium- and a long-term impact as well. If existing stand volumes in the IDF zone were overestimated by 25% then timber supply in the medium term would be about 16% below the base case level. Management for visual quality affects access to both existing and regenerated stand volumes. If the allowable disturbance in visual quality areas was increased from 10% to 15% there would be a 1.5% increase in medium- and long-term timber supply.

Long-term (over 100 years from now) timber supply is affected by uncertainties in all of the factors affecting short- and medium-term timber supply. In addition, factors that affect the volume of regenerated stands or the availability of those stands also affect long-term timber supply.

If regenerated stand volumes were 10% higher than estimated then long-term timber supply was projected to be 8% higher than in the base case. If regenerated stand volumes were 10% lower than estimated the long-term timber supply was expected to be 6% lower than the base case. If site productivity of existing old-growth stands is underestimated, as suggested by recent research, yields from stands regenerated after harvesting old growth could be significantly higher than projected in the base case. In the 100 Mile House TSA, stands older than 140 years comprise 6% of the timber harvesting land base and the old-growth site index adjustment resulted in a 4.2% increase in long-term timber supply.

The time taken to achieve green-up conditions and the amount of area allowed to be in a non-greened-up condition also have significant effects on long-term timber supply. If the time taken to reach the green-up height of three metres was increased by five years then long-term timber supply was reduced by about 8%. If the time to green-up was reduced by five years then it would be possible to increase long-term timber supply by about 3%. In the base case 35% of the area in the multiple use zone (56% of the timber harvesting land base) was allowed to be in a non-green-up condition. If this constraint was tightened to allow only 25% of the area to be below green-up then long-term timber supply would be reduced by 5%.

The socio-economic analysis for the 100 Mile House TSA indicates that the current AAC of 1 335 600 cubic metres can support about 1,037 person-years of employment in the TSA, and 2,563 person-years of forestry employment across the province.

If fully harvested and utilized, the volume in the base case harvest forecast would generate an estimated $58.6 million in provincial government revenues annually.

In conclusion, this analysis indicates that based on current inventory, growth and yield, and forest management information, timber harvests in the 100 Mile House TSA can be maintained at the current level for 100 years. The existing partition of 112 000 cubic metres per year for Pulpwood Agreement 16 can be maintained for 20 years. The analysis indicates that several factors related to the current forest inventory and management regime could affect timber supply. However, except for the likelihood that existing stand volumes may be overestimated, there is no conclusive evidence to suggest that significant inaccuracies exist in the information used in this analysis.

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Introduction

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

Assessing the timber supply involves considering physical, biological, 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 wildlife or a recreation area.

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

Thus, before an estimate of 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 — 250 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 upon which they are based remains relevant. Thus, it is important that re-analysis occurs regularly, using new information and knowledge to update the timber supply picture. Indeed, the *Forest Act* requires that the timber supply for management units through British Columbia be reviewed at least every five 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
The amount of timber that is forecast to be available for harvesting over a specified time period, under a particular management regime.
Timber supply area (TSA)
An integrated resource management unit established in accordance with Section 7 *of the* Forest Act.

Allowable annual cut (AAC)
The rate of timber harvest permitted each year from a specified area of land, usually expressed as cubic metres of wood per year.

Introduction

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

The following sections outline the timber supply analysis for the 100 Mile House TSA. Following a brief description of the area in Section 1, data preparation and formulation of assumptions are discussed in Section 2. Timber supply analysis methodology and results are presented in Sections 3 and 4. Section 5 examines the sensitivity of the results to uncertainties in the data and assumptions used. This is followed by a summary and conclusions for the timber supply analysis. Section 7 shows results of a socio-economic analysis for the 100 Mile House TSA. Appendixes A and B contain further details about the data and assumptions used in the analysis.

As part of the timber supply review (TSR), information is gathered on the short- and long-term implications of alternative harvest levels, and the capabilities and requirements of existing and proposed processing facilities. The socio-economic analysis provides information for the chief forester and the local community to better understand the potential magnitude of impacts associated with any proposed harvest level changes.

Forest inventory
An 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 other forest values such as recreation and visual quality.

Model
An abstraction and simplification of reality constructed to help understand an actual system or problem. Forest managers and planners have made extensive use of models, such as maps, classification systems and yield projections, to help direct management activities.

1 Description of the 100 Mile House Timber Supply Area

The 100 Mile House Timber Supply Area (TSA) is situated in the south-central portion of British Columbia and covers approximately 1.23 million hectares. The TSA is bounded by the Fraser River to the west, the Cariboo Mountains and Wells Grey Park to the east, the Williams Lake TSA to the north, and the Kamloops TSA to the south. The boundaries of the TSA are the same as those of the 100 Mile House Forest District, one of five districts in the Cariboo Forest Region. The TSA is administered by the forest district office in 100 Mile House.

According to the 1996 census, the population of the 100 Mile House TSA is 15,893, a 20% increase since 1991. The main communities are 100 Mile House (including the 108 Mile Ranch) and Clinton where 20% of the population reside. Other smaller communities include Lac la Hache, Forest Grove, 70 Mile, Lone Butte and Bridge Lake. Population is very dispersed throughout the TSA with many small rural settlements.

The topography of the 100 Mile House TSA is characterized by gently rolling hills with higher mountains in the Marble Range to the southwest and the Quesnel Highlands to the northeast. The western part of the TSA, along the Fraser River, has a hot, dry climate, while the Cariboo Mountains in the east have a wetter climate and steep slopes. The central portion of the TSA is a moderate elevation interior plateau that is dry and flat.

The forests of the 100 Mile House TSA are fairly diverse, reflecting the variety of topography and climate. Within the land base currently considered available for timber harvesting, lodgepole pine is by far the dominant species, but Douglas-fir, spruce, subalpine fir, western larch, western redcedar, western hemlock and hardwoods also occur. About 75% of stands in the timber harvesting land base* are at or above the minimum harvestable age (MHA), with an abundance of stands 100 to 120 years old and very few stands older than 250 years.

The current allowable annual cut (AAC) in the 100 Mile House TSA is 1.362 million cubic metres. This level was set by the chief forester effective November 9, 1995, and maintains the previous harvest level of 1.250 million cubic metres plus a partition* of 112 000 cubic metres of previously non-merchantable forest types* (Pulpwood Agreement* 16 areas).

About 72% of the TSA land base is considered productive forest land managed by the B.C. Forest Service (approximately 885 300 hectares). Currently about 83% of this forested land base is considered available for harvesting (59% of the total TSA land base).

Timber harvesting land base
Crown forest land within the timber supply area where timber harvesting is considered both acceptable and economically feasible, given objectives for all relevant forest values, existing timber quality, market values and applicable technology.
Partition
A portion of the AAC that is attributable to certain types of timber and/or terrain.

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.
Pulpwood agreements
An agreement applying to a fixed geographic area that allows harvesting of timber below sawlog standards if mill residues suitable for the facility under the agreement are not available.

1 Description of the 100 Mile House Timber Supply Area

Significant changes that influence forest management have occurred since the last timber supply review was completed. Some of these changes include:

- implementation of the *Forest Practices Code (FPC)**;
- use of draft landscape units (LU)* and biodiversity emphasis options (BEO);
- revisions to scenic areas*, lakes classification and wildlife features;
- non-timber resource inventories and planning work under the sub-regional planning process, (e.g., tourism visuals, back-country classification, recreation features); and
- management direction from the Cariboo-Chilcotin Land Use Plan (CCLUP).

The Cariboo-Chilcotin Land Use Plan was approved by government in October 1994 and included the announcement of five new protected areas*, which later became parks, in the 100 Mile House TSA. In March 1995, the *90-Day Implementation Process Report* was released, and the targets and strategies relating to operational planning were declared as Higher Level Plan* direction under the *Forest Practices Code* effective January 31, 1996. The Inter-Agency Management Committee, in consultation with the Regional Resources Board, was directed by government to oversee implementation of the Land Use Plan. An *Integration Report* has been endorsed by both groups and provides direction to operational planning as well as to further levels of planning, such as the 100 Mile Sub-Regional Plan and subsequent landscape unit plans. The report also contains management strategies to meet the long- and short-term targets of the Land Use Plan. Any changes to the current management regime that occur before the AAC determination will be presented to the chief forester for his consideration in the determination.

A sub-regional planning process, covering the entire 100 Mile House TSA, is currently underway. This plan will further refine the implementation of the Cariboo-Chilcotin Land Use Plan targets and will provide additional direction to operational planning. Some of the draft results of this sub-regional process (e.g., non-timber resource inventories) have been incorporated in this timber supply review; others will be considered in future timber supply reviews in the 100 Mile House TSA.

The forests of the 100 Mile House TSA provide a wide range of forest land resources, including forest products (timber and non-timber, such as botanical forest products), recreation and tourism amenities, and fishery and wildlife habitats. The grasslands and open forests in the TSA provide forage for the beef cattle ranching industry. Residents and visitors make extensive use of the forests, parks and lakes of the TSA for recreational activities such as hiking, fishing, hunting, mountain-biking, backcountry recreation, wildlife viewing, snowmobiling and cross-country skiing. The area is well-travelled as it is extensively roaded and Highway 97, a major route to north-central B.C., runs through the TSA.

Forest Practices Code
Legislation, standards and guidebooks that govern forest practices and planning, with a focus on ensuring management for all forest values.
Landscape unit
A planning area based on topographic or geographic features, that is appropriately sized (up to 100 000 hectares), and designed for application of landscape-level biodiversity objectives.
Scenic area
Any visually sensitive area or scenic landscape identified through a visual landscape inventory or planning process carried out or approved by a district manager.

Protected area
A designation for areas of land and water set aside to protect natural heritage, cultural heritage or recreational values (may include national park, provincial park, or ecological reserve designations).
Higher level plans
Higher level plans establish the broader, strategic context for operational plans, providing objectives that determine the mix of forest resources to be managed in a given area.

1 Description of the 100 Mile House Timber Supply Area

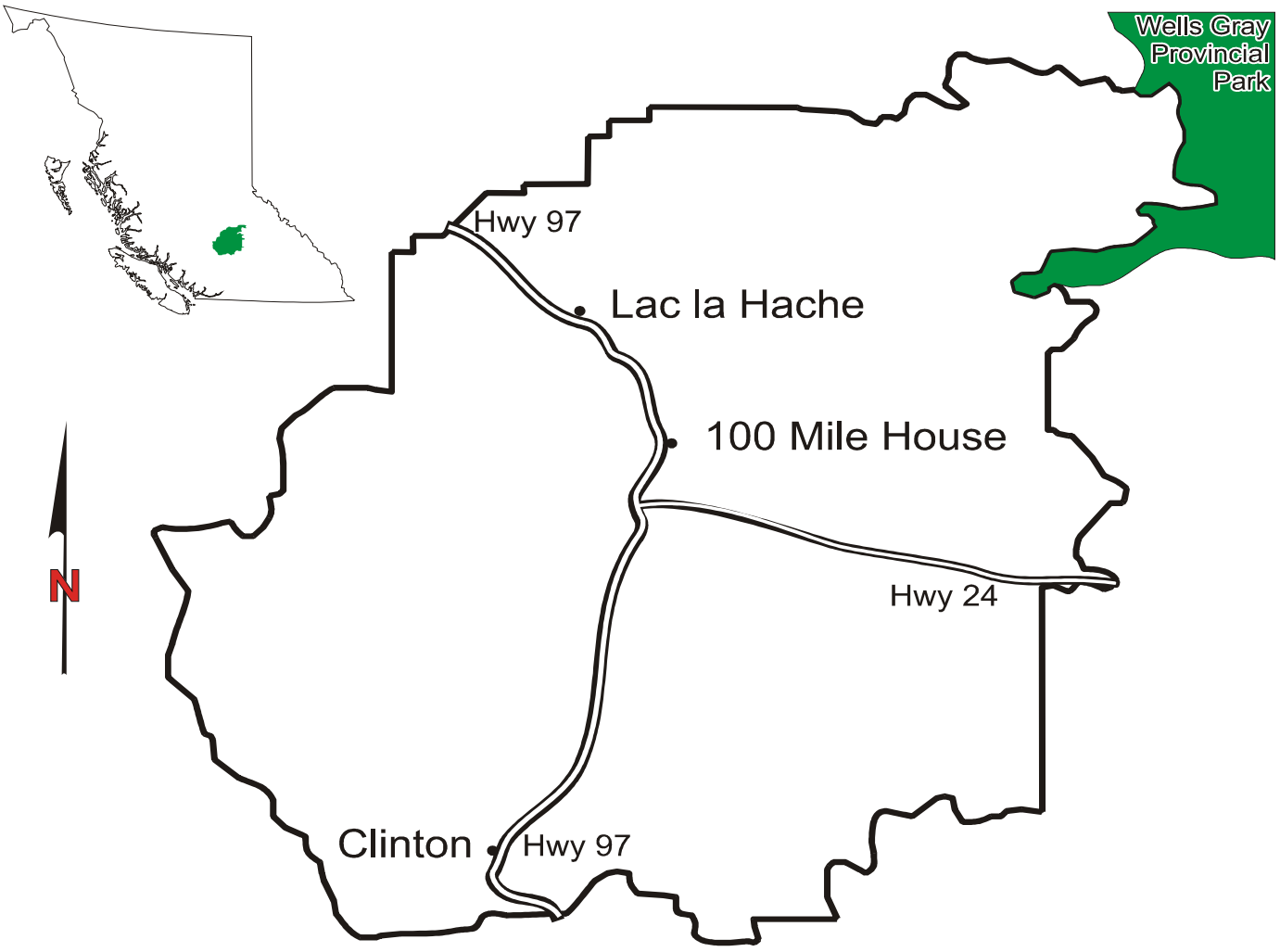

Figure 1. Map of the 100 Mile House Timber Supply Area, Cariboo Forest Region.

1 Description of the 100 Mile House Timber Supply Area

1.1 The environment

The 100 Mile House TSA includes six forested biogeoclimatic zones*, ranging from dry, open stands of pine and fir, to moist mountain slopes with dense forests of cedar, hemlock, spruce and subalpine fir. The varied ecological features and unique nature of the area contribute to the high biodiversity* values found in this TSA. The five main forested zones are described below (the Montane Spruce zone has only a minor occurrence in this TSA).

The Interior Douglas-fir (IDF) zone dominates the low- to mid-elevation landscape in this TSA. The IDF is characterized by warm, dry summers, a fairly long growing season and cool winters. Substantial growing season moisture deficits are common and frosts can occur at any time. The dominant tree species in this zone are Douglas-fir and lodgepole pine, but ponderosa pine, white spruce and trembling aspen are also common.

The Sub-Boreal Pine-Spruce (SBPS) zone occupies the gently rolling landscape in the eastern portion of this TSA, generally above the IDF zone and below the Sub-Boreal Spruce zone. The climate is characterized by cold, dry winters and cool, dry summers. Tree growth is restricted by the cool dry conditions during the short growing season. Nighttime frosts are common in all seasons. Lodgepole pine is by far the most common tree species, but Douglas-fir, white spruce and trembling aspen are also common. Other occasional species are subalpine fir, birch and cottonwood.

The Sub-Boreal Spruce (SBS) zone occurs in the northern and eastern portions of the TSA, generally at elevations above the SBPS zone and below the Engelmann Spruce-Subalpine Fir zone. The SBS is characterized by seasonal extremes of temperature, with severe, snowy winters and relatively warm, moist and short summers. Annual precipitation is moderate. Common tree species are white spruce, subalpine fir, lodgepole pine, trembling aspen, paper birch and Douglas-fir.

The Interior Cedar-Hemlock (ICH) zone occurs at mid-elevations in the Quesnel Highlands in the eastern portion of the 100 Mile House TSA. The ICH zone is characterized by cool, wet winters and warm, dry summers. It is the most productive forest zone in the interior of B.C. and has the highest diversity of tree species of any zone in the province. Common tree species are western redcedar, spruce, subalpine fir, Douglas-fir, lodgepole pine, birch and various poplar species.

The Engelmann Spruce-Subalpine Fir (ESSF) zone generally occurs above the ICH in the Quesnel Highlands. Growing seasons are short and cool while winters are long and cold in this high elevation zone. Engelmann spruce and subalpine fir are the most common tree species, but lodgepole pine, western hemlock and western redcedar are also found.

In addition to these forested zones, the Bunchgrass (BG) zone occurs in the bottom of the Fraser River valley along the western edge of the TSA. In this deep valley, drought restricts tree establishment and grasslands predominate. The Alpine Tundra (AT) zone occurs at high elevations in the very southwest and northeast corners of the TSA. This zone is mostly treeless and the vegetation is dominated by shrubs, herbs, mosses and lichens. Much of the landscape is the domain of rock, ice and snow.

The TSA hosts a wide variety of wildlife species including mule deer, moose, black bear, eastern caribou, grizzly bear, California bighorn sheep, lynx, marten, raptors and owls. The TSA lies entirely within the Fraser River drainage*, and the Fraser and its tributaries are highly productive and support many fish species. The most common game fish are rainbow trout, lake trout and kokanee, while important habitat for salmon and steelhead also occurs.

Biogeoclimatic zones
A large geographic area with broadly homogeneous climate and similar dominant tree species.
Biodiversity (biological diversity)
The diversity of plants, animals and other living organisms in all their forms and levels of organization, including the diversity of genes, species and ecosystems, as well as the evolutionary and functional processes that link them.

Drainage
The surface and sub-surface water derived within a clearly defined catchment area, usually bounded by ridges or other similar topographic features, encompassing part, most, or all of a watershed. The term is sometimes used to describe an operating area or location.

1 Description of the 100 Mile House Timber Supply Area

Under the *Forest Practices Code*, a process exists for identifying species at risk and designating wildlife habitat areas with specific management practices. The wildlife species that have been identified in *Managing Identified Wildlife: Procedures and Measures, Volume 1, Forest Practices Code*, *(February 1999)* in the six ecosections of the 100 Mile House Forest District are presented in Table 1. The Cariboo Basin, Cariboo Plateau and Quesnel Highland are the dominant ecosections in this district.

Other species considered at risk in the 100 Mile House TSA are listed in Table 2.

Table 1. Species at risk as identified under the Forest Practices Code (February 1999)

Common names of identified wildlife	Ecosection					
	Cariboo Basin (CB)	Cariboo Plateau (CP)	Fraser River Basin (FRB)	Quesnel Highland (QH)	Pavilion Ranges (PR)	Northern Thompson Upland (NTU)
Bull trout			x		x	
Rubber boa	x		x		x	x
American bittern	x	x				x
Northern goshawk *atricapillus*	x	x	x	x	x	x
Prairie falcon	x	x	x		x	x
Sandhill crane	x	x				
Long-billed curlew	x		x			
Lewis's woodpecker			x			
Brewer's sparrow *breweri*			x		x	
Bobolink	x	x	x			
Fisher	x	x	x	x	x	x
Grizzly bear		x		x	x	x
Mountain goat				x		
Bighorn sheep *californiana*	x		x		x	x

Source: *Managing Identified Wildlife: Procedures and Measures, Volume 1, Forest Practices Code*, *February 1999*, and R. Packam, FES, personal communication 2001.

Table 2. Vulnerable, endangered and threatened species

Common name of species	Red-listed (endangered or threatened)	Blue-listed (vulnerable)	Ecosection
White sturgeon	x		FRB, PR
Great basin spadefoot toad		x	FRB, CB, PR
Racer		x	FRB, CB, PR
Gopher snake		x	FRB, CB, PR
Great blue heron		x	FRB, CB, CP
Swainson's hawk		x	FRB, CB
Sharp-tailed grouse		x	CB, CP
American avocet		x	CB
Flammelated owl		x	FRB
Short-eared owl		x	FRB, CB
Fringed myotis bat		x	FRB, CB
Western small-footed bat		x	FRB, CB
Spotted bat		x	FRB, CB
Badger	x		FRB, CB, CP, PR

Source: R. Packham, FES, 100 Mile House Forest District, personal communication 2001.

Current forest management practices follow the legislation and guidelines set out by the *Forest Practices Code*. Consequently, the protection of wildlife and the environment will be managed through the *Code*. In addition, the Cariboo-Chilcotin Land Use Plan provides further management direction for public forest lands in the 100 Mile House TSA, as well as for wildlife habitat.

1.2 First Nations

Three First Nations have communities located in the 100 Mile House TSA with a total population of about 1,100 people. All three — Canim Lake, High Bar and Canoe Creek bands — are Secwepemc (Shuswap) people. Other First Nations with traditional territories in the 100 Mile House TSA are Williams Lake, Esketemc, Pavilion, Bonaparte, Whispering Pines, Skeetchestn and North Thompson bands.

A number of traditional-use surveys are underway in the 100 Mile House TSA. These surveys focus on oral presentations by community members to clarify which lands in the TSA were used traditionally. Archaeological Impact Assessments (AIA) are done as part of operational planning on areas that have been identified as having high archaeological potential (based on an Archaeological Overview Assessment (AOA)) or on request by First Nation bands.

The forest industry provides some employment opportunities to First Nations people, although concern is expressed that First Nations do not receive an equitable share of the timber supply and forest industry employment. While there is general support for timber harvesting, First Nations have expressed concern about lack of consultation and the impact of logging on water and fishery resources, traditional use areas, heritage resources and spiritual ceremonial sites in their traditional territories.

2 Information Preparation for the Timber Supply Analysis

Timber supply analysis requires three general categories of information: land base inventory; timber growth and yield; and management practices. These three categories are discussed below. Also, in preparation for the analysis, a number of changes since the 1994 100 Mile House TSA timber supply analysis were noted, and are described in Section 2.4, "Changes since the 1994 100 Mile House TSA analysis and 1995 addendum."

2.1 Land base inventory

Land base information used in this analysis came as a computer file compiled in 1999 by the B.C. Forest Service. This file contains information on the forest land in the 100 Mile House TSA including general geographic location, area, nature of forest cover (such as presence or absence of trees, species, number of trees, age, and timber volume), and other characteristics such as environmental sensitivity and physical accessibility (operability*). Stand attributes such as tree height, stocking* and age have been projected to 1997. The inventory file has been updated to account for timber harvesting up to 1998 for the 100 Mile House TSA.

The inventory file represents the land base for the entire TSA. It includes information on land that does not contain forest, and other areas where timber harvesting is not expected to occur. Examples are land set aside for parks, areas needed to protect wildlife habitat, areas in utility and transportation corridors, and residential and industrial development. A description of these areas specific to the 100 Mile House TSA is provided below. These types of areas do not contribute to the timber harvesting land base of the 100 Mile House TSA. Before assessing timber supply, these non-contributing areas are identified and separated from the timber harvesting land base. When deriving this data file, care is taken to make only a single reduction for areas that overlap (for example, where an inoperable area* is also wildlife habitat).

Identifying areas as not contributing to timber supply does not mean the area is removed from the 100 Mile House TSA. The B.C. Forest Service still manages the entire area of the TSA (except for designated areas under the jurisdiction of other agencies) as a land unit that contributes a mix of timber and non-timber values. The timber supply is managed within this integrated resource context, and the analysis described herein is consistent with this philosophy.

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

For the 100 Mile House TSA, the following types of areas were excluded from the timber harvesting land base.

- not managed by the B.C. Forest Service — these are non-Crown areas, such as private land, Indian Reserves, woodlots and parks. The forested portions of parks and ecological reserves contribute towards biodiversity values.
- non-forest areas — areas not occupied by productive forest cover (e.g., rock, swamp, alpine areas and water bodies).
- existing classified roads — roads that have been identified in the geographic information system (GIS) were removed from the productive forest area.
- non-commercial cover areas — areas occupied by non-commercial tree or brush species.

Operability
Classification of an area considered available 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.
Stocking
The proportion of an area occupied by trees, measured by the degree to which the crowns of adjacent trees touch, and the number of trees per hectare.

Inoperable areas
Areas defined as unavailable for harvest for terrain-related or economic reasons. Characteristics used in defining inoperability include slope, topography (e.g., the presence of gullies or exposed rock), difficulty of road access, soil stability, elevation and timber quality. Operability can change over time as a function of changing harvesting technology and economics.

- inoperable areas — areas classified as unavailable for harvest for terrain-related or economic reasons. Characteristics used to define operability include slope, topography (e.g., presence of gullies or exposed rock), difficulty of road access, soil stability and elevation.
- existing, unclassified roads, trails and landings (RTL) — areas of forest land (not identified on maps) which have been removed from timber production due to access development and harvesting to date.
- environmentally sensitive areas (ESA)* — portions of the areas considered environmentally sensitive and/or significantly valuable for other resources.
- riparian areas* — unavailable for timber harvesting to protect riparian habitat* and stream ecosystems.
- class A lake buffer zones — a 200-metre reserve around class A lakes where no timber harvesting is permitted.
- wildlife tree* patch (WTP) areas — areas reserved within and along the edges of cutblocks* for the maintenance of stand-level biodiversity* (stand structure), primarily for conservation or enhancement of wildlife.
- caribou no-harvest areas — all areas identified as "no harvest" in the data provided were reserved for caribou habitat. See Table A-1. in Appendix A for a list of data files used in this analysis.
- sites with low timber productivity — areas occupied by forest with low timber-growing potential.

A more detailed description of these categories, including specific criteria for removal is located in Appendix A, "Description of Data Inputs and Assumptions for the Timber Supply Analysis." Table 3 summarizes the areas in each category, and shows the area of the timber harvesting land base.

Environmentally sensitive areas
Areas with significant non-timber values, fragile or unstable soils, impediments to establishing a new tree crop, or high risk of avalanches.
Riparian area
Areas of land adjacent to wetlands or bodies of water such as swamps, streams, rivers or lakes.
Riparian habitat
The stream bank and flood plain area adjacent to streams or water bodies.

Wildlife tree
A standing live or dead tree with special characteristics that provide valuable habitat for conservation or enhancement of wildlife.
Cutblock
A specific area, with defined boundaries, authorized for harvest.
Stand-level biodiversity
A stand is a relatively localized and homogeneous land unit that can be managed using a single set of treatments. In stands, objectives for biodiversity are met by maintaining specified stand structure (wildlife trees or patches), vegetation species composition and coarse woody debris levels.

2 Information Preparation for the Timber Supply Analysis

Table 3. Determination of the timber harvesting land base for the 100 Mile House TSA

Classification	Area (hectares)	Per cent of total TSA area	Per cent of Crown forest land
Total TSA area	1 234 875	100.0	
Existing roads (FC1 roads)	19 018	1.5	
Not managed by the B.C. Forest Service	155 139	12.6	
Newly created parks	43 594	3.5	
Non-forest	131 864	10.7	
Total forest area managed by the Forest Service (Crown forest)	**885 260**	**71.7**	**100.0**
Reductions to Crown forest			
Non-commercial forest	375	0.0	0.0
Environmentally sensitive areas (ESAs) — soils	14 806	1.2	1.7
ESAs — regeneration and avalanche	3 665	0.3	0.4
Inoperable areas	9 141	0.7	1.0
Secondary roads	5 718	0.5	0.6
Class A Lake buffers	593	0.1	0.1
Riparian areas	56 930	4.6	6.4
Caribou areas[a]	6 812	0.6	0.8
Wildlife tree patch (WTP) area	47 233	3.8	5.3
Sites with low productivity	8 960	0.7	1.0
Total current reductions	154 233	12.5	17.4
Current timber harvesting land base (includes 38 152 hectares not satisfactorily restocked (NSR) land)	**731 027**	**59.2**	**82.6**
Future land base changes			
Future road reductions	20 698		2.3
Long-term timber harvesting land base	**710 329**	**57.5**	**80.2**

(a) Not including the 609 hectares managed for caribou habitat.

2 Information Preparation for the Timber Supply Analysis

The current timber harvesting land base in the 100 Mile House TSA represents about 59% of the total TSA area and about 83% of the forested area managed by the B.C. Forest Service (Crown forest). Most of the excluded area is in two categories: riparian areas (6.5% of the Crown forest), and wildlife tree patches (5.3%). The percentages provided depend on the order in which each category is considered. For instance, riparian areas would constitute a larger proportion of the reduction if they were considered prior to environmentally sensitive areas.

Figure 2 represents both the total 100 Mile House TSA area, and the Crown forested land base. The total area chart shows that about 16% of the total land base is classified as not managed by B.C. Forest Service, and 12% as non-forest or non-productive forest (i.e., having very few trees). The Crown forested chart details the categories of forest land and shows that about 83% of the Crown forested land in the 100 Mile House TSA is considered to be available for harvesting (including not satisfactorily restocked (NSR)*).

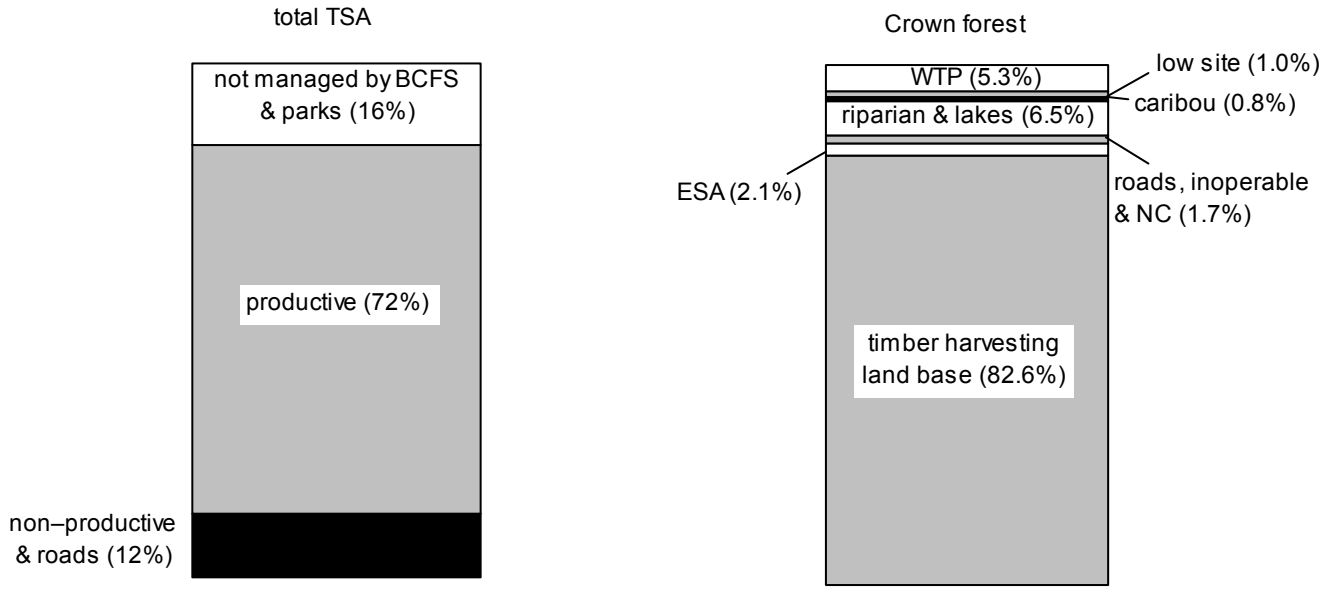

Figure 2. Composition of the total and Crown forested land bases — 100 Mile House TSA, 2001.

Not satisfactorily restocked (NSR) areas
An area not covered by a sufficient number of well-spaced tree stems of desirable species. Stocking standards are set by the B.C. Forest Service. Areas harvested prior to October 1987 and not yet sufficiently stocked according to standards are classified as backlog NSR. Areas harvested or otherwise disturbed since October 1987 are classified as current NSR.

2 Information Preparation for the Timber Supply Analysis

Figure 3 and Table 4 show the distribution of biogeoclimatic (BEC) variants in the Crown forested area and in the timber harvesting land base of the 100 Mile House TSA. Also shown is the proportion of each BEC variant that is outside of the timber harvesting land base. For example, the IDFdk3 variant makes up 46.2% of the total forested area and 46.9% of the timber harvesting land base, while 16% of the total area of IDFdk3 is outside of the timber harvesting land base. It can be seen that three variants (IDFdk3, SBPSmk, and SBSdw1) account for three-quarters of the timber harvesting land base. The numbers in the last column of Table 4 show that the forest outside the timber harvesting land base may be sufficient to meet old-seral* requirements in the longer term if it is well-distributed among the landscape units and is allowed to grow undisturbed.

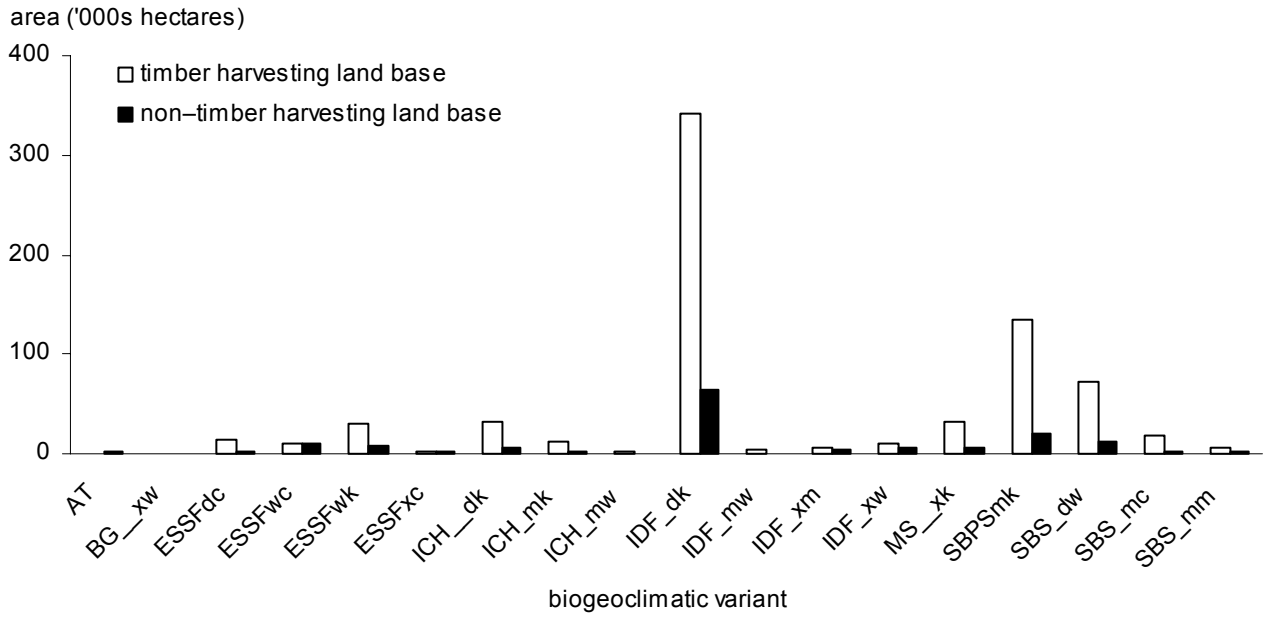

Figure 3. Area by biogeoclimatic classification — 100 Mile House TSA, 2001.

Old seral
Old seral refers to forests with appropriate old forest characteristics. Ages vary depending on forest type and biogeoclimatic variant.

Table 4. Summary of biogeoclimatic zone areas — 100 Mile House TSA, 2001

Biogeoclimatic ecosystem classification (BEC) zone/variant	Per cent of Crown forested area in BEC variant	Per cent of timber harvesting land base in BEC variant	Per cent of BEC variant outside the timber harvesting land base
AT[a]	0.1	0.0	99
BGxw	0.1	0.0	80
ESSFdc	2.0	2.0	15
ESSFwc	2.3	1.4	51
ESSFwk	4.3	4.2	19
ESSFxc	0.3	0.2	47
ICHdk	4.2	4.4	13
ICHmk	1.8	1.8	17
ICHmw	0.3	0.3	15
IDFdk	46.2	46.9	16
IDFmw	0.6	0.6	17
IDFxm	1.0	0.7	39
IDFxw	1.9	1.3	41
MSxk	4.4	4.3	18
SBPSmk	17.7	18.5	13
SBSdw	9.7	10.0	14
SBSmc	2.4	2.5	13
SBSmm	0.8	0.9	15
Total	100	100	Not applicable

(a) A small portion of area classified as AT (Alpine Tundra) corresponds to forested area due to combining information from different map bases and resolutions.

2 Information Preparation for the Timber Supply Analysis

Figure 4 shows the current composition of the timber harvesting land base by dominant tree species. Lodgepole pine dominates about 55% of the timber harvesting land base, with Douglas-fir dominating on 31%, and spruce/balsam 9%. After harvest, most stands are expected to be regenerated to the same species, except for cedar/hemlock sites, which will be planted to fir, spruce and pine along with some natural regeneration of hemlock. Deciduous* stands expected to be harvested under Pulpwood Agreement (PA) 16 make up 5.3% of the timber harvesting land base. Pulpwood Agreement 16 also includes pine- and fir-leading stands in addition to the deciduous stands and comprise 12.7% of the timber harvesting land base.

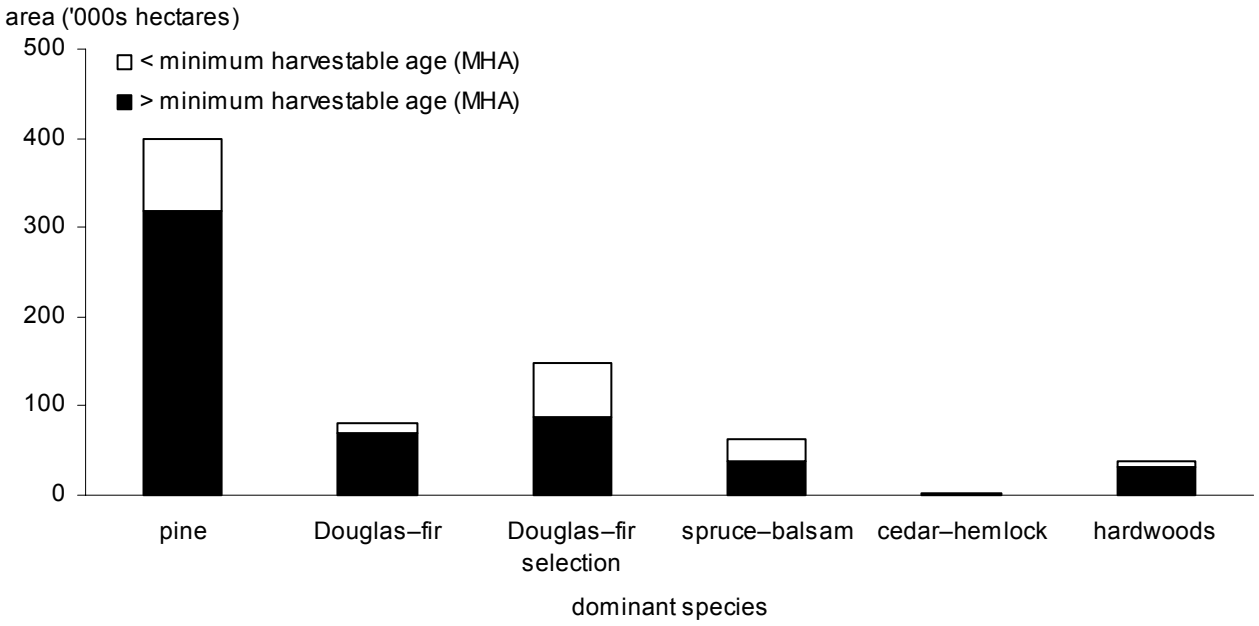

Figure 4. Area by dominant species — 100 Mile House TSA timber harvesting land base, 2001.

Figure 4 also shows the proportion of area of each species that is either younger or older than the minimum harvestable age (see Appendix A, "Description of Data Inputs and Assumptions for the Timber Supply Analysis" for details on the minimum harvestable age for each species). In total, about 75% of stands in the timber harvesting land base are at or above the minimum harvestable age. There is variation around this proportion for each of the species groupings: 80% of pine stands, 68% of Douglas-fir stands, 61% of spruce/balsam stands, and 79% of deciduous stands are currently older than the minimum harvestable age.

Deciduous
Deciduous trees shed their leaves annually and commonly have broad-leaves.

2 Information Preparation for the Timber Supply Analysis

Figure 5 provides an overview of the distribution of site productivity of the dominant stand types within the timber harvesting land base. The site classes in Figure 5 are groupings of site index (SI)*. Five per cent of the stands are in the 'poor' site class, while stands with a site class value of 'medium' occupy 28% of the area, and those with a site class value of 'good', cover 67% of the timber harvesting land base. All of the stands in the poor site class are part of the area earmarked for PA 16.

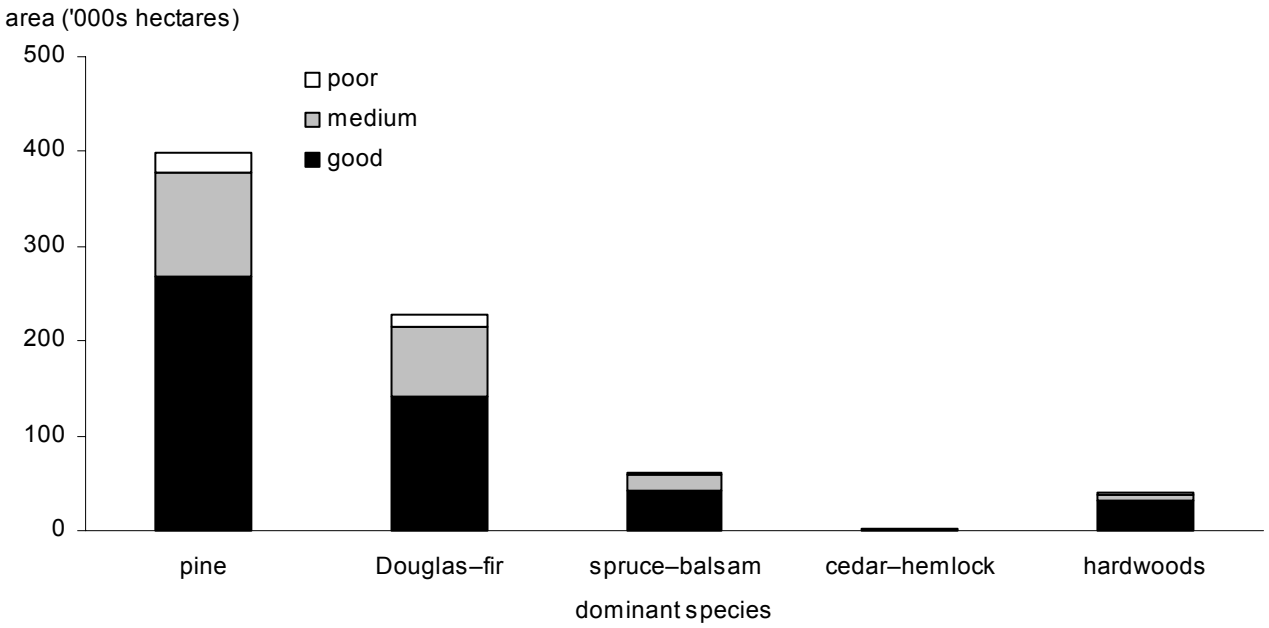

Figure 5. Area by predominant species and site productivity — 100 Mile House TSA timber harvesting land base, 2001.

Site index
A measure of site productivity. The indices are reported as the average height, in metres, that the tallest trees in a stand are expected to achieve at 50 years (age is measured at 1.3 metres above the ground). Site index curves have been developed for British Columbia's major commercial tree species.

2 Information Preparation for the Timber Supply Analysis

Figure 6 shows the current age composition of all Crown forested area in the 100 Mile House TSA. Currently, very few stands (1.6%) are older than 250 years both within the timber harvesting land base and outside of the timber harvesting land base. About 12% of stands in the total forested area are 20 years or younger, 69% are between 21 and 140 years old, 19% are older than 140 years. In the timber harvesting land base almost 75% of the stands are at or above the minimum harvestable age applicable to the stand. In this portion of the land base 12% of the stands are 20 years or younger, 70% are between 21 and 140 years old, and 18% are older than 140 years.

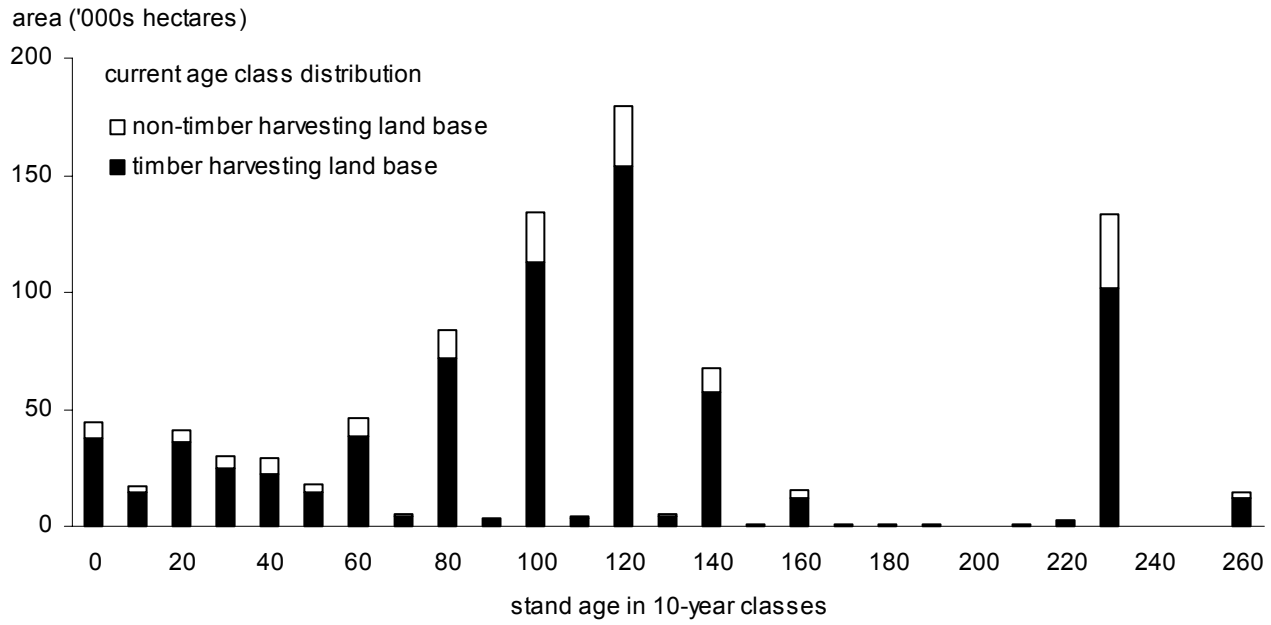

Figure 6. Current age class composition — 100 Mile House TSA forested land base, 2001.

The age class distribution of forested stands excluded from the timber harvesting land base also affects timber supply. In the case of the 100 Mile House TSA, 17% of the Crown forested land base is covered by these stands which, although they do not contribute directly to the timber supply, can affect how much harvesting can be conducted and the pattern of the harvesting within the TSA by providing old-forest and biodiversity attributes. Only 2% of these "non-timber harvesting land base" stands are older than 250 years. Twelve per cent of the stands are 20 years or younger, 69% are between 21 and 140 years old, and 19% are older than 140 years.

2.2 Timber growth and yield

Two growth and yield models were used to estimate timber volumes for the 100 Mile House TSA analysis. The variable density yield prediction (VDYP)* model developed by the B.C. Forest Service, Resources Inventory Branch, was used for estimating volumes in unmanaged coniferous* stands. The table interpolation program for stand yields (TIPSY)*, developed by the B.C. Forest Service, Research Branch, was used to estimate yields for future coniferous managed stands. TIPSY was also used to estimate yields from regenerated coniferous stands that were harvested during the past 30 years since these stands were managed to current standards. One-quarter of the stands harvested between 30 and 40 years ago were also considered managed.

Timber volume estimates* assume a specific utilization level, or set of dimensions, which establish the minimum sizes of trees and logs that are removed from a site. Utilization levels used in estimating timber volumes specify minimum diameters both near the base and the top of a tree as well as a maximum stump height.

Appendix A, "Description of Data Inputs and Assumptions for the Timber Supply Analysis" contains details on the definition of managed stands, utilization standards and the specific model versions used.

Volume estimation and prediction are subject to uncertainty due to uncertainties in inventories which form the basis for estimating site productivity, limited experience with second-growth in British Columbia, and the long-time frame over which trees grow. Sensitivity analyses described in Section 5, "Timber Supply Sensitivity Analyses," address the possibility that actual timber volumes may be different from estimates used in this analysis.

Based on timber volume estimates, the current timber inventory on the timber harvesting land base is approximately 99.8 million cubic metres. About 97.6 million cubic metres, or 97% of the total, are currently merchantable; that is, older than minimum harvestable age.

Variable Density Yield Prediction model
An empirical yield prediction system supported by the B.C. Forest Service, designed to predict average yields and provide forest inventory updates over large areas (i.e., Timber Supply Areas). It is intended for use in unmanaged natural stands of pure or mixed composition.
Coniferous
Coniferous trees have needles or scale-like leaves and are usually 'evergreen'.

Table Interpolation Program for Stand Yields
A B.C. Forest Service computer program used to generate yield projections for managed stands based on interpolating from yield tables of a model (TASS) that simulates the growth of individual trees based on internal growth processes, crown competition, environmental factors and silvicultural practices.
Volume estimates (yield projections)
Estimates of yields from forest stands over time. Yield projections can be developed for stand volume, stand diameter or specific products, and for empirical (average stocking), normal (optimal stocking) or managed stands.

2.3 Management practices

Timber supply depends directly on how the forest is managed for both timber and non-timber values. Therefore, levels of management activity must be defined for the timber supply analysis. The *Forest Practices Code of British Columbia Act* and associated regulations, and agreements made under the Cariboo-Chilcotin Land Use Plan (CCLUP) guide forest management practices in the 100 Mile House TSA. The focus of the Timber Supply Review is to assess timber supply based on current management practices as implemented in plans for the area. Current management is described in Appendix A, "Description of Data Inputs and Assumptions for the Timber Supply Analysis"). Staff in the 100 Mile House Forest District provided information for the following management practices:

- Harvest systems — clearcut and partial harvesting system systems are employed in the TSA. Partial harvesting is practiced in the Douglas-fir stands in the IDF and SBPS biogeoclimatic zones (dry belt), the areas managed for mule deer winter range (MDWR), and areas managed for caribou habitat.
- Silviculture — reforestation activities required to establish free-growing* stands of acceptable tree species. Where necessary, stands are spaced early in their development to ensure young trees are well distributed to maximize growth.
- Forest health and unsalvaged losses* — timber losses to fire and pest (insect) damage are expected to average 34 370 cubic metres per year over.
- Utilization levels — minimum sizes of trees, and logs to be removed during harvesting.
- Cutblock adjacency* and green-up* — in the 100 Mile House TSA, approval of harvesting activities is contingent on previously harvested stands reaching a desired condition, or green-up (three metres in height for multiple use areas), before adjacent stands may be harvested. The purpose of the cutblock adjacency guideline is to prevent timber harvesting from becoming overly concentrated in an area. These guidelines were modelled by limiting the area within the multiple use zones that does not meet green-up conditions to a maximum of 35%.
- Protection of environmentally sensitive areas — areas where potentially unstable soils, avalanche tracks, forest regeneration problems and habitat for various wildlife have been identified. To maintain ecological or other resource values, land has been partially or wholly removed from the timber harvesting land base.
- Community watersheds* — within the Clinton Creek community watershed a maximum harvest of 1% of the timber harvesting land base per year is permitted. This harvest prescription is part of the Clinton Creek Watershed Management Plan of April 1998.

Free-growing
An established seedling of an acceptable commercial species that is free from growth-inhibiting brush, weed and excessive tree competition.
Unsalvaged losses
The volume of timber killed or damaged annually by natural causes (e.g., fire, wind, insects and disease) and not harvested.
Cutblock adjacency
The desired spatial relationship among cutblocks. Most adjacency restrictions require that recently harvested areas must achieve a desired condition (green-up) before nearby or adjacent areas can be harvested. Specifications for the maximum allowable proportion of a forested landscape that does not meet green-up requirements are used to approximate the timber supply impacts of adjacency restrictions.

Green-up
The time needed after harvesting for a stand of trees to reach a desired condition (usually a specific height) — to ensure maintenance of water quality, wildlife habitat, soil stability or aesthetics — before harvesting is permitted in adjacent areas.
Watershed
An area drained by a stream or river. A large watershed may contain several smaller watersheds.

- Maintenance of scenic values — maintaining important scenic values requires that visible evidence of harvesting must be kept within limits in designated areas of the 100 Mile House TSA. All scenic areas within this TSA were assigned a visual quality objective (VQO)* of partial retention*. The maximum proportion of the forested area in each VQO that may be covered by young stands that do not meet green-up requirements (three metres) is 10%.
- Minimum harvestable ages (MHA) — the time it takes for stands to grow to a merchantable condition. For this analysis, minimum harvestable ages were the earlier of: the age at which stands attained a volume of 65 cubic metres per hectare, or 80 years for pine- and 120 years for other conifer-leading analysis units (AU)*. Actual harvest age may be greater but not less than the minimum, and will depend on ages of other available stands, forest cover objectives* and overall timber harvest targets.
- Landscape-level biodiversity* — to maintain biological diversity throughout a landscape unit, the *Forest Practices Code* contains targets for the proportion of the area in each biogeoclimatic variant* that should be covered by stands with old-forest characteristics. Within the 100 Mile House TSA, old-forest is characterized by stands greater than 250 years old in natural disturbance types (NDT)* 1, 2, and 4 and 140 years in natural disturbance type 3. Since landscape units and biodiversity emphasis options (BEO) have not been established for each landscape unit, a weighted-average old-seral requirement was applied to draft landscape units (see Section A.4.10, "Forest cover requirements" in Appendix A for details regarding landscape-level biodiversity).

The data package for the 100 Mile House Timber Supply Area (TSA) was released in April 1998. As a result of public input and new regional and district information, changes were made to the data package. The revised data package, which includes detailed descriptions of the management practices and the assumptions used to incorporate them into the analysis, is presented in Appendix A, "Description of Data Inputs and Assumptions for the Timber Supply Analysis" of this document.

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.
Partial retention VQO
Alterations may be visible but not conspicuous. Up to 15% of the area can be visibly altered by harvesting activity (see ***Visual quality objective****).*
Analysis unit
A grouping of types of forest — for example, by species, site productivity, silvicultural treatment, age, and or location — done to simplify analysis and generation of timber yield tables.

Forest cover objectives
Specify desired distributions of areas by age or size class groupings. These objectives can be used to reflect desired conditions for wildlife, watershed protection, visual quality and other integrated resource management objectives. General adjacency and green-up guidelines are also specified using forest cover objectives (see ***Cutblock adjacency and Green–up****).*
Landscape-level biodiversity
The Landscape Unit Planning Guide *provides objectives for maintaining biodiversity at both the landscape level and the stand level. At the landscape level, guidelines are provided for the maintenance of seral stage distribution, patch size distribution and landscape connectivity.*
Biogeoclimatic (BEC) variant
A subdivision of a biogeoclimatic subzone. Variants reflect further differences in regional climate and are generally recognized for areas slightly drier, wetter, snowier, warmer or colder than other areas in the subzone.
Natural disturbance type (NDT)
An area that is characterized by a natural disturbance regime, such as wildfires, which affects the natural distribution of seral stages. For example areas subject to less frequent stand-initiating disturbances usually have more older forests.

2 Information Preparation for the Timber Supply Analysis

Figure 7 shows the proportions of the timber harvesting land base according to the forest management objectives for those areas. Ten per cent of the timber harvesting land base is managed for the maintenance of mule deer and caribou habitat. Visual quality is the major objective in almost 6% of the area. Timber management is the major objective in the multiple use, dry-belt fir and PA 16 areas which constitute almost 84% of the timber harvesting land base. An area managed for an objective such as mule deer habitat includes non-timber harvesting land base as well as timber harvesting land base. The percentages shown in Figure 7 are only for the timber harvesting land base portion of that management objective.

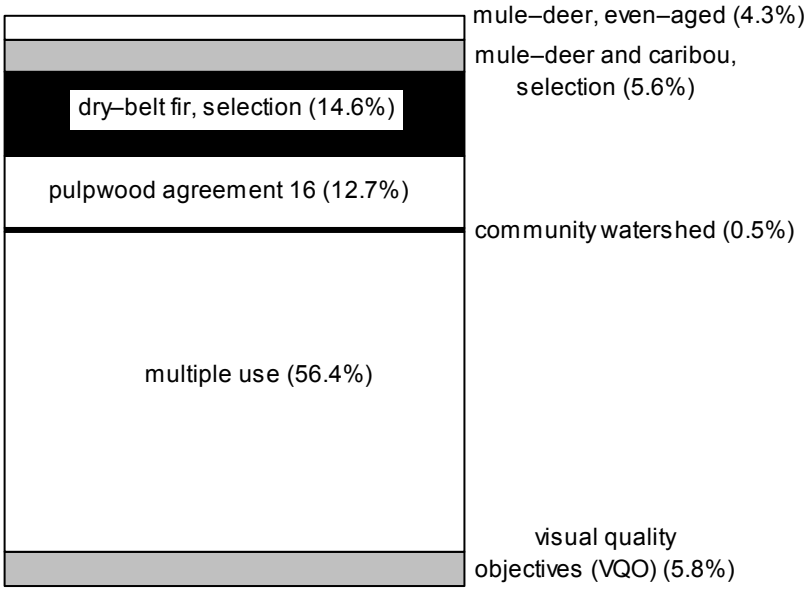

Figure 7. Timber harvesting land base by management emphasis — 100 Mile House TSA timber harvesting land base, 2001.

2.4 Changes since the 1994 100 Mile House TSA analysis and 1995 addendum

The size and availability of the timber harvesting land base has changed since the last analysis for the 100 Mile House TSA. The objective of this section is to present the major changes to the land base and forest management assumptions* since the last analysis.

In the last analysis the forested area managed by the B.C. Forest Service was 938 421 hectares. It is now 885 260 hectares, mostly due to the creation of new parks.

The current timber harvesting land base is about 12 600 hectares larger than it was in the previous analysis, but there are significant differences in composition. The current timber harvesting land base includes 93 000 hectares of land suitable for meeting the requirements of PA 16 whereas PA 16 was not considered in the previous analysis. Areas for caribou habitat and mule deer winter range which were removed from the timber harvesting land base in the previous analysis are now included and managed for habitat.

Implementation of the *FPC* has led to the removal of 57 000 hectares for the protection of riparian areas and 47 000 hectares for the maintenance of stand-level biodiversity. Additional constraints which also often limit the availability of the timber harvesting land base are the requirements to maintain (or recruit) suitable areas of old forest for landscape-level biodiversity.

In summary, the timber harvesting land base has increased by only 2% since the last analysis but its composition has changed considerably. Given the extent of these changes, comparisons between this and the previous analysis should be made with caution. Each analysis needs to be evaluated in the context of the management regime and related data inputs and assumptions that applied at the time. As noted in the introductory section, there is uncertainty surrounding information used in analyses, and forest management objectives change over time, which is why the *Forest Act* requires the chief forester to review the timber supply and AAC for each TSA on a regular basis.

Any changes to the land base or management assumptions that occur or become effective after the completion of this timber supply analysis will be presented to the chief forester for consideration during the AAC determination, if possible.

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

3 Timber Supply Analysis Methods

The purpose of this analysis is to examine both the short- and long-term timber harvesting opportunities in the 100 Mile House TSA, in light of current forest management practices. A timber supply computer simulation model developed by the B.C. Forest Service (FSSIM version 3.0) 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 long period of time. Generally, only the results for the first 250 years are shown graphically in this report because the harvest level remains constant after that time.

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

This type of analysis is used to determine the timber supply implication of a particular management regime. The results of the analysis are especially important in determining allowable cuts that will not restrict options of future resource managers, and that will assist 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 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 sustainable forest management in the field.

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 practices. 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.

4 Results

This section presents results of the timber supply analysis for the 100 Mile House TSA. The base case harvest forecast* 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 for the Timber Supply Analysis." The impacts of uncertainty in the inputs to the analysis will be discussed in Section 5, "Timber Supply Sensitivity Analyses." The base case provides only a part of the timber supply picture for the 100 Mile House TSA, and should not be viewed in isolation of the sensitivity analysis*.

Section 2.4, "Changes since the 1994 100 Mile House TSA analysis and 1995 addendum," provides an overview of the major changes to the land base since the last analysis. As noted in that section, any comparison between this and the last analysis should be made with recognition of the extent and nature of those changes. Each analysis should be evaluated in the context of the management regime and related data inputs and assumptions that applied at the time. Finally, one of the major reasons the chief forester is required under the *Forest Act* to periodically review the timber supply and AAC is to account for changes in management, information and knowledge.

4.1 Base case harvest forecast

The base case harvest forecast for the 100 Mile House TSA represents current management as described in the various sections of Appendix A of this report.

Base case harvest forecast
The timber supply forecast which illustrates the effect of current forest management practices on the timber supply using the best available information, and which forms the reference point for sensitivity analysis.

Sensitivity analysis
A process used to examine how uncertainties about data and management practices could affect timber supply. Inputs to an analysis are changed, and the results are compared to a baseline or base case.

4 Results

Figure 8 shows the base case harvest forecast for the 100 Mile House TSA. The initial harvest level is 1 335 600 cubic metres per year, which consists of the current AAC of 1 362 000 cubic metres per year, less 26 400 cubic metres per year that has been issued to new woodlot licences*. Included in the current harvest level of 1 335 600 cubic metres per year is the partition harvest of 112 000 cubic metres per year, currently allocated to Pulpwood Agreement (PA) 16 from within the TSA.

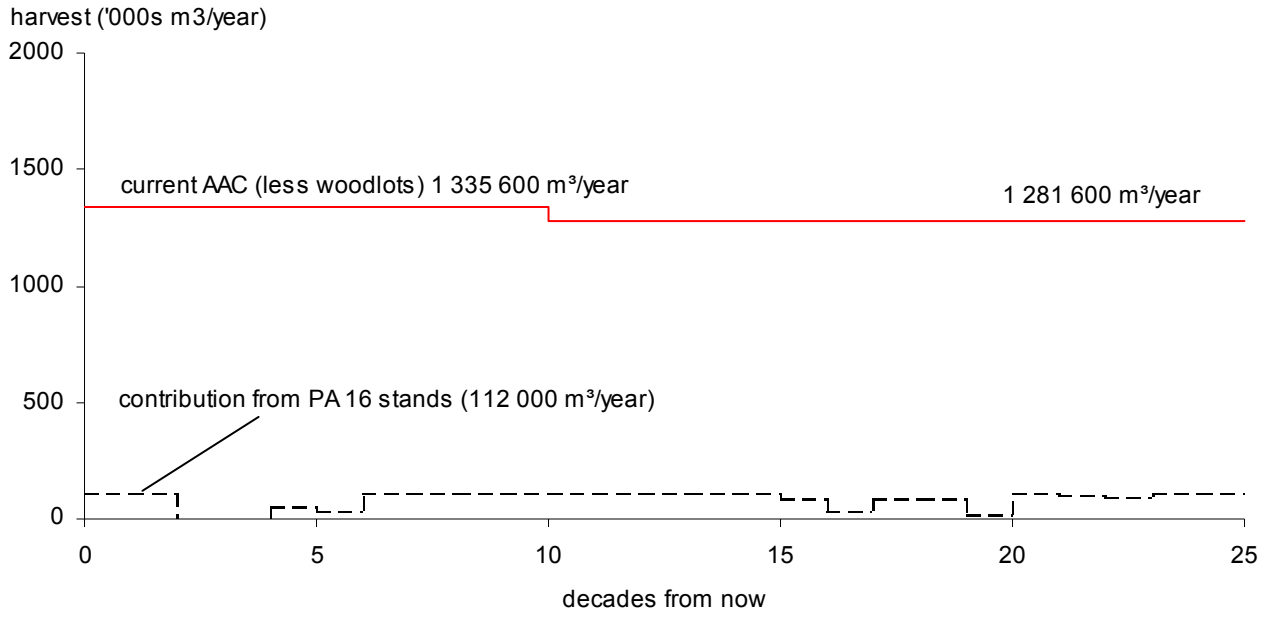

Figure 8. Base case harvest forecast for the 100 Mile House TSA, 2001.

Within the 100 Mile House TSA, harvesting attributable to PA 16 has averaged about 21 000 cubic metres per year during the past five years. Approximately 15 years remain until expiry of PA 16, and it is fully expected that given the current distribution of harvest across the four TSAs (Williams Lake, 100 Mile House, Kamloops and Lillooet) that contribute to the PA, harvesting activity will continue in the 100 Mile House TSA.

In the base case harvest forecast, an annual harvest level of 1 335 600 cubic metres could be maintained for 100 years before declining to the long-term harvest level* of 1 281 600 cubic metres per year. The long-term level is just 4% below the initial harvest level. Timber supply attributable to PA 16 is maintained at 112 000 cubic metres per year for the first 20 years of the forecast, which is the approximate time frame until the PA expires.

Unsalvaged losses due to natural forces such as insects, wind and fire are estimated to be 34 370 cubic metres per year for the entire 250-year horizon and have been subtracted from all harvest forecasts shown in this report.

Woodlot licence
An agreement entered into under the Forest Act. *It allows for small-scale forestry to be practised in a described area (Crown and private) on a sustained yield basis.*

Long-term harvest level
A harvest level that can be maintained indefinitely given a particular forest management regime (which defines the timber harvesting land base, and objectives and guidelines for non-timber values) and estimates of timber growth and yield.

4 Results

In the short- and medium-terms the harvest forecast for this TSA depends on the amount of currently existing timber growing stock*. Figure 9 shows a projection of timber inventory volumes over time corresponding to the base case harvest forecast. Total growing stock on the timber harvesting land base declines over the next 13 decades from 99.8 million cubic metres as the oldest of the existing mature stands are harvested and replaced by younger second-growth. Over the long term, the average total growing stock for the base case is about 62 million cubic metres.

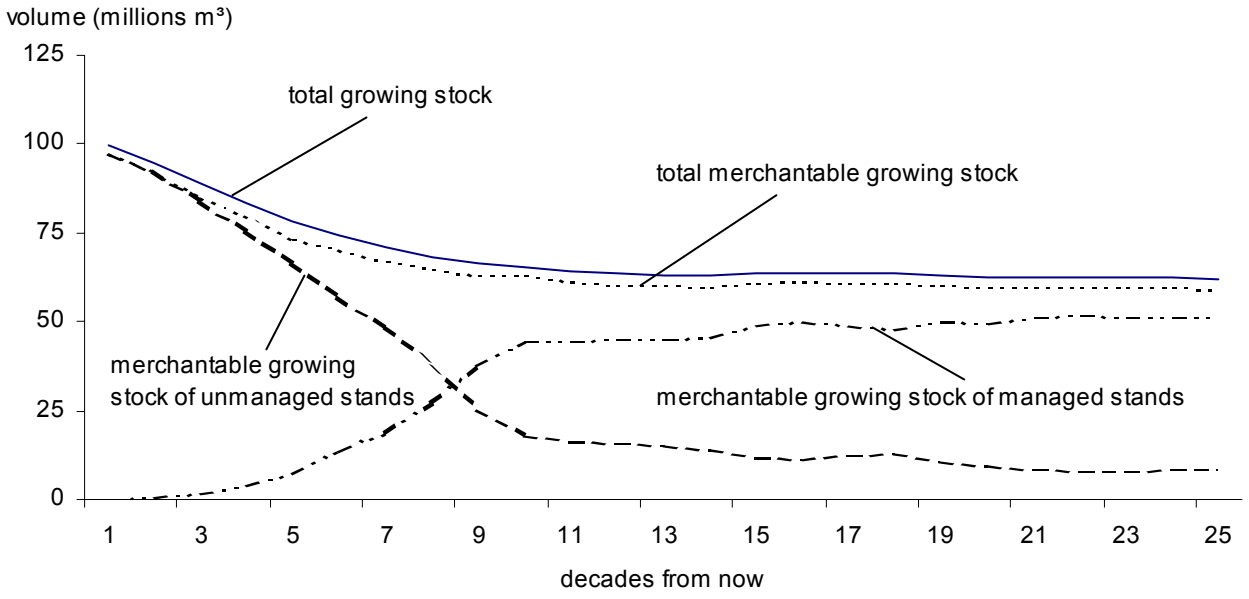

Figure 9. Total and merchantable growing stocks — 100 Mile House TSA, 2001.

About 97.6 million cubic metres, or 97% of the total growing stock, are currently merchantable; that is, older than minimum harvestable age. The average merchantable growing stock over the long term is about 59 million cubic metres.

The base case long-term harvest level of 1 335 600 cubic metres per year is the harvest rate that can be achieved while maintaining the total timber growing stock on the timber harvesting land base at an even level, on average, over the long term. An even-growing stock indicates that harvesting can continue at the corresponding harvest level in perpetuity. A continually increasing growing stock would indicate that the timber is being harvested below the productive capability of the land. A continually declining growing stock would signify that the timber is being harvested above the productive capability of the land.

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

4 Results

As can be seen in Figure 9, the merchantable growing stock from unmanaged stands averages about 8 million cubic metres in the long term. This is because the stands earmarked for selection harvesting are considered "unmanaged". Such stands comprise approximately 148 000 hectares or 20% of the timber harvesting land base. Figure 10 shows that the contribution from selection harvesting is about 10% of the total TSA long-term harvest level.

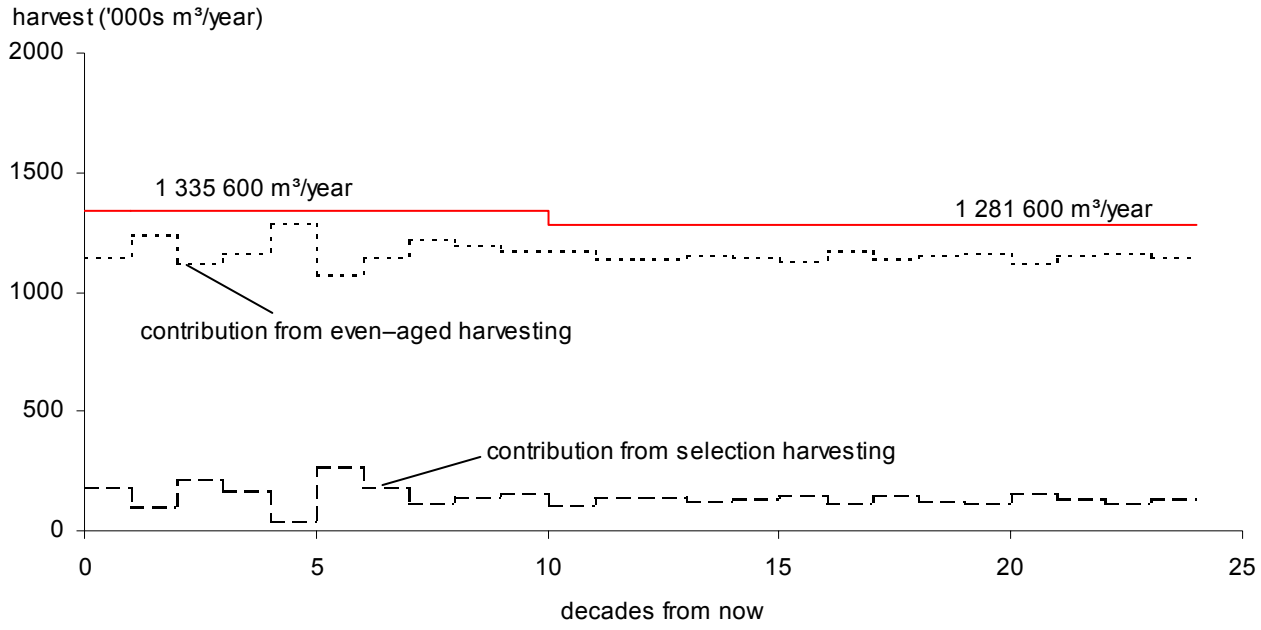

Figure 10. Contribution from selection and even-aged harvesting — 100 Mile House TSA, 2001.

4 Results

Figure 11 shows the transition of harvesting from existing to managed stands, and the amount that each makes up in the base case forecast. For the first eight decades the harvest depends fully on existing stands, and then during decades 9 and 10 the harvest rapidly changes from unmanaged to managed stands. The high volume of existing merchantable growing stock allows managed stand volume to accumulate and thus be available to maintain the base case harvest projection after decade 9.

Figure 11. Harvest contribution from unmanaged and managed stands — 100 Mile House TSA, 2001.

4 Results

Figure 12 tracks the contribution to the base case harvest forecast from the various CCLUP resource management zones. The enhanced resource development zone accounts for about 82% of the harvest from the TSA. About 15% of the harvest is from the special resource development zone. The integrated resource management (IRM)* zone accounts for the remainder of the harvest. There is a small (5000 cubic metres) contribution from areas identified as goal 2 protected areas. At the time of this analysis these areas were still not officially removed from the timber harvesting land base.

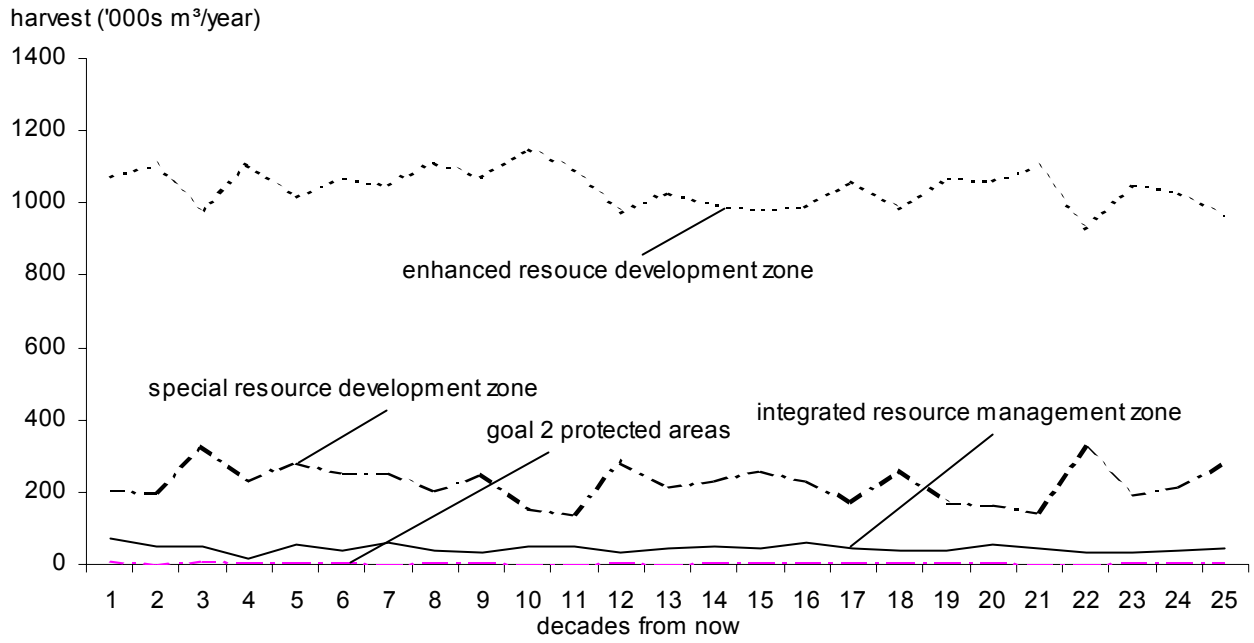

Figure 12. Harvest contribution by CCLUP zones — 100 Mile House TSA, 2001.

Integrated resource management (IRM)
The identification and consideration of all resource values, including social, economic and environmental needs, in resource planning and decision-making.

4.2 Average age, area, and volume harvested

Figure 13 tracks the area-weighted average harvest age resulting from the base case forecast. The pattern of harvested age over the first nine decades reflects that highest harvest priority was given to stands furthest above their minimum harvestable age. The second decade dip results because forest cover requirements restrict harvests in older stands, while the third decade rise reflects the increased availability of old stands when cover requirements are achieved. From decade 10 onwards, the average harvest age fluctuates around 100 years.

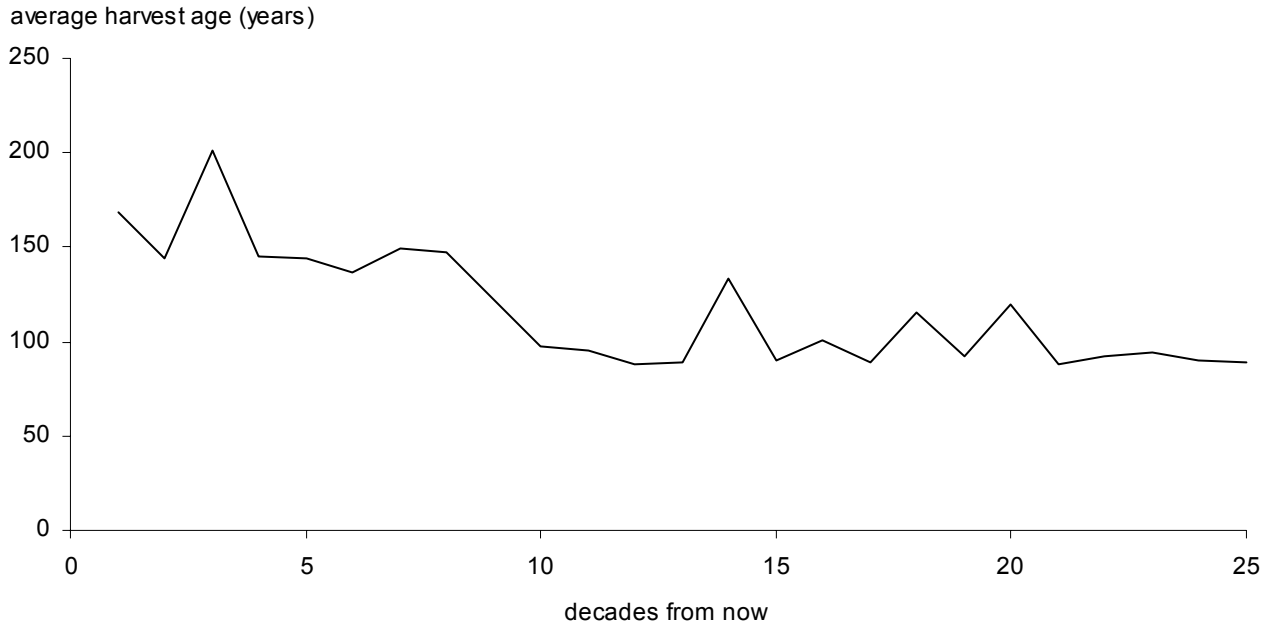

Figure 13. Average age of stands harvested over time — 100 Mile House TSA, 2001.

4 Results

Figure 14 shows the annual area harvested over the next 250 years (these areas have not been adjusted to account for the volumes deducted annually for non-recoverable losses) by both clearcut (even-aged) and selection (uneven-aged) harvest systems.

The wide fluctuations in area harvested under the selection system reflect the management prescriptions for these areas as described in Appendix A, "Description of Data Inputs and Assumptions for the Timber Supply Analysis." By decade 10 the pattern of harvesting stabilizes at an average of about 9000 hectares harvested per year, of which approximately half is by selection.

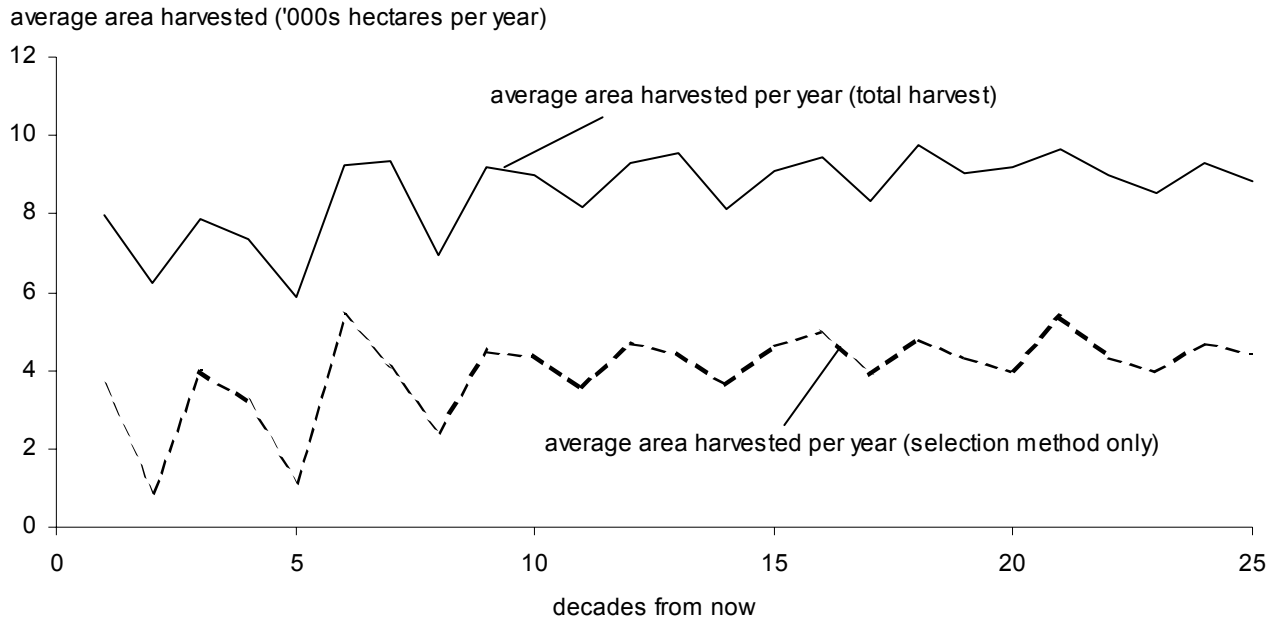

Figure 14. Average area harvested over time — 100 Mile House TSA, 2001.

4 Results

Figure 15 shows the average timber volume per hectare harvested in the base case forecast. These average volumes were derived using the total harvested volume from either selection or even-aged harvested stands. No accounting was made for unsalvaged losses since it was not possible to adjust area harvested figures to account for the area corresponding to the losses. As shown in Figure 15, areas harvested with uneven-aged or selection systems remove a much lower volume per hectare on average. Selection systems remove lower amounts of volume, but harvests occur at more frequent intervals. Refer to Appendix A for a description of the selection management* regime. Over the long term, the average volume per hectare harvested is about 145 cubic metres for the total TSA and about 30 cubic metres for the selection system.

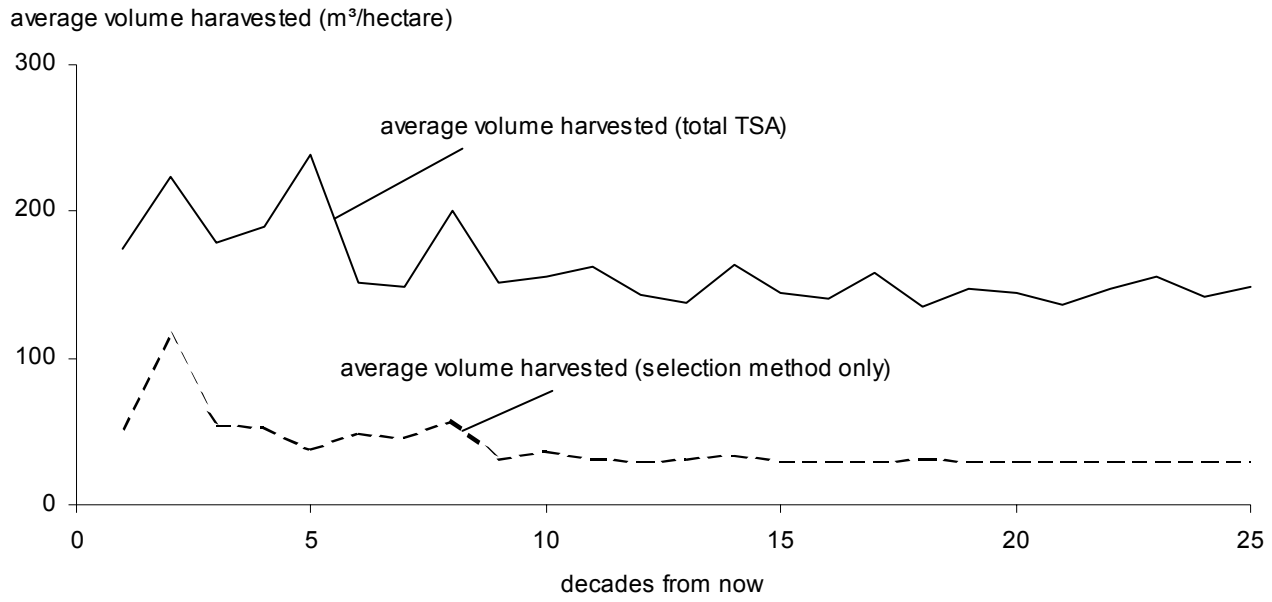

Figure 15. Average volume per hectare harvested over time — 100 Mile House TSA, 2001.

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

4.3 Age class profile over time

The charts in Figure 16 show how the age composition of the forest both in the timber harvesting land base and in the non-timber harvesting land base of the 100 Mile House TSA change over time under the base case harvest forecast.

The current age class distribution shows a significant shortage of stands between ages 150 and 220 years. The majority of the stands are between 100 and 150 years old. The stands outside of the timber harvesting land base exhibit a similar age class distribution as the stands within the timber harvesting land base.

One consequence of the small proportion of stands greater than 250 years is that some of the old-growth requirements for landscape-level biodiversity are not met until the beginning of the third decade of the harvest forecast. The spike in the average harvest age in decade 3 shown in Figure 13 reflects the increased availability of stands which are currently 230 years old. This lack of older forest in the non-timber harvesting land base does not necessarily mean that merchantable forest cannot be harvested. The forest estate model used by the B.C. Forest Service reserves some of the older forest from the timber harvesting land base needed to meet old-growth objectives.

4 Results

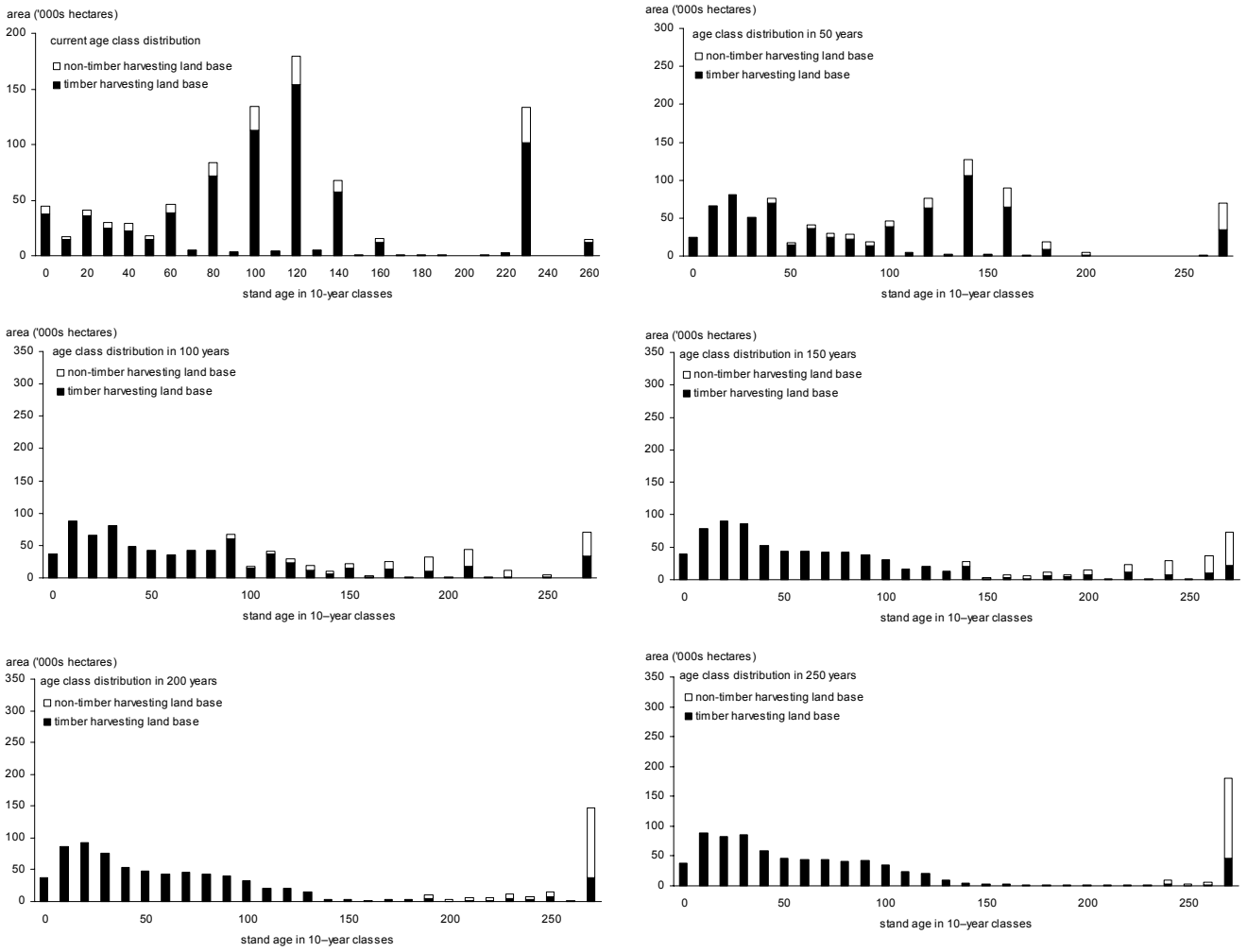

Figure 16. Changes in age composition on the productive land base over time — 100 Mile House TSA base case, 2001.

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 complicated since it 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, so that decisions we make today have not only short-term but also long-term effects beyond the life spans of current decision makers. In such a context, we cannot be certain that all the 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 how values of interest, for example, timber supply, could change if the information used in the analysis is not accurate. Sensitivity analysis is one way of evaluating how uncertainty could affect analysis results, and ultimately decision-making. Sensitivity analysis can highlight that fairly small uncertainties about some variables could have large effects on timber supply projections, or conversely that fairly large inaccuracies in others could have negligible effects. Also, sensitivity analysis could show that some variables affect timber supply more in the short term than in the long term, while others have the opposite effect. Sensitivity analysis can highlight priorities for collecting information for future analyses, and show which variables, and associated uncertainties, have the most significance for decisions. It can clarify whether current best estimates provide a 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 discussed. Sensitivity analyses are intended primarily to test the relative change (i.e., high *versus* low sensitivity) in the harvest forecast resulting from changes in forest management assumptions and data used in the base case.

5.1 Alternative harvest flows

The base case harvest forecast shown in Figure 8 was developed subject to several assumptions. For example, the initial harvest level was predetermined by the current allowable annual cut. The harvest level shown for Pulpwood Agreement 16 was based on the current allotment in the 100 Mile House TSA, and the length of time remaining in the agreement.

5 Timber Supply Sensitivity Analyses

Figure 17 compares two alternative forecasts with the base case. In both forecasts, the amount of harvest ascribed to Pulpwood Agreement 16 remains constant at 112 000 cubic metres per year for the first 20 years. All inputs related to land base, growth and yield and management remain constant in all forecasts in Figure 17.

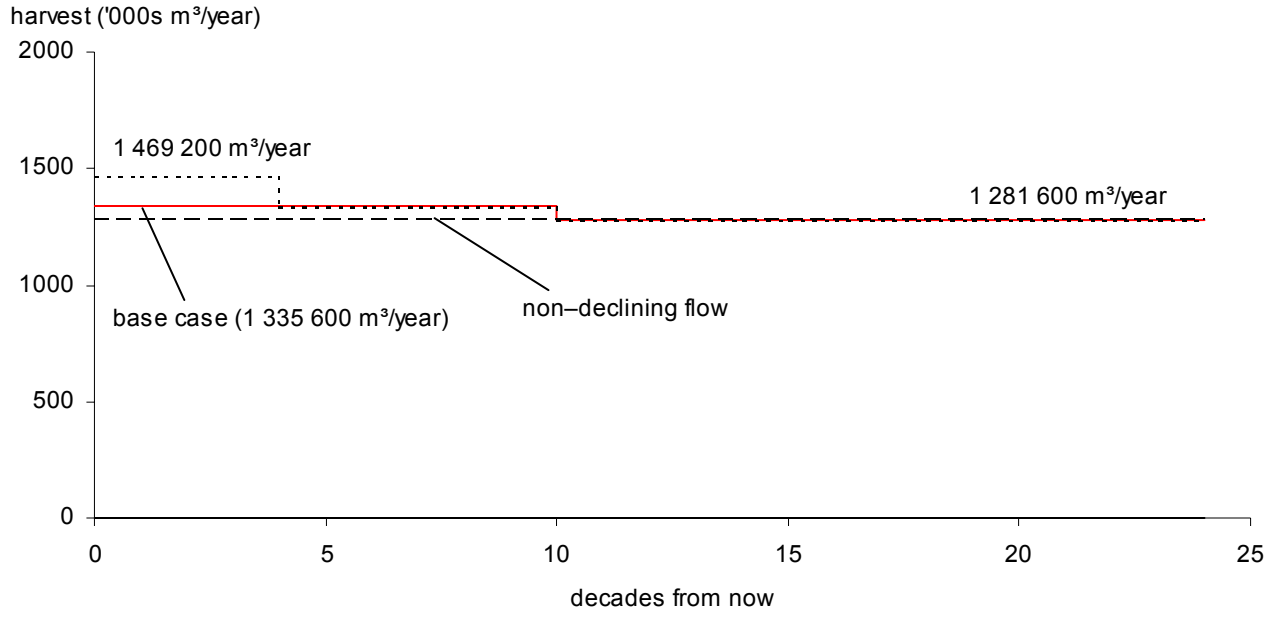

Figure 17. Alternative harvest forecasts — 100 Mile House TSA, 2001.

Maximum non-declining even-flow

- The non-declining even-flow harvest level of 1 281 600 cubic metres per year can be maintained for 250 years. This harvest level is the same as the long-term harvest level for the base case.
- This represents a 4% reduction in the short-term harvest level for the TSA.
- Managed, regenerated stands are projected to contribute significantly to the harvest starting at approximately decade 12, as compared to decade 10 in the base case.

Increase short-term harvest level by 10%

- It is possible to increase the short-term harvest level by 10% and maintain the harvest at that level for four decades before following the same harvest flow projection as for the base case.
- Total growing stock projections are slightly lower than those resulting from the base case from decades 3 to 8.
- Managed, regenerated stands are projected to contribute significantly to the harvest starting at approximately decade 9, as compared to decade 10 in the base case.

5 Timber Supply Sensitivity Analyses

5.2 Uncertainty in the estimated area of the timber harvesting land base

Uncertainty in the estimated size of the timber harvesting land base is due to factors such as fluctuations in timber prices, changes in the definition of problem forest types, changes in harvesting and milling technology and land-use decisions.

The timber harvesting land base has changed significantly since the last timber supply analysis for the 100 Mile House TSA. While the land base was reduced somewhat for factors such as the newly created parks and riparian reserves, it has also increased significantly due to the explicit inclusion of Pulpwood Agreement 16 and the management for wildlife (mule deer and caribou) habitat rather than removal of these areas.

Currently there is no indication that the timber harvesting land base has been over- or underestimated. However, sensitivity analyses were performed to provide general information that might help evaluate the implications of any new information that becomes available before the AAC determination. The first analysis evaluates the outcome of either decreasing or increasing the timber harvesting land base by 10%. These results are discussed in subsection 5.2.1. A second analysis, discussed in subsection 5.2.2, examines the timber supply contribution of the PA 16 area. The third analysis examines the implications of increasing the operable land base. These results are discussed in subsection 5.2.3.

5.2.1 General land base uncertainty

Table 5 shows the base case and shifted land bases for the sensitivity analyses. Figure 18 shows the resulting harvest forecasts.

Table 5. Area of the base case and land base sensitivity analysis — 100 Mile House TSA

Forecast	Timber harvesting land base (hectares)	Forest outside timber harvesting land base (hectares)	Total (hectares)
Base case	731 027	148 142	879 169
Reduce timber harvesting land base by 10%	655 563	223 606	879 169
Increase the timber harvesting land base by 10%	801 769	77 400	879 169

5 Timber Supply Sensitivity Analyses

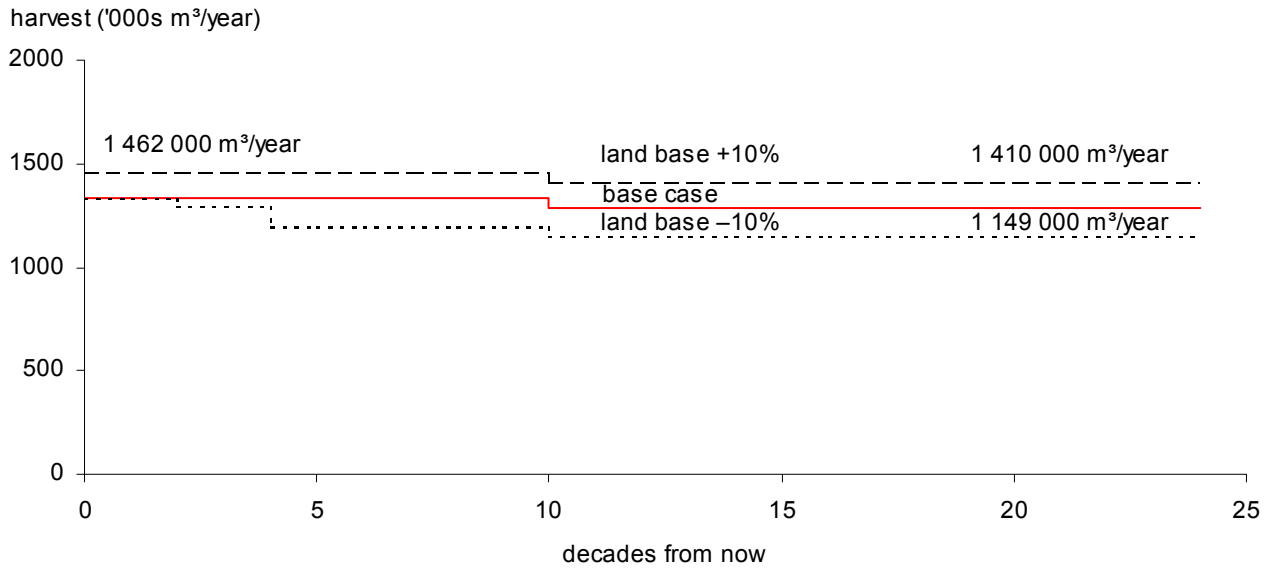

Figure 18. Land base sensitivity analysis — 100 Mile House TSA, 2001.

<u>If the timber harvesting land base is 10% smaller than in the base case</u>

- Still sufficient area in older existing stands to support the base case initial harvest for two decades.
- After two decades harvest decreases by 3% and then by a further 8%.
- Long-term harvest level of 1 149 000 cubic metres per year, about 10% below the base case, reached in decade 11.

<u>If the timber harvesting land base is 10% larger than in the base case</u>

- Current harvest level can be increased by 9% and maintained for 10 decades.
- Long-term harvest level approximately 10% higher than the base case long-term level, reached in decade 11.

5.2.2 Pulpwood area 16 contribution

The area associated with the explicit inclusion of Pulpwood Agreement 16 is approximately 93 200 hectares or 13% of the timber harvesting land base. See Table A-3a. in Appendix A for the criteria defining stands meeting the requirements for PA 16.

The base case harvest forecast assumed that after harvesting all stands, including PA 16 stands, become managed stands.

Figure 19 displays two harvest projections that result from the uncertainty associated with harvesting on lands identified for PA 16.

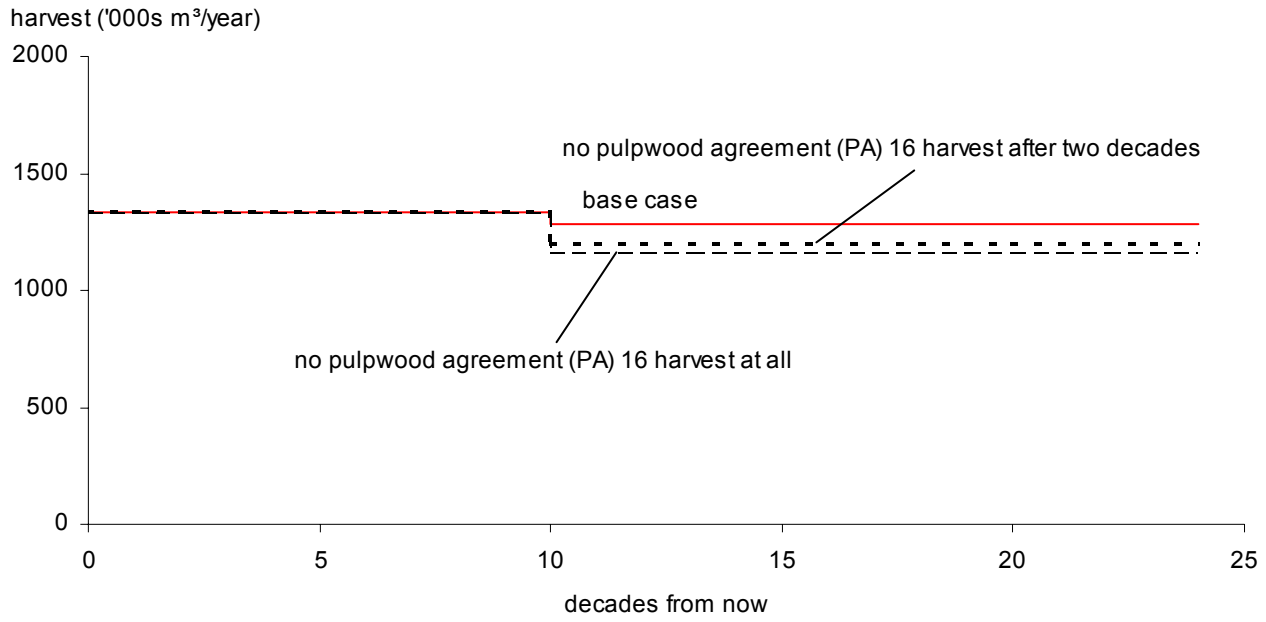

Figure 19. Pulpwood agreement 16 land base sensitivity analysis — 100 Mile House TSA, 2001.

With no PA 16 harvest after 20 years

- Initial harvest level same as the base case for the first 10 decades.
- Long-term harvest level (1 200 000 cubic metres per year) 6% below the base case level; reached in decade 11.

With no PA 16 harvest at all

- Initial harvest level same as the base case for the first 10 decades.
- Long-term harvest level (1 166 000 cubic metres per year) 9% below the base case level; reached in decade 11.

5.2.3 Include all of operability classes 2 and 4

In the base case only 50% of operability classes 2 (cable yarding) and 4 (helicopter logging) were included in the timber harvesting land base. In this sensitivity analysis all of the areas in these operability classes were included in the timber harvesting land base. This change led to a 7612 hectare (1%) increase in the timber harvesting land base. The effect on timber supply was an increase of 10 000 cubic metres per year throughout the analysis horizon.

5.3 Uncertainty in green-up requirements

Within the 100 Mile House TSA base case it was assumed that no more than 35% of the timber harvesting land base within each landscape unit (LU) could be less than 3 metres in height. The age when stands attain the height condition depends on the mix of species and site productivity of the LU. The data models used in this analysis show that in the Bridge Creek LU, stands are greened-up on average by age 14 years, whereas in the Hendrix Lake LU stands are not greened-up until age 20 years. Some studies have shown that the time taken to achieve green-up in practice is less than the results obtained from the models used to project green-up. Both the percentage limitation and the green-up age are sources of uncertainty.

5.3.1 Percentage allowed below green-up

Figure 20 shows the effects of changing the maximum allowable area in the multiple use zone (56% of the timber harvesting land base) which could be in a non-green-up condition, i.e., less than 3 metres in height.

- At 45% of area below green-up the harvest flow is the same as the base case forecast.
- At 25% of area below green-up, long-term harvest level decreases to 1 216 000 cubic metres per year or 5% below the base case harvest forecast.

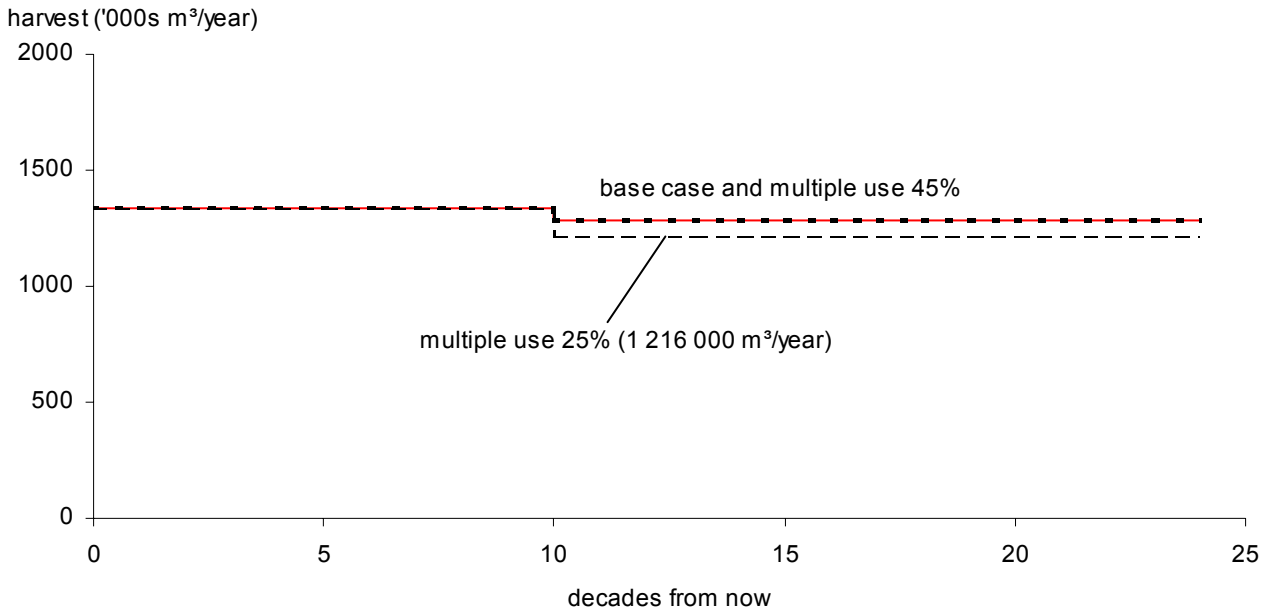

Figure 20. The effect on the harvest forecast of changing the allowable area below green-up — 100 Mile House TSA, 2001.

5.3.2 Green-up age

Based on current site productivity information, achieving a green-up height of 3 metres requires approximately 17 years on average (varies from 14 to 20 years depending on the LU) in the 100 Mile House TSA.

- If the time required to achieve green-up was increased by 5 years across all LUs, the long-term harvest level would decrease by 7.8% to 1 181 000 cubic metres per year (Figure 21).
- If the time required to achieve green-up was reduced by 5 years, it would be possible to increase the long-term harvest level by about 3.2% to 1 322 000 cubic metres per year.

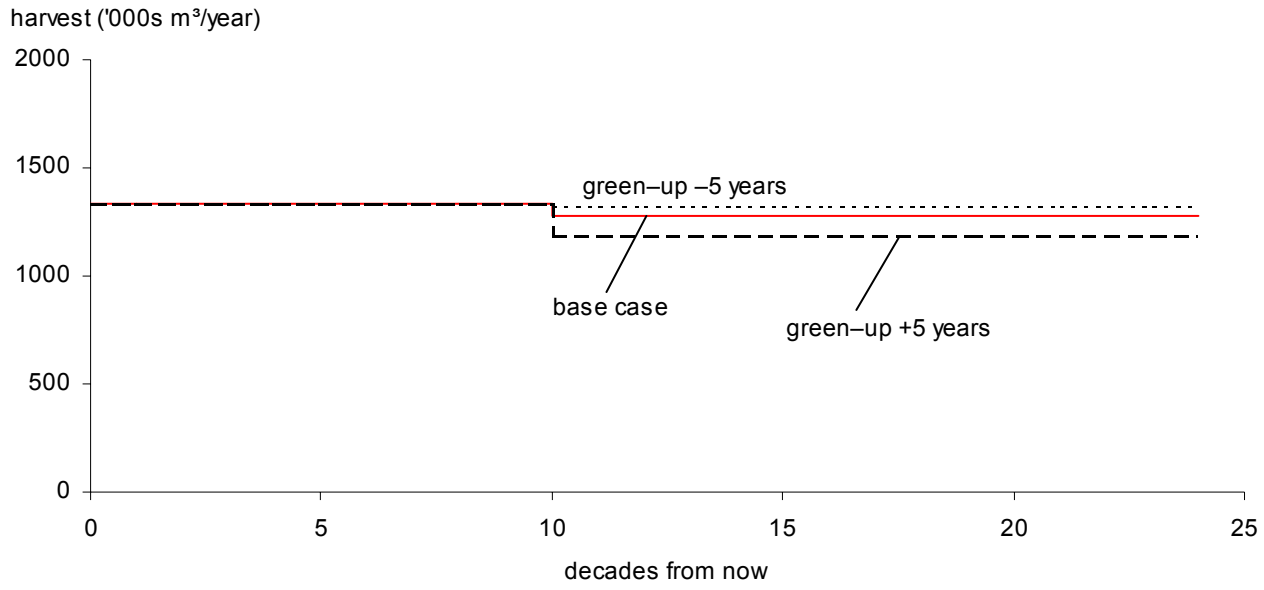

Figure 21. The effect on the harvest forecast of changing the length of time to achieve green-up — 100 Mile House TSA, 2001.

5.3.3 Regeneration delay

The green-up period includes both the green-up age as described above and the regeneration delay*, or time taken to establish a stand after harvesting. In the base case the regeneration delay was assumed to be from 3 to 5 years for stands under even-aged management. Figure 22 shows how timber supply would change if the regeneration delay for such analysis unit were increased or decreased by 2 years.

- If the regeneration delay was increased by 2 years, the long-term harvest level would decrease by 2% to 1 254 000 cubic metres per year (Figure 22).
- If the time required to establish a stand after harvesting was reduced by 2 years, it would be possible to increase the long-term harvest level by about 2% to 1 308 000 cubic metres per year.

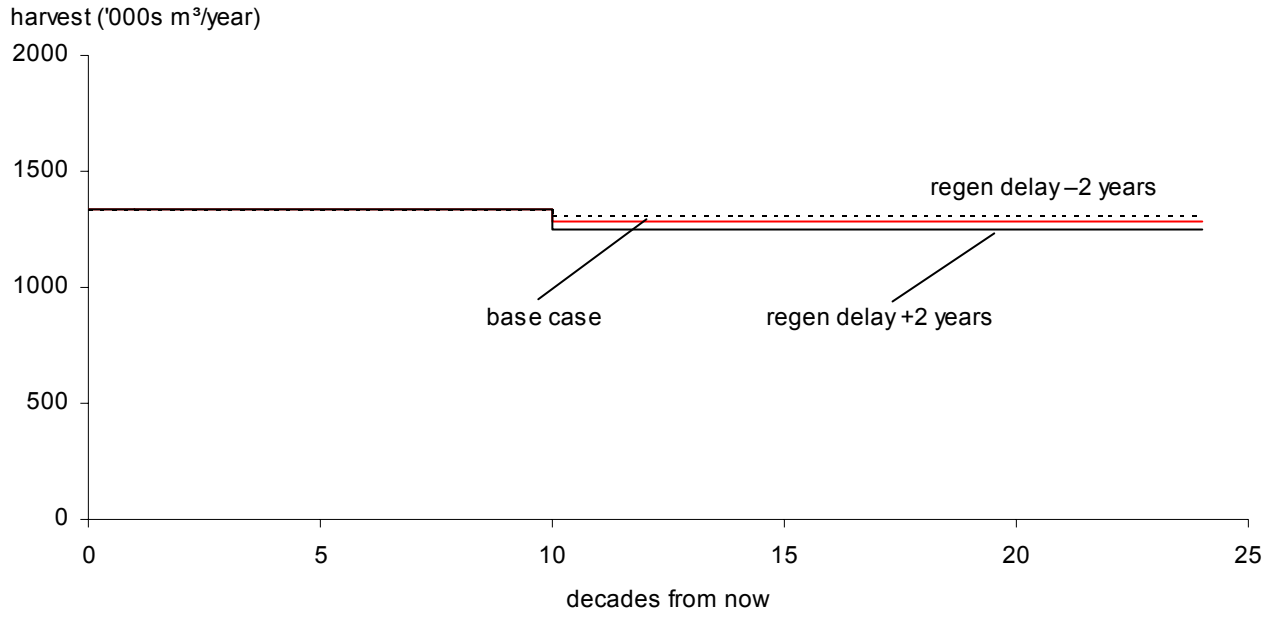

Figure 22. The effect on the harvest forecast of uncertainty about regeneration delay — 100 Mile House TSA, 2001.

Regeneration delay
The period of time between harvesting and the date at which an area is occupied by a specified minimum number of acceptable well-spaced trees.

5.4 Uncertainty in the estimated existing stand yields

Timber volume estimates for existing unmanaged stands are subject to uncertainties in the forest inventory used to estimate timber volumes (i.e., estimated tree heights and stand ages), and the statistical process used to develop the equations for predicting forest growth and yield. Timber volumes are normally accurate when averaged over large areas, but may not reflect actual volumes within individual stands. Uncertainty may also arise in the estimates of the volume lost both to decay in older trees, and to waste and breakage during harvest, and of the utilization levels practiced during harvesting. In addition, some stands in the dry-belt fir area (IDF BEC zone) of the 100 Mile House TSA were harvested using selection methods during the past 40 years. Uncertainty may arise around the estimates of volumes left behind after selection harvesting and how such stands are portrayed in the inventory.

Inventory audit

During the last several years, Resources Inventory Branch has performed audits of the standing volume of trees within TSAs and Tree Farm Licences (TFLs)* across the province. These audits provide an indication of how confident we can be in estimated volumes in the management unit. For the 100 Mile House TSA, initial indications from the inventory audit were that volumes in stands over 60 years may be overestimated by approximately 11%. Further analysis of the audit data by staff in the Cariboo Forest Region suggested that most of the possible discrepancies may be concentrated in the Big Bar public sustained yield unit (PSYU) and in the IDF biogeoclimatic zone. Table 6 presents a summary of the audit results for these two portions of the 100 Mile House TSA land base.

Table 6. Summary of inventory audit results — 100 Mile House TSA, 2001

Land base stratum	Timber harvesting land base (hectares)	Per cent (%) of total timber harvesting land base	Inventory volume (m^3/hectare)	Audit volume (m^3/hectare)	Per cent (%) difference
Big Bar PSYU	254 940	34.9	186	151	19
IDF BEC zone	361 840	49.5	157	117	25

Approximately 188 500 hectares of the IDF zone are in the Big Bar PSYU. Given the uncertainties in existing stand volumes, the impacts of decreasing existing unmanaged stand yields (yield curves created through VDYP) in the Big Bar PSYU by 19% and in the IDF BEC zone by 25% were assessed separately. Figure 23 displays the results of these assessments as well as that of a standard sensitivity analysis where existing unmanaged stand yields for the entire TSA were decreased by 10%.

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

5 Timber Supply Sensitivity Analyses

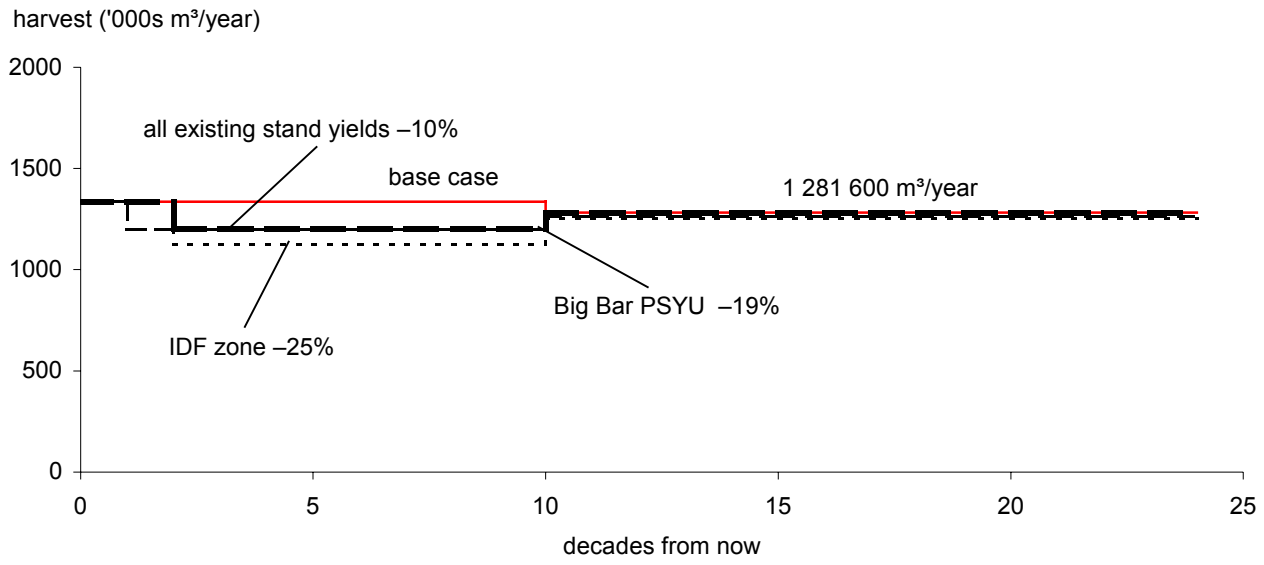

Figure 23. The effect on the harvest forecast of decreasing volume estimates for existing unmanaged stands — 100 Mile House TSA, 2001.

<u>If all existing unmanaged stand yields are 10% lower than in the base case</u>

- The base case harvest forecast can be maintained for two decades.
- Timber supply declines to 1 198 600 cubic metres per year, 10% below the base case level, during decades 3 to 10.
- After decade 10 the timber supply is the same as that in the base case.

<u>If existing unmanaged stand yields in the Big Bar PSYU are 19% lower than in the base case</u>

- The base case harvest forecast can be maintained for only one decade.
- From decades 2 to 10 the timber supply is 1 198 600 cubic metres per year, 10% below the base case level.
- After decade 10 the timber supply increases to 1 261 600 cubic metres per year, 1.6% below the base case.

<u>If existing unmanaged stand yields in the IDF BEC zone are 25% lower than in the base case</u>

- The base case harvest forecast can be maintained for only one decade before declining by 10% in decade two followed by a further 6% in decade three.
- From decades 3 to 10 the timber supply is 1 125 300 cubic metres per year, 15.7% below the base case level.
- After decade 10 the timber supply increases to 1 251 600 cubic metres per year, 2.3% below the base case.
- The long-term timber supply does not recover to the base case level because about 41% of the IDF BEC zone is under selection management and the existing management prescription was intended to be applied to stands with more growing stock than assumed in this sensitivity analysis.

In summary, more work is necessary in the 100 Mile House TSA to determine whether the volumes from existing stands are accurate across the timber harvesting land base. If existing stand volumes are overestimated to the extent assumed in this sensitivity analysis the current harvest level can be maintained for only one decade and mid-term harvest levels may have to be reduced by as much as 15.7%.

5.4.1 Harvest deciduous component of existing mixed-wood stands

In the base case the deciduous component of mixed-wood stands for the non-PA 16 land base were excluded from the development of the yield curves for those stands. After harvesting, the mixed-wood* stands were assumed to be regenerated to purely coniferous stands. A sensitivity analysis was conducted to test the effect on timber supply of including the volume contribution of deciduous species from mixed-wood stands.

The analysis showed that the deciduous contribution to timber supply was 34 000 cubic metres per year for the first 10 decades.

5.5 Uncertainty in estimated managed stand yields

Uncertainty in volume estimates for managed stands exists for the same reasons listed for estimated existing stand yields (inaccuracies in the forest inventory and the growth and yield models), but also because of the limited experience and data that is available for regenerated managed stands in B.C. In this section, the timber supply effects of uncertainty associated with predicting volumes in regenerated stands is examined.

Figure 24 shows the harvest forecasts that result when regenerated stand volumes are increased and decreased by 10%.

Managed stand yields decreased by 10%

- New long-term harvest level of 1 206 000 cubic metres per year reached in decade eleven.
- New long-term level is 6% below the base case long-term level.

When managed stand yields are increased by 10%

- Long-term harvest level increased to 1 389 600 cubic metres per year, 8% greater than the base case.

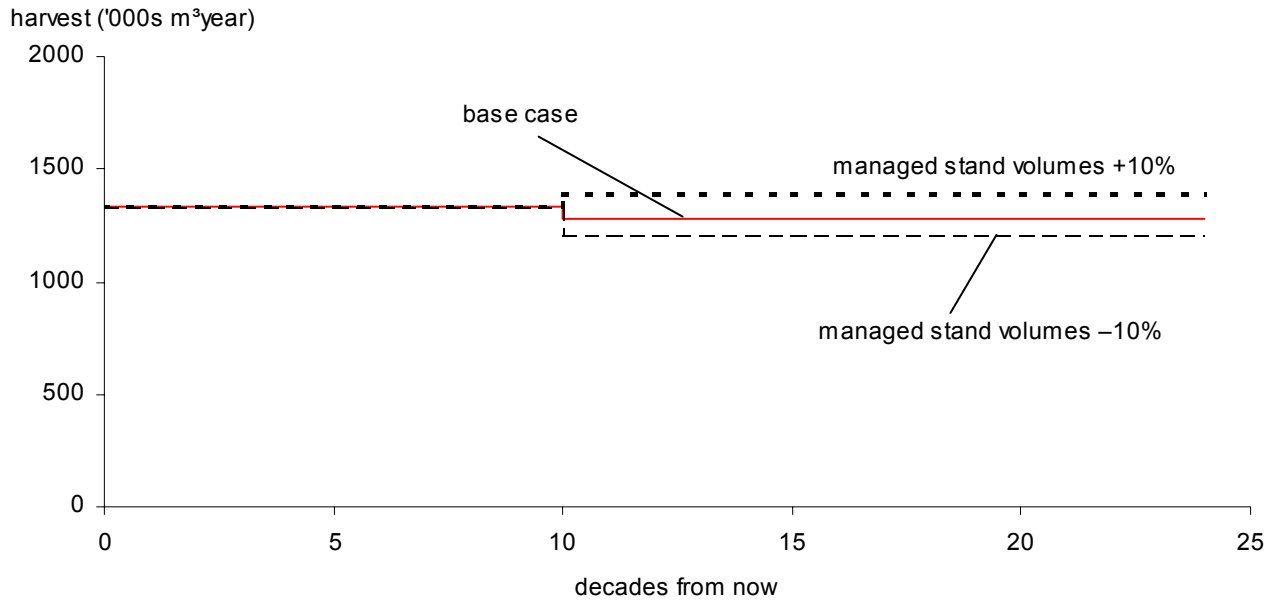

Figure 24. The effect on the harvest forecast of increasing and decreasing volume estimates for managed stands by 10% — 100 Mile House TSA, 2001.

Mixed-wood
Forests that have a mix of coniferous and deciduous trees.

Changes to regenerated stand yields have no effect on the short-term harvest forecast for the 100 Mile House TSA. Regenerated stands are not eligible for harvest until they have reached their minimum harvestable ages, which range between 40 and 120 years. While some young existing managed stands will achieve their minimum harvestable ages beginning in a few decades, the timber inventory in the TSA is dominated by older existing stands. The harvest is not projected to be dominated by regenerated stands until about 90 years from now (see Figure 11).

5.6 Uncertainty in the productivity of current old-growth sites after harvest

The productivity of a site largely determines how quickly trees will grow. It therefore affects the timber volumes in regenerated stands, the time to reach green-up and the age at which those stands will reach merchantable size. The most accurate estimates of site productivity come from stands between 30 and 150 years old. At ages less than about 30 years a temporary increase or decrease in growth due to factors such as a post-harvest flush of nutrients or an unusual drought year can affect the overall productivity estimated for the stand.

Old-growth site index (OGSI)

Site productivity estimates derived for older stands may be incorrect because tree heights do not represent actual productivity — for example due to top breakage — and it is very difficult to determine ages of old trees accurately. The results of recent province-wide research suggest that the estimated productivity of sites currently occupied by old-growth stands may be significantly underestimated. Two Old-Growth Site Index (OGSI) studies applicable to timber supply forecasting are:

- *Site index adjustments for old-growth stands based on paired plots* (Nussbaum 1998). Data were obtained from paired plots installed in old-growth stands and adjacent logged and regenerated stands of the same productivity. Site index was estimated for both and comparisons were made. Results are available for Douglas-fir, lodgepole pine, and interior spruce.
- *Site index adjustments for old-growth stands based on veteran trees* (Nigh 1998). The objective of the study was to develop site index adjustments for species not covered by the paired-plot project. The data for this study came from temporary and permanent plots with a veteran and main stand component. The site indices for the two components were estimated and an adjustment equation for each species was derived using linear regression analysis. The results of the study are considered less reliable than those from the paired-plot study.

The results of these studies were applied to the non-PA 16 stands managed using even-aged methods. The stands greater than 140 years old which belonged to this group comprise 44 800 hectares or 6% of the timber harvesting land base in the 100 Mile House TSA. To test the sensitivity of the base case harvest forecast to uncertainty about site productivity estimates, an analysis was performed that incorporated adjustments to site indices.

Site indices of stands older than 140 years were adjusted using either the paired-plot or veteran-tree results, whichever was applicable. Managed stand volume estimates for those analysis units (AU) affected by changes in estimated future productivity were recalculated based on average adjusted site productivity. Green-up and minimum harvestable ages were also recalculated. Table 7 compares the average forest inventory-based site index for each analysis unit to those defined using each of the adjustments.

5 Timber Supply Sensitivity Analyses

Table 7. Average analysis unit site index based on forest inventory and OGSI information — 100 Mile House TSA, 2001

Analysis unit	Area (hectares)	Inventory site index	Adjusted site index
Fir poor (non-selection)	3 097	11.2	15.2
Fir good/medium (non-selection)	2 419	15.6	17.9
Cedar-hemlock poor	547	11.1	20.7
Cedar-hemlock good/medium	955	13.9	20.7
Spruce-balsam poor	16 273	10.6	19.5
Spruce-balsam good/medium	5 928	17.3	20.8
Lodgepole pine poor	9 872	11.2	17.3
Lodgepole pine good/medium	5 707	14.9	20.3

Harvest forecast with OGSI adjustments

- Harvest forecast same as base case for first ten decades (Figure 25).
- Long-term harvest level of 1 336 000 cubic metres per year — 4.2% above base case — can be maintained from decade 11 onward.

Old-growth site index adjustments were not included in the base case since there is little local data, and a lack of long-term monitoring data for regenerating stands to validate the adjustments. The results of the sensitivity analysis, however, do provide insight into the trends associated with possible adjustments to site productivity estimates for the 100 Mile House TSA.

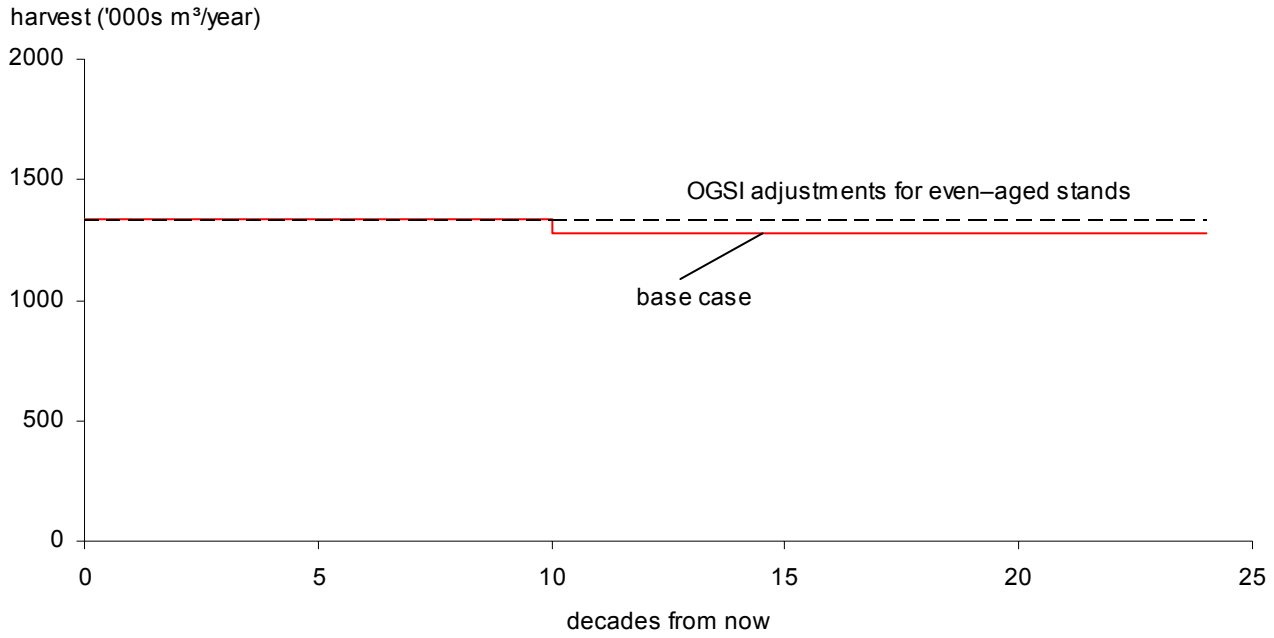

Figure 25. Harvest forecast based on OGSI (paired plot and veteran studies) site index adjustments — 100 Mile House TSA, 2001.

5.7 Uncertainty in forest cover requirements for visual quality

In the 100 Mile House TSA, areas determined to be visually sensitive to timber harvesting occupy approximately 6% of the timber harvesting land base. Where visual quality objectives apply, limits are placed on the percentage of the area where harvesting-related disturbance may be visible. When newly established forest reaches a specified height, the disturbance is no longer visible. Uncertainties are associated with the allowable disturbance percentages.

Percentage limits on visible disturbance

The level of harvest from visually sensitive areas is a function of the visual absorption capacity, the visual quality rating, and the current visual condition of each area. Uncertainty about forest cover and green-up objectives for visual quality may arise from inventory and classification of land into visual absorption capacity classes, from estimates of how well different disturbance limits may meet visual objectives, and from estimates of how non-harvestable forest may contribute to visual quality.

In the base case, the allowable visible disturbance applied to visually sensitive areas in each landscape unit was 10%. Sensitivity analyses were performed to assess the impacts of relaxing and increasing forest cover constraints for visual quality. Figure 26 shows the results.

Increasing the allowable disturbance to 15%

- Harvest forecast 20 000 cubic metres per year (1.5%) higher than base case for first 10 decades.
- Long-term harvest level is 2% higher than the base case.

Decreasing the allowable disturbance to 5%

- Harvest forecast same as base case for first 10 decades.
- Long-term harvest level is 2% lower than the base case.

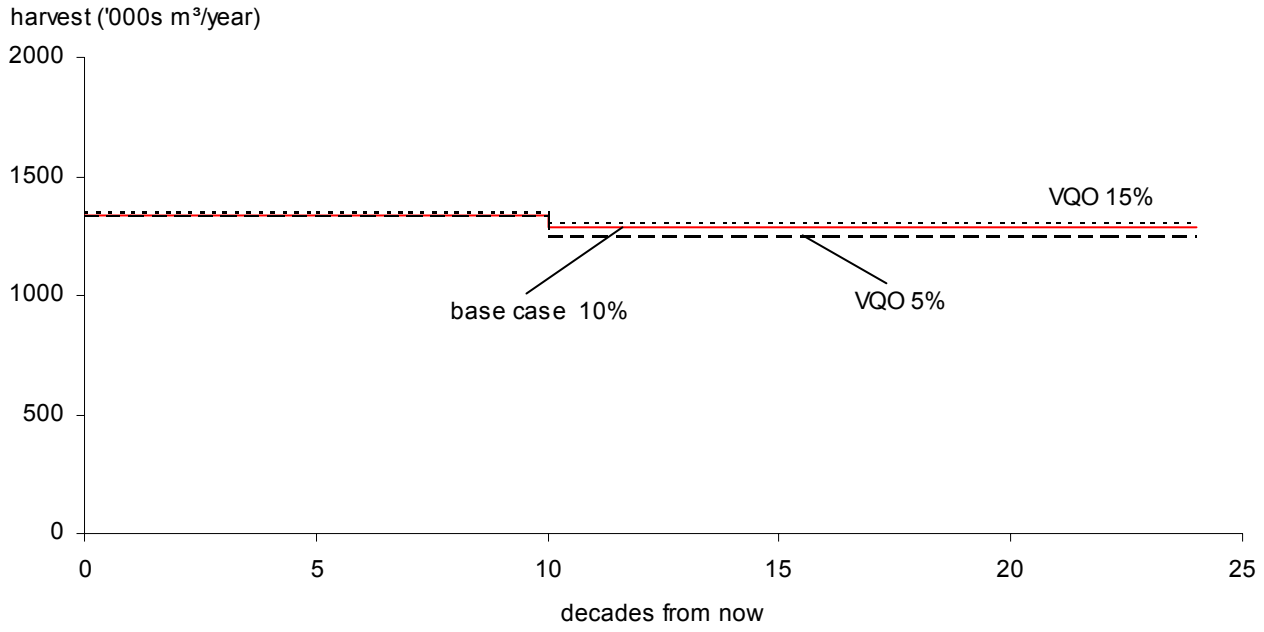

Figure 26. Timber supply projections for changes in visual quality objectives — 100 Mile House TSA, 2001.

5.8 Uncertainty in minimum harvestable ages

Minimum harvestable ages are an estimate of the time needed for stands to reach a merchantable condition. They affect the time over which existing stands must be metered-out while regenerated stands grow to merchantability. The time at which stands will become merchantable is not known with precision because of uncertainty about the growth of regenerated stands, and an inability to foresee future conditions that will determine merchantability.

For this analysis, stands were considered merchantable at the earlier of the age when they attained a volume of 65 cubic metres per hectare or 80 years for pine-leading stands and 120 years for all other stands. These criteria applied only to the stands managed under the even-aged system. See Appendix A, "Description of Data Inputs and Assumptions for the Timber Supply Analysis" for the minimum harvestable ages applied in this analysis. Approximately 75% of the stands in the timber harvesting land base of the 100 Mile House TSA are currently at or above the minimum harvestable age applicable to the stand. Minimum harvestable ages are meant to approximate the timing of merchantability and are not legal or policy requirements.

Figure 27 shows how timber supply would change if stands in fact become merchantable either earlier or later than assumed in the base case.

<u>Increase the minimum volume from 65 to 75 cubic metres/hectare</u>

- No change from the base case harvest projections.

<u>Minimum harvestable ages set at the culmination of mean annual increment (MAI)* age</u>

- Timber supply increased by 5000 cubic metres per year after decade 10.

<u>Minimum harvestable ages set at 80 years for pine-leading stands and 120 years for all other stands</u>

- Timber supply decreased by 2% (25 600 cubic metres per year) after decade 10.

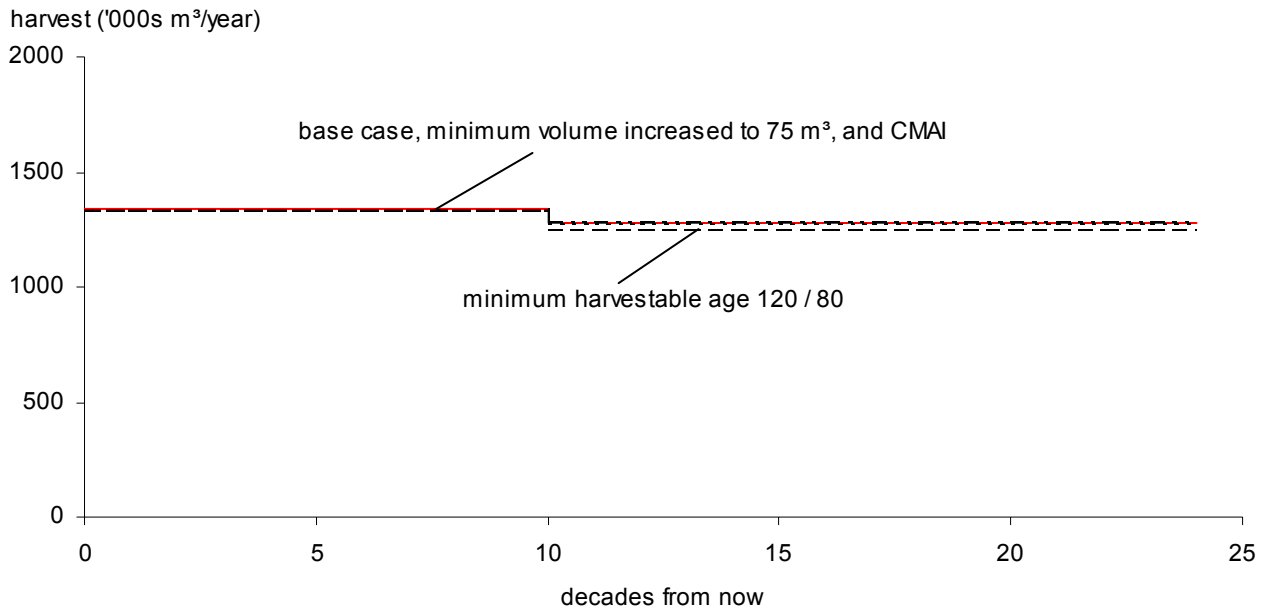

Figure 27. Harvest forecasts if minimum harvestable ages different from the base case — 100 Mile House TSA, 2001.

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.

5.9 Uncertainty in the application of seral stage* retention recommendations

The *Forest Practices Code Act of British Columbia* (FPC) describes the conservation of biodiversity as an essential component of sustainable forest use. The *FPC Landscape Unit Planning Guide (LUPG)* provides recommendation for maintaining biodiversity at both the stand- and landscape-levels. Stand-level biodiversity has been addressed in this analysis by removing portions of each stand from the timber harvesting land base. Therefore, uncertainty about stand-level biodiversity can be assessed through sensitivity analysis that examines the timber supply impacts of changes to the timber harvesting land base.

Management for landscape-level biodiversity was modelled in this analysis through the use of forest cover requirements applied to each combination of natural disturbance type, biogeoclimatic subzone, and variant within each landscape unit. In the base case, old-growth targets, as found in the *Landscape Unit Planning Guide*, were applied at the biogeoclimatic variant level within each draft landscape unit. These targets were a weighted average of the lower, medium and higher biodiversity emphasis option (BEO) targets with 45% assumed as low, 45% as medium and 10% as high. For the lower emphasis BEO, an initial draw down of the old-seral requirements to one-third of the target was allowed in the base case. Two-thirds of the old-seral target was required to be met by the seventh decade and the full target was requested after the fourteenth decade.

While the approach used in the base case represents current policy for managing and modelling landscape-level biodiversity, there is uncertainty about how the recommendations in the *Landscape Unit Planning Guide* will be applied once landscape units and BEOs are declared. The 100 Mile House TSA has delineated draft landscape units and has assigned draft BEOs to these landscape units. (See Table A-17. in Appendix A, "Description of Data Inputs and Assumptions for the Timber Supply Analysis").

Two sensitivity analyses were performed to evaluate the potential timber supply impacts associated with uncertainty about landscape-level biodiversity management.

Using the draft option for BEOs, meet old-seral targets immediately in all draft landscape unit — biogeoclimatic zone variant combinations as required by the *Landscape Unit Planning Guide*.

Using the draft option for BEOs, meet old- and mature-seral* targets immediately in all draft landscape unit — biogeoclimatic zone variant combinations as required by the *Landscape Unit Planning Guide*.

In both of the sensitivity analyses there were no changes to the base case timber supply forecasts. Immediate application of old- and mature-seral forest requirements in the combinations tested had no timber supply impact because of the quantity and distribution of older forest in both the timber harvesting land base and the non-timber harvesting land base.

Seral stages
Sequential stages in the development of plant communities that successively occupy a site and replace each other over time.

Mature seral
Forest stands with trees between 80 and 120 years old, depending on species, site conditions and biogeoclimatic zone.

6 Summary and Conclusions of the Timber Supply Analysis

The results of this timber supply analysis suggest that, given data and management assumptions that reflect current information and practices, the current allowable annual cut in the 100 Mile House TSA of 1 335 600 cubic metres per year can be maintained for ten decades. After the tenth decade, the projected harvest level declines by 4% to 1 281 600 cubic metres per year. A series of sensitivity analyses showed that data and management uncertainties affect timber supply projections to varying degrees, some with positive impacts and others with negative impacts.

Short-term timber supply is sensitive to changes that influence the amount of timber available from existing unmanaged stands, because the harvest forecast relies on harvests from these stands for the next 100 years. Estimates of timber volumes in existing stands have the largest potential to affect the base case projection of short-term harvest levels (next 20 years). An audit conducted in 1999 showed that the inventory estimate of volume in all mature stands (over 60 years old) was approximately 11% above the estimate derived from ground samples. When samples from the IDF BEC zone of the TSA (approximately 50% the timber harvesting land) were considered separately, volumes estimated using inventory information were 25% higher than estimates based on ground measurements. When samples from the Big Bar PSYU (approximately 35% the timber harvesting land) were considered separately, volumes estimated using inventory information were 19% higher than estimates based on ground measurements. If existing stand volumes in the IDF BEC zone are indeed 25% lower than the inventory estimates the current AAC can be maintained for only ten years. This analysis shows that timber supply will decline to about 16% below the base case level during decades 3 to 10. After decade 10, timber supply recovers to about 2.3% below the base case level. Similar results are obtained when existing stand volumes of all stands in the Big Bar PSYU are reduced by 19% to account for the possible inventory error.

The level of disturbance allowed in visually sensitive areas also affected short-term timber supply. Sensitivity analysis suggested that if the disturbance level was increased from 10% to 15%, timber supply would increase by 1.5% throughout the analysis horizon.

Like the short term, medium-term (21 to 100 years from now) timber supply is affected by uncertainties that affect either the total amount of existing volume, or the ability to access existing volume during the first 100 years. In this TSA, timber supply in the medium term is most affected by changes in: the size of the timber harvesting land base, volumes from existing stands, and forest cover requirements for management of visual quality.

Changes in the amount of the land base that is available for harvesting have direct effects on timber supply. When the timber harvesting land base was increased by 10%, timber supply was increased by about 10% throughout the analysis horizon. When the timber harvesting land base was decreased by 10%, medium- and long-term timber supply decreased by about 10%. In addition to the impact on short-term timber supply, a decrease in volume from existing stands had a medium- and a long-term impact as well. If existing stand volumes in the IDF zone were overestimated by 25% then timber supply in the medium term would be about 16% below the base case level. The effect on timber supply of changing the level of disturbance in visually sensitive areas was as described above.

Long-term (over 100 years from now) timber supply is affected by uncertainties in all of the factors affecting short- and medium-term timber supply. In addition, factors that affect the volume of regenerated stands or the availability of those stands also affect long-term timber supply.

If regenerated stand volumes were 10% higher than estimated then long-term timber supply was projected to be 8% higher than in the base case. If regenerated stand volumes were 10% lower than estimated then long-term timber supply was expected to be 6% lower than the base case. If site productivity of existing old-growth stands is underestimated, as suggested by recent research, yields from stands regenerated after harvesting old growth could be significantly higher than projected in the base case. In the 100 Mile House TSA, stands older than 140 years comprise 6% of the timber harvesting land base and the old-growth site index adjustment resulted in a 4.2% increase in long-term timber supply.

6 Summary and Conclusions of the Timber Supply Analysis

The time taken to achieve green-up conditions and the amount of area allowed to be in a non-greened-up condition also have significant effects on long-term timber supply. If the time taken to reach the green-up height of 3 metres was increased by 5 years then long-term timber supply was reduced by about 8%. If the time to green-up was reduced by 5 years then it would be possible to increase long-term timber supply by about 3%. In the base case 35% of the area in the multiple use zone (56% of the timber harvesting land base) was allowed to be in a non-green-up condition. If this constraint was tightened to allow only 25% of the area to be below green-up then long-term timber supply would be reduced by 5%.

In conclusion, this analysis indicates that based on current inventory, growth and yield, and forest management information, timber harvests in the 100 Mile House TSA can be maintained at the current level for 100 years. The existing partition of 112 000 cubic metres per year for Pulpwood Agreement 16 can be maintained for 20 years. The analysis indicates that several factors related to the current forest inventory and management regime could affect timber supply. However, except for the likelihood that existing stand volumes may be overestimated, there is no conclusive evidence to suggest that significant inaccuracies exist in the information used in this analysis.

7 Socio-Economic Analysis

The impact of timber supply adjustments on local communities and the provincial economy is an important consideration in the timber supply review. This analysis examines the socio-economic implications of alternative harvest levels in the 100 Mile House TSA. It compares the level of forestry activity currently supported by timber harvested from the 100 Mile House TSA to the level of activity that could be supported as the timber supply in the TSA moves towards the long-term harvest level. The analysis uses the base case harvest forecast as an indication of future timber supply levels.

The socio-economic analysis includes:

- a profile of the current socio-economic setting;
- a description of the forest industry; and
- an analysis of the socio-economic implications of the base case harvest forecast.

The socio-economic analysis considers the current and projected levels of forestry activity associated with the 100 Mile House TSA within the context of regional timber supplies and production capacity. It does this by examining the profile of the region and the local forest industry; and by undertaking a socio-economic analysis using the harvest forecasts as projected in the base case.

The socio-economic analysis includes an estimate of the employment and income impacts associated with timber supply analysis projections by three main sectors: harvesting and woodlands-related activities, processing, and silviculture. Employment is measured in terms of person-years*. Employment income is calculated using average industry income estimates.

Data on direct employment, harvest levels, and fibre flows were obtained by surveying licensees and mill operators. The information was used to estimate harvesting, processing and silviculture direct employment averages associated with the harvest and the proportion of workers living in the area. The estimates of local and provincial harvesting, processing, and silviculture direct employment were then used to determine ratios of employment per 1000 cubic metres of timber harvested.

Indirect and induced employment were calculated using the 100 Mile House TSA and provincial employment multipliers* developed by the Ministry of Finance. Indirect impacts result from direct businesses purchasing goods and services; induced impacts result from direct employees purchasing goods and services. Employment coefficients* per 1000 cubic metres were also determined for these indirect and induced imports.

To estimate the level of employment that could be supported by alternative harvest rates, projected timber supply levels were multiplied by the calculated employment coefficients. It should be noted that employment coefficients are based on current productivity, harvest practices and management assumptions and will not likely reflect industry conditions decades into the future. As such, the employment estimates should only be viewed in a general way.

7.1 Current socio-economic setting

7.1.1 Population and demographic trends

The 100 Mile House TSA, one of three TSAs in the Cariboo Forest Region, has a population of approximately 15,900 people (1996 census). The major communities are 100 Mile House, Clinton, 108 Mile Ranch, Lone Butte/Horse Lake and Lac la Hache. Smaller communities include Forest Grove and 70 Mile House. From 1991 to 1996, the population of the TSA increased 20%. By 2001, the population of the TSA is projected to be about 16,700, an increase of 5.2% from 1996 (Table 8).

Person-year(s)
One person working the equivalent of one full year, defined as at least 180 days of work. Someone working full-time for 90 days accounts for 0.5 person-years.
Employment multiplier
An estimate of the total employment supported by each direct job, for example a multiplier of 2.0 means that one direct job supports one additional indirect and induced job.

Employment coefficient
The number of person-years of employment supported by every 1000 cubic metres of timber harvested; for example, a coefficient of 1.0 indicates that every 1000 cubic metres harvested supports one person-year, or 500 000 cubic metres supports 500 person-years.

Table 8. Population statistics — 100 Mile House TSA

Communities	Population 1991 census	Population 1996 census	Population 2001 estimate[a]	Per cent (%) change 1996–2001
100 Mile House	1,866	1,850	2,193	18.5
Clinton	622	729	754	3.4
Thompson-Nicola Subdivision D[b]	963	1,142	1,140	–0.1
Cariboo Subdivision B[c]	9,446	11,073	12,109	9.4
Other communities	336	1,093	519	–52.5
100 Mile House TSA Total	13,233	15,893	16,715	5.2

Sources: 1991 and 1996 census data. Between the 1991 and 1996 census, boundaries were changed for some enumeration areas. Therefore, population figures between the censuses for some communities may not be based on the same geographic area.

(a) Estimates are based on Local Health Area Population Projections. Data are from Population Section, BCSTATS.

(b) Includes the communities of Chasm and 70 Mile House.

(c) Includes the communities of Canim Lake, Forest Grove and Lac la Hache.

7.1.2 Economic profile

From 1991 to 1996, the experienced labour force in the 100 Mile House TSA increased by almost 20% to 7,675. In comparison, the experienced labour force for the province increased by about 12% over the same period. The unemployment rate in the 100 Mile House TSA was 13.0% in 1996, compared with 14.8% in 1991. As Figure 28 illustrates, the major employment sectors in the 100 Mile House TSA are forestry, the public sector (which includes education, health, and federal, provincial and local public services) and tourism. Information from the 1996 census indicates that the forestry sector accounted for about 30% of employment (direct, indirect and induced) in the TSA. Employment in the agriculture sector, which includes the ranching industry, accounted for about 9% of employment in the TSA.

Tourism, which includes portions of several service sectors including accommodation services, retail trade and transportation, has demonstrated significant growth and investment in recent years. Almost 1,300 persons are employed in the 100 Mile House TSA's tourism sector, catering to both tourist and business travellers. Nearly 400 businesses in the 100 Mile House TSA, including outdoor recreation facilities, tours and attractions, retail and service businesses, food and beverage facilities, and accommodations, service visitors' needs.

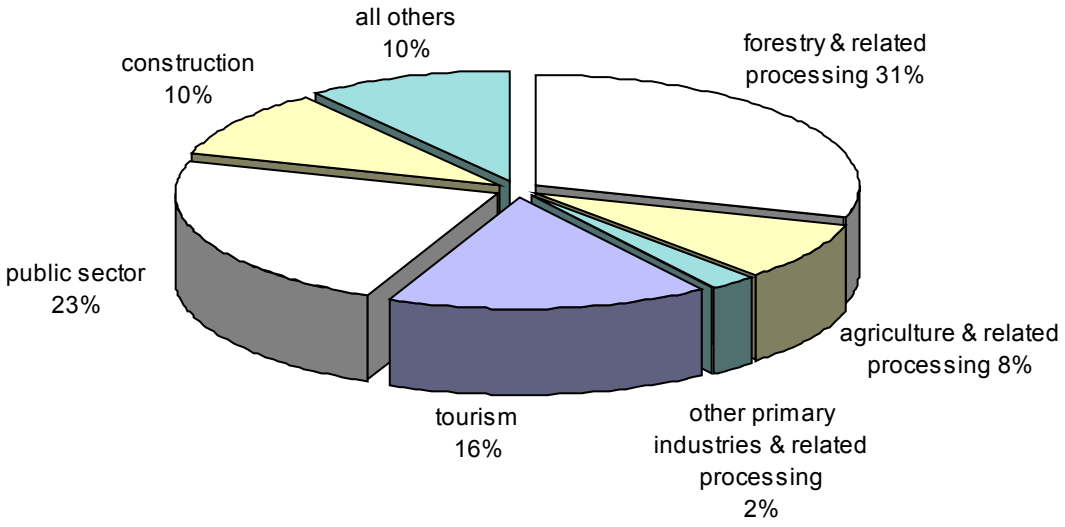

Figure 28. Estimates of employment by sector — 100 Mile House TSA, 1996.

Source: 1996 census.

Income, whether business or personal, is another indicator of a sector's contribution to the economy. Jobs in sectors with high-income levels tend to support more employment per job than those in sectors with lower income levels. Statistics Canada labour force data, comparing average weekly earnings in different sectors of the economy, indicate that the forestry sector is one of the highest paying sectors and, therefore, a major contributor to the local and provincial economies. Mining is the only sector that has consistently paid higher wages than forestry. In 1999, the average weekly earnings (before income taxes) in the forestry sector were about $962, compared with $1,165 for the mining sector. Other sectors' average weekly earnings were $697 for the construction industry; $244 for the accommodation, food and beverage services industries; and $797 for the public sector.

Employment multipliers reflect the income effect: the greater the multiplier, the greater the impact that each job in this sector has on the economy. For example, estimates by the Ministry of Finance indicate that for every 100 full-time direct forestry jobs in the 100 Mile House TSA, another 12–51 indirect and induced jobs* are supported, depending on the forestry activity (harvesting or timber processing). In comparison, for every 100 full-time direct jobs in the tourism sector, an estimated additional 8–18 indirect and induced jobs are supported. The differences are due to greater spending patterns by both forestry sector businesses and their employees. Table 9 compares estimated employment, average weekly earnings and employment multipliers for selected industry sectors of the 100 Mile House TSA.

Indirect and induced jobs
Indirect jobs are supported by direct business purchases of goods and services. Induced jobs are supported by employee purchases of goods and services; for example, at retail outlets.

Table 9. Average weekly earnings and employment multipliers — 100 Mile House TSA

Industry sector	1999 average weekly earnings ($)	Employment multiplier[a]
Forestry and related	962	1.22–1.51
Mining and related	1,165	1.48–1.74
Construction	697	1.32–1.48
Tourism[b]	244	1.08–1.18
Public sector	797	1.13–1.27

Sources: Statistics Canada. 1999. Estimates of average weekly earnings. Weekly earnings are before income taxes.

Ministry of Finance and Corporate Relations. 1999. The 1996 forest district tables. Refers to 1996 census data.

(a) Includes direct, indirect and induced jobs.

(b) In British Columbia, the average weekly earnings for those in the tourism sector range from $220 for food service workers to $362 for hotel workers. In 1999, there were more than four times the number of workers in food services than in hotels, motels and trailer courts services in the province. The average weekly earnings in the tourism sector reflect, therefore, the larger portion of workers who have the lower average weekly earnings.

7.2 100 Mile House forest industry

7.2.1 Current allowable annual cut

The current allowable annual cut (AAC) of 1 362 000 cubic metres was established in 1996. Forest licences account for about 75% of the apportioned volume in the TSA, and the Ministry of Forests' Small Business Forest Enterprise Program (SBFEP) accounts for another 15% of the apportioned volume. Table 10 indicates the current apportioned AAC by type of licence.

Table 10. Allowable annual cut apportionment — 100 Mile House TSA, 1996

Type of licence	Volume (m³)	Per cent (%)
Forest licences, replaceable	1 009 584	74.1
Small Business Forest Enterprise Program (SBFEP)	207 166	15.2
Forest Service Reserve	5 000	0.4
Woodlot licences	28 250[a]	2.1
Pulpwood agreement	112 000	8.2
Total	1 362 000	100.0

Source: Ministry of Forests, Resource Tenures and Engineering Branch.

(a) Includes woodlot licences in Schedule A and B lands.

7.2.2 Recent harvest history

The actual annual harvest level is an important indicator of forestry activity in the TSA. While the AAC is the maximum allowable annual harvest level, the actual volume of timber harvested in a particular year determines the level of economic activity.[1] If actual annual harvest levels are less than the AAC, then economic activity is also less than that which should be attained if the full AAC were harvested. A persistent gap between the AAC and the actual annual harvest level could influence the potential short-term impacts of changes in the AAC. Table 11 summarizes the volume of timber harvested in the 100 Mile House TSA from 1995 to 1999.

Table 11. AAC and volume billed, by licence type — 100 Mile House TSA, 1995–1999

Type of licence[a]	Cubic metres (m^3)					
	1995	1996	1997	1998	1999	Average 1995-1999
Forest licence	775 361	1 395 596	1 000 627	929 228	1 010 562	1 022 275
Small Business Forest Enterprise Program (SBFEP)	208 137	138 750	291 469	291 175	287 185	243 343
Pulpwood agreement	25 611	10 681	2 406	46 901	22 638	21 647
Other[b]	3 221	3 794	1 826	2 711	5 141	3 339
Total	1 012 330	1 548 820	1 296 328	1 270 015	1 325 527	1 290 604
Allowable annual cut	1 237 000	1 362 000	1 362 000	1 362 000	1 362 000	

Source: Ministry of Forests, Harvest database.

(a) Timber harvested from private lands and woodlots is not included in the analysis of this report. Average annual harvest from private lands for the same period was 128 867 cubic metres and from woodlots was 10 355 cubic metres.

(b) Other includes rights-of-way clearing, roads, trespass and other miscellaneous harvests.

(1) Cut-control permits licensees to vary the volume between annual harvest and AAC by ± 50% per year and by ± 10% over a five-year period. This variability gives licensees the flexibility to adapt to changing conditions, including changing markets.

7.2.3 Major licensees and processing facilities

Ainsworth Lumber Ltd.

Ainsworth Lumber Ltd. (Ainsworth) has a replaceable forest licence to harvest 486 742 cubic metres per year and a pulpwood agreement allowing harvest of up to 112 000 cubic metres per year, identified in TSR I, for a total of 598 742 cubic metres per year. Almost all of the harvest from these licences is processed in the TSA at the company's lumber and oriented strand board mills in 100 Mile House. Based on recent data, Ainsworth's average annual harvest from these two licences supported an estimated 310–324 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 12). Average harvests from Ainsworth's forest licence were more than 95% of the apportioned volume, while the average harvest from the 100 Mile House TSA portion of Ainsworth's pulpwood agreement has been between 20 000 and 25 000 cubic metres per year. More than 80% of the workers associated with the harvesting and processing of the timber from this licence reside in the 100 Mile House TSA. Note: As of April 2001, Ainsworth sold its 100 Mile House operations, specifically FL A20001 and the lumber mill at Clinton, to West Fraser Timber Ltd.

Table 12. Ainsworth's harvest and direct employment statistics

Allowable annual cut (AAC)	598 742 cubic metres
Annual average harvest — forest licence (1997-1999)	464 545 cubic metres
1999 harvest	506 251 cubic metres
Estimated employment (person-years)[a]	
Harvesting and administration	72-75
Log transport	19-21
Road construction and maintenance	4-6
Silviculture	15-17
Timber processing	200-205
Total	310-324

Source: Ministry of Forests, Harvest database.

(a) Estimates of employment are based on 1997–1999 average annual harvest of 464 545 cubic metres. Estimates are derived from information supplied by the licensee and include employment associated with TSA timber that is processed within the TSA as well as outside the TSA.

Weldwood of Canada Ltd.

Weldwood of Canada Ltd. (Weldwood) has a replaceable forest licence to harvest 419 396 cubic metres per year. About 80% of the timber harvested from this licence is processed in the TSA at the company's lumber mill in 100 Mile House. Based on recent data, Weldwood's average annual harvest from this licence supported an estimated 411-449 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 13). About 60% of the workers associated with the harvesting and processing of the timber from this licence live in the 100 Mile House TSA.

Table 13. Weldwood's harvest and direct employment statistics

Allowable annual cut (AAC)	419 396 cubic metres
Annual average harvest (1997-1999)	419 969 cubic metres
1999 harvest	414 859 cubic metres
Estimated employment (person-years)[a]	
Harvesting and administration	106-108
Log transport	24-26
Road construction and maintenance	15-16
Silviculture	14-20
Timber processing	252-279
Total	411-449

Source: Ministry of Forests, Harvest database.

(a) Estimates of employment are based on 1997-1999 average annual harvest of 419 969 cubic metres. Estimates are derived from information supplied by the licensee and include employment associated with TSA timber that is processed outside the TSA.

Lignum Limited

Lignum Limited (Lignum) has a replaceable forest licence to harvest 103 449 cubic metres per year. Most of the harvested timber from this licence is processed in the company's lumber mill in Williams Lake, which is outside the 100 Mile House TSA. Based on recent data, Lignum's average annual harvest from this licence supported an estimated 78-107 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 14). About one-third of the workers associated with the harvesting and processing of the timber from this licence live in the 100 Mile House TSA.

Table 14. Lignum 's harvest and direct employment statistics

Allowable annual cut (AAC)	103 449 cubic metres
Annual average harvest (1997-1999)	119 607 cubic metres
1999 harvest	112 090 cubic metres
Estimated employment (person-years)[a]	
Harvesting and administration	17-33
Log transport (included in harvesting and administration)	6-9
Road construction and maintenance	2-3
Silviculture	2-7
Timber processing	51-55
Total	78-107

Source: Ministry of Forests, Harvest database.

(a) Estimates of employment are based on 1997-1999 average annual harvest of 119 607 cubic metres. Estimates are derived from information supplied by the licensee and include employment associated with TSA timber that is processed outside the TSA.

Small Business Forest Enterprise Program (SBFEP)

The apportioned volume in 100 Mile House TSA's SBFEP is 207 166 cubic metres per year, or about 15% of the TSA's apportioned AAC. SBFEP harvests in recent years have averaged nearly 290 000 cubic metres per year, or about 23% of the total annual harvest in the TSA. An estimated 55% of the timber harvested in the SBFEP is by licensees who reside in the TSA. Based on averages of licensees and operators in the TSA, the volume harvested under the SBFEP supported an estimated 240–250 person-years of employment in harvesting, silviculture, timber processing and related activities (Table 15). An estimated 65% of the workers associated with the harvesting and processing of the timber from the SBFEP licences live in the 100 Mile House TSA.

Table 15. SBFEP's harvest and direct employment statistics

Allowable annual cut (AAC)	207 166 cubic metres
Annual average harvest (1997-1999)	289 943 cubic metres
1999 harvest	287 185 cubic metres
Estimated employment (person-years)[a]	
Harvesting and administration	58-60
Log transport	14-16
Road construction and maintenance	10-12
Silviculture	8-10
Timber processing	150-152
Total	240-250

Source: Ministry of Forests, Harvest database.

(a) Estimates of employment are based on 1997-1999 annual average harvest of 289 943 cubic metres. Estimates are derived from industry averages of licensees and operators in the TSA and include employment associated with TSA timber that is processed outside the TSA.

100 Mile House TSA timber supply and processing capacity

About 75% of the timber harvested in the 100 Mile House TSA is processed within the TSA. Timber processing plants in the 100 Mile House TSA include three lumber mills, one oriented strand board mill, one shake and shingle mill and several log home mills. These timber processing plants have an estimated annual processing capacity of 1.7 million cubic metres. From 1997 to 1999, harvests in the TSA averaged less than 1.3 million cubic metres per year. Some of the harvest in the TSA is transported out of the TSA to be processed. Therefore, additional timber supply for processing plants in the TSA comes from nearby TSAs and private sources (Table 16).

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Table 16. Timber processing facilities and estimated annual capacities — 100 Mile House TSA, 2000

Name	Type of mill	Location of mill	Estimated annual capacity ('000s m³)
100 Mile House Wood Products Ltd.	Lumber	100 Mile House	20
Ainsworth Lumber Co. Ltd.	Lumber	Clinton	385
Ainsworth Lumber Co. Ltd.	Oriented strand board	100 Mile House	465
Caliga Log Homes Ltd.	Log home	93 Mile House	2
Canada's Log People Ltd.	Log home	100 Mile House	5
Falcon Log Homes Ltd.	Log home	100 Mile House	3
Kanstam Log Homes Ltd.	Log home	93 Mile House	3
Keeko Log Homes Ltd.	Log home	100 Mile House	12
Original Log Homes Ltd.	Log home	100 Mile House	5
Pacific Log Homes Ltd.	Log home	Lone Butte	8
Sitka Log Homes Ltd.	Log home	100 Mile House	5
Superior Log Homes Ltd.	Log home	108 Mile Ranch	2
W. Boyes Shake and Shingle Ltd.	Shake and shingle	100 Mile House	15
Weldwood of Canada Ltd.	Lumber	100 Mile House	790
Total			1 720

Sources: Ministry of Forests. Major primary timber processing facilities in British Columbia, 2000.

Capacity estimates for lumber mills and shake and shingle mills are based on 480 eight-hour shifts per year.

Capacity estimate for oriented strand board is based on 720 eight-hour shifts per year.

Capacity estimates for log home builders are based on log input or 240 workings days per year, whichever is higher.

Additional information provided by operators in TSA.

7.2.4 Forestry sector employment and employment coefficients

Harvesting and employment information is used to estimate employment coefficients which will be used to project future employment levels in the forestry sector. For this purpose, the forestry sector has been divided into three sub-sectors:

- harvesting and other woodlands-related employment such as log transportation, log salvage, log scaling and harvest planning and administration;
- silviculture employment such as planting, surveying and other basic and intensive silviculture activities, such as spacing, fertilization and pruning*; and
- primary timber processing employment, such as manufacturing activities at lumber mills, veneer and plywood mills, shake and shingle mills and pulp and paper mills.

Harvesting employment

The harvesting employment component is closely related to the volume that is harvested and is, therefore, the first sub-sector affected by changes in the TSA's harvest level. This sub-sector includes employees who work in the harvesting operations of a forest company, as well as contract loggers. Harvesting activity in the 100 Mile House TSA occurs mostly from August to February. Clearcutting by fellerbuncher is the main harvesting method used. Selection harvesting of Douglas-fir occurs in the Interior Douglas-fir (IDF) biogeoclimatic zone.

Silviculture employment

The silviculture employment component is not as closely related to the AAC as harvesting employment because time can elapse between when harvesting ends and when regenerating the harvested areas begins.[2] Basic silviculture consists of surveys, site preparation, planting, brushing, cone collection and spacing. Enhanced silviculture includes spacing, fertilization and pruning. In the 100 Mile House TSA, licensees are responsible for basic silviculture on areas harvested under major licences. The provincial government is responsible for all enhanced silviculture and the remaining basic silviculture on Crown land.

Primary timber processing employment

The timber harvested from the 100 Mile House TSA is processed into a variety of products such as lumber, panel products, log homes, poles and posts, shakes and shingles, and pulp at mills within the TSA and in neighbouring TSAs. Mills in the TSA also process timber that is harvested from other TSAs and private sources. Estimates of timber processing employment are derived from information supplied by licensees and include timber processing employment associated with TSA timber that is processed within the TSA as well as outside the TSA.

Ministry of Forests employment

The 100 Mile House Forest District office has about 60 full-time employees, excluding summer students. Forest district staff oversee the management of forestry-related activities on Crown land in 100 Mile House TSA. Employment in the Ministry of Forests is not included as part of direct employment in the forestry sector because its activities are more related to the administration of government policy than to the level of timber harvesting and would not be affected by marginal changes in the timber supply. Ministry employees are, nevertheless, an important part of total employment in the TSA and are accounted for in the government services component of the TSA's economic base.

> ***Pruning***
> *The manual removal of the lower branches of crop trees to a predetermined height to produce clear, knot-free wood.*

(2) In addition to replanting the harvested area, there are requirements for the harvested stand to be re-established, first to a green-up state and then to a free-growing state. The time that it takes for a regenerated area to reach green-up state varies, depending on the requirements for visual, hydrological and wildlife resource values. The height requirement for regenerated stands can vary among different resource zones. The time required for the regenerated stands to reach the free-to-grow state (when the planted commercial species are as high or higher than competing non-commercial species or brush vegetation) varies according to the silvicultural system used and the ecological association of the stand. Experience indicates that this period can range from 7 to 20 years after harvest. Silviculture activity in harvested areas continues until the stand reaches the free-growing state.

Employment coefficients

Employment coefficients, expressed as person-years of employment per 1000 cubic metres of harvest, have been calculated using employment information from licensees and operators. Table 17 summarizes employment supported by the 1997–1999 harvests in the 100 Mile House TSA and the corresponding employment coefficients. The employment and coefficients are separated into two groups:

1. TSA employment and employment coefficients, which comprise residents of the 100 Mile House TSA who are employed in the forestry sector within the TSA; and
2. Provincial employment and employment coefficients, which comprise all forestry sector employment in the province that relies on the 100 Mile House TSA timber supply, including both residents of the TSA and those who live elsewhere.

Calculations have been made for both groups to identify the importance of the forestry sector within the 100 Mile House TSA and to highlight the contribution that the 100 Mile House TSA's forestry sector makes to the provincial economy. Employment is divided into direct, indirect and induced components; the sum of the components is the total impact, expressed as the number of full-time jobs per 1000 cubic metres of timber harvested or processed. Indirect and induced employment figures were derived using employment multipliers developed by the Ministry of Finance.

The 1995 *100 Mile House Timber Supply Area Socio-Economic Analysis* reported that the AAC of 1 237 000 cubic metres per year supported an estimated 990 person-years of direct forestry employment in the province. This result indicated a provincial employment coefficient of 0.80 person-years of direct employment per 1000 cubic metres.

The current timber supply review shows that harvesting, silviculture and timber processing activities associated with 100 Mile House TSA's 1997-1999 average annual harvest of about 1.3 million cubic metres supported an estimated 1,053 person-years of direct employment in the province. This outcome indicates a provincial employment coefficient of 0.82 person-years of direct employment per 1000 cubic metres (Table 17)[3]. For a more detailed discussion regarding employment coefficients, see Appendix B, "Socio-Economic Analysis Background Information."

Table 17. Forestry sector employment and employment coefficients — 100 Mile House TSA[a]

Activity	Within TSA		Province	
	TSA employment (person-years)	TSA employment coefficient (person-years/ '000s m³)	Province employment (person-years)	Province employment coefficient (person-years/ '000s m³)
Harvesting	318	0.25	331	0.26
Silviculture	16	0.01	49	0.04
Timber processing	357	0.28	673	0.52
Total direct employment	**691**	**0.54**	**1,053**	**0.82**
Indirect + induced employment	316	0.24	1,436	1.11
Total	**1,007**	**0.78**	**2,489**	**1.93**

(a) Employment estimates are reported in person-years (PY) and are based on 1997–1999 average employment and harvest in the 100 Mile House TSA. Due to rounding, some totals may not equal the sum of their components.

(3) Differences in employment coefficient ratios can be due to several reasons: (1) different sources of information; (2) different methods of calculation; (3) reference to employment at different harvest levels; (4) different definitions of full-time employment; and (5) different definitions of forestry sub-sectors. Regardless of which definitions are used, the resulting estimates of impacts of harvest level changes should illustrate similar effects.

7.2.5 Forestry sector employment income

In 1999, the average annual income of forestry employees was $46,956 for those working in logging and forestry services; $44,980 for those working in solid wood manufacturing; and $58,136 for those working in pulp and paper mills. For workers in indirect and induced employment (such as construction, business services, and retail trade), the estimated average annual income in 1999 was $30,732. Based on 1997–1999 annual averages, the 100 Mile House TSA's timber harvest supported more than $50.0 million in direct employment income and an additional $43.5 million of indirect and induced employment income. In all, the harvest supported an estimated total of $94.2 million in employment income, or more than $72,500 per 1000 cubic metres harvested (Table 18).

Table 18. Estimate of forestry sector provincial employment income — 100 Mile House TSA[a]

Employment component	Estimated person-years of employment	Estimated annual income per worker ($)	Total employment income ($ million)	Employment income ($/'000s m³)
Direct employment				
Logging and forestry services	380	46,844	17.80	13,721
Solid wood processing	489	46,183	22.58	17,406
Pulp and paper processing	184	55,931	10.29	7,932
Subtotal	1,053		50.67	39,059
Indirect + induced employment	1,436	30,320	43.54	33,562
Total	**2,489**		**94.21**	**72,621**

Source: Statistics Canada. Survey of employment, payroll and hours. 1997 to 1999 data.

(a) Estimates based on 1997–1999 average annual harvest of 1 297 290 cubic metres. Due to rounding, some totals may not equal the sum of their components.

7.2.6 Provincial government revenues

The provincial government receives taxes and revenues from the forest industry. The forest industry pays stumpage, royalties and rent to the provincial government for the right to harvest and use timber. The forest industry also pays operating taxes such as logging, corporate income, property and sales taxes. As well, the provincial and federal governments receive revenues from forestry employees through income taxes.

Between 1997 and 1999, the timber harvest in the 100 Mile House TSA contributed almost $39.0 million in stumpage and rent payments annually to the provincial government. Other taxes paid by the forest industry, such as logging, corporate income, property and sales taxes, contributed about $10.0 million annually. In addition, the provincial government received more than $8.0 million in income taxes paid by forestry sector employees (Table 19). Altogether, the timber harvest in the 100 Mile House TSA contributed an estimated $57.0 million to provincial government revenues.

Table 19. Estimate of average annual provincial revenues, 1997–1999 — 100 Mile House TSA[a]

Provincial revenues from:	Average annual provincial revenues ($ million)	Average annual provincial revenue ($/'000s m³)
Stumpage and related revenues[b]	38.87	29,962
Forest industry taxes[c]	10.03	7,732
Employment income taxes[d]	8.06	6,213
Total	56.96	43,907

(a) Based on average annual volume harvested of 1 297 290 m³.

(b) Source: Ministry of Forests, Revenue Branch.

(c) Based on estimates by PricewaterhouseCoopers, and includes taxes for logging, corporate income, corporate capital, sales, property and electricity.

(d) Estimated from Revenue Canada income tax rates and includes only the provincial share of income taxes paid.

7.3 Implications of the base case harvest forecast

The socio-economic analysis focuses on the harvest level forecast for the first 10 decades from now and considers:

- the implications of alternative harvest levels for both the 100 Mile House TSA and the province;
- possible impacts on the communities within the TSA;
- log supply requirements of timber processing facilities within the 100 Mile House TSA; and
- regional timber supply implications.

The socio-economic analysis considers average levels of forestry activity that the base case harvest forecast could support, assuming that the current role of the forestry sector in the provincial economy continues and that labour productivity does not change. The analysis also assumes that the proportions of harvesting, silviculture and timber processing employment remain constant and that the types and portions of wood products manufactured remain the same.

Employment impacts associated with future harvest levels are calculated using employment coefficients (person-years of employment per 1000 cubic metres). This method of calculating employment coefficients assumes that employment levels in the future can be predicted using current conditions of employment and the volume of timber harvested or processed. While this method can be reasonably accurate for short-term forecasts (within the next 3–5 years), employment coefficients 20 years from now may be very different due to changes in markets for forest products and timber processing technologies, for example. The analysis indicates the size of impacts on employment, employment income and provincial government revenues, within a constantly changing socio-economic environment.

Base case harvest forecast

The base case harvest forecast for the 100 Mile House TSA for the next 10 decades is 1 335 600 cubic metres per year, which is 26 400 cubic metres per year less than the current AAC.

7.3.1 Employment and employment income impacts in the 100 Mile House TSA

Using 1997–1999 annual averages, the base case harvest forecast of 1 335 600 cubic metres per year for the next 10 decades will support an estimated 1,037 person-years of employment (direct, indirect and induced) in the TSA. Employment will likely remain close to current levels even as companies respond to market changes and adjust harvesting activities under cut-control regulations.

Employment income generated in the 100 Mile House TSA is estimated to be $42.9 million.

7.3.2 Employment and employment income impacts in the province

Provincial employment includes all forestry sector employment supported by the timber harvested from the 100 Mile House TSA. The base case harvest forecast for the next 10 decades will support an estimated 2,563 person-years of employment in the province and generate an estimated $97.0 million in employment income (Table 20).

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Table 20. Socio-economic impacts of base case harvest forecast — 100 Mile House TSA, 2001

	Current AAC[a]	Base case harvest forecast decades 1 to 10
Harvesting activity	**('000s m³)**	
Current AAC/forecast timber supply	1 362.0	1 335.6
Harvest level (1997-1999 average)	1 297.3	
Difference from current AAC	–64.7	–26.4
100 Mile House TSA		
Employment	**(person-years)**	
Direct	725	711
Indirect + induced	332	325
Total	1,057	1,037
Range of employment gain[b] or (loss)		(20)
Employment income	**($ millions)**	
Direct	33.73	33.08
Indirect + induced	10.06	9.86
Total	43.79	42.94
Range of income gain (loss) compared with AAC		(0.85)
Province[c] (including 100 Mile House TSA)		
Employment	**(person-years)**	
Direct	1,106	1,084
Indirect + induced	1,508	1,478
Total	2,614	2,563
Range of employment gain or (loss)		(51)
Employment income	**($ millions)**	
Direct	53.20	52.17
Indirect + induced	45.71	44.82
Total	98.91	96.99
Range of income gain (loss) compared with AAC		(1.92)
Provincial government revenues	**($ millions)**	
Stumpage and related payments	40.81	40.02
Forest industry taxes	10.53	10.33
Employee income taxes	8.46	8.30
Total	59.80	58.64
Gain (reduction) in revenues compared with current AAC		(1.16)

(a) Employment estimates in Table 20 are based on the current AAC of 1 362 000 cubic metres. Employment estimates in Tables 17-19 are based on the 1997–1999 average annual harvest volume of 1 297 290 cubic metres. Due to rounding, some totals may not equal the sum of their components.

(b) The ranges for employment and income changes consider employment insurance and other social assistance programs that give temporary short-term income to unemployed or displaced workers. The range's upper limit assumes that all those who are unemployed or displaced will leave the TSA to seek opportunities elsewhere and will no longer spend their income locally, thus imparting a higher impact on the local economy than if they had not left. The range's lower limit assumes that employment insurance and other social assistance payments to unemployed or displaced workers will temporarily encourage them not to leave the community, thus reducing the induced impacts of a lower harvest level. The actual impacts of changes in harvest levels on employment and incomes will likely fall within the specified ranges. See Appendix B for additional explanations.

(c) Estimates of TSA employment and income impacts are included as part of the estimates of provincial employment and income impacts.

7.3.3 Provincial government revenues

Provincial government revenues from the harvest of the current AAC are estimated to be $59.8 million annually. The base case harvest forecast of 1 335 600 cubic metres per year for the next 10 decades will also generate, on average, an estimated $58.6 million annually in provincial government revenues. Assuming that there will be no changes to tax rates or to stumpage-related charges and provided that the entire volume is harvested and fully utilized, annual provincial government revenues will remain close to current levels.

7.3.4 Community impacts

The impacts of short- and long-term changes in timber supply will be much greater on an economy that depends on the local timber supply than on one that is more diversified. The base case harvest forecast is about 2% less than the current AAC and can be maintained for the next 10 decades. Forestry activity in the 100 Mile House TSA is expected to continue at its current level.

7.3.5 Log supply requirements of timber processing facilities in the 100 Mile House TSA

Between 1997 and 1999, harvests in the 100 Mile House TSA averaged about 1.3 million cubic metres per year. About 75% of the timber from harvest was processed within the TSA. The estimated timber processing capacity in the 100 Mile House TSA is about 1.7 million cubic metres per year. Additional timber supplies are from nearby TSAs and private sources.

7.3.6 Regional timber supply issues

The movement of timber across forest district boundaries means that communities in the 100 Mile House TSA can be vulnerable to timber supply changes in other districts. Information from previous timber supply reviews indicated that the timber supply in this part of the Cariboo region could decline by about 15% or almost 1.3 million cubic metres by the year 2017.[4] Because mills in the 100 Mile House TSA depend on neighbouring management units (including private sources) for more than 50% of their timber supply, future reductions in neighbouring timber supply areas could affect the timber supply available to these mills. However, this outlook may change as each successive timber supply review re-examines the timber supply in the region. How these processes may eventually impact the 100 Mile House TSA will depend on the actual timber supply changes, the composition of the industry and timber flows at the time.

7.4 Summary

Forestry is the major resource sector in the 100 Mile House TSA's economy. Major licence holders in the TSA include Ainsworth Lumber Co. Ltd., Lignum Limited and Weldwood of Canada Ltd. Together, these licensees account for more than 80% of the apportioned volume in the TSA. The Ministry of Forests, Small Business Forest Enterprise Program accounts for an additional 15%. Primary timber processing plants in the 100 Mile House TSA include three lumber mills, one oriented strand board mill and two log home mills.

The base case harvest forecast for the 100 Mile House TSA indicates that an annual cut of 1 335 600 cubic metres per year can be maintained for the next 10 decades. This level of harvest activity can support an estimated 2,563 person-years of forestry employment (includes direct, indirect and induced jobs) and generates $97.0 million of employment income in the province. An estimated $58.6 million per year in provincial government revenues is also generated. Within the 100 Mile House TSA, the volume from the base case harvest forecast would continue to support an estimated 1,037 person-years of employment annually and generate an estimated $42.9 million in employment income.

Because the volume in base case harvest forecast is only slightly less than the current AAC, it will provide continuing stability to the present level of forestry activity in the 100 Mile House TSA.

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(4) These estimates are based on the most recent timber supply review's base case forecasts for 100 Mile House, Williams Lake, Kamloops and Lillooet TSAs. The combined timber supply volume for these management units is currently 8.49 million cubic metres per year. The harvest level is forecast to be 7.20 million cubic metres per year by 2017.

8 References

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9 Glossary

Allowable annual cut (AAC) — The rate of timber harvest permitted each year from a specified area of land, usually expressed as cubic metres of wood per year.

Analysis unit — A grouping of types of forest — for example, by species, site productivity, silvicultural treatment, age, and or location — done to simplify analysis and generation of timber yield tables.

Base case harvest forecast — The timber supply forecast which illustrates the effect of current forest management practices on the timber supply using the best available information, and which forms the reference point for sensitivity analysis.

Biodiversity (biological diversity) — The diversity of plants, animals and other living organisms in all their forms and levels of organization, including the diversity of genes, species and ecosystems, as well as the evolutionary and functional processes that link them.

Biogeoclimatic (BEC) variant — A subdivision of a biogeoclimatic subzone. Variants reflect further differences in regional climate and are generally recognized for areas slightly drier, wetter, snowier, warmer or colder than other areas in the subzone.

Biogeoclimatic zones — A large geographic area with broadly homogeneous climate and similar dominant tree species.

Coniferous — Coniferous trees have needles or scale-like leaves and are usually 'evergreen'.

Cutblock — A specific area, with defined boundaries, authorized for harvest.

Cutblock adjacency — The desired spatial relationship among cutblocks. Most adjacency restrictions require that recently harvested areas must achieve a desired condition (green-up) before nearby or adjacent areas can be harvested. Specifications for the maximum allowable proportion of a forested landscape that does not meet green-up requirements are used to approximate the timber supply impacts of adjacency restrictions.

Deciduous — Deciduous trees shed their leaves annually and commonly have broad-leaves.

Drainage — The surface and sub-surface water derived within a clearly defined catchment area, usually bounded by ridges or other similar topographic features, encompassing part, most, or all of a watershed. The term is sometimes used to describe an operating area or location.

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Employment coefficient — The number of person-years of employment supported by every 1000 cubic metres of timber harvested; for example, a coefficient of 1.0 indicates that every 1000 cubic metres harvested supports one person-year, or 500 000 cubic metres supports 500 person-years.

Employment multiplier — An estimate of the total employment supported by each direct job, for example a multiplier of 2.0 means that one direct job supports one additional indirect and induced job.

Environmentally sensitive areas — Areas with significant non-timber values, fragile or unstable soils, impediments to establishing a new tree crop, or high risk of avalanches.

Forest cover objectives — Specify desired distributions of areas by age or size class groupings. These objectives can be used to reflect desired conditions for wildlife, watershed protection, visual quality and other integrated resource management objectives. General adjacency and green-up guidelines are also specified using forest cover objectives (see **Cutblock adjacency and Green–up**).

Forest inventory — An 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 other forest values such as recreation and visual quality.

Forest Practices Code — Legislation, standards and guidebooks that govern forest practices and planning, with a focus on ensuring management for all forest values.

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

Green-up — The time needed after harvesting for a stand of trees to reach a desired condition (usually a specific height) — to ensure maintenance of water quality, wildlife habitat, soil stability or aesthetics — before harvesting is permitted in adjacent areas.

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Growing stock	The volume estimate for all standing timber at a particular time.
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 practices. 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.
Higher level plans	Higher level plans establish the broader, strategic context for operational plans, providing objectives that determine the mix of forest resources to be managed in a given area.
Indirect and induced jobs	Indirect jobs are supported by direct business purchases of goods and services. Induced jobs are supported by employee purchases of goods and services; for example, at retail outlets.
Inoperable areas	Areas defined as unavailable for harvest for terrain-related or economic reasons. Characteristics used in defining inoperability include slope, topography (e.g., the presence of gullies or exposed rock), difficulty of road access, soil stability, elevation and timber quality. Operability can change over time as a function of changing harvesting technology and economics.
Integrated resource management (IRM)	The identification and consideration of all resource values, including social, economic and environmental needs, in resource planning and decision-making.
Landscape-level biodiversity	The *Landscape Unit Planning Guide* provides objectives for maintaining biodiversity at both the landscape level and the stand level. At the landscape level, guidelines are provided for the maintenance of seral stage distribution, patch size distribution and landscape connectivity.
Landscape unit	A planning area based on topographic or geographic features, that is appropriately sized (up to 100 000 hectares), and designed for application of landscape-level biodiversity objectives.

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Long-term harvest level

A harvest level that can be maintained indefinitely given a particular forest management regime (which defines the timber harvesting land base, and objectives and guidelines for non-timber values) and estimates of timber growth and yield.

Management assumptions

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

Mature seral

Forest stands with trees between 80 and 120 years old, depending on species, site conditions and biogeoclimatic zone.

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.

Mixed-wood

Forests that have a mix of coniferous and deciduous trees.

Model

An abstraction and simplification of reality constructed to help understand an actual system or problem. Forest managers and planners have made extensive use of models, such as maps, classification systems and yield projections, to help direct management activities.

Natural disturbance type (NDT)

An area that is characterized by a natural disturbance regime, such as wildfires, which affects the natural distribution of seral stages. For example areas subject to less frequent stand-initiating disturbances usually have more older forests.

Non-merchantable forest types

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

Not satisfactorily restocked (NSR) areas

An area not covered by a sufficient number of well-spaced tree stems of desirable species. Stocking standards are set by the B.C. Forest Service. Areas harvested prior to October 1987 and not yet sufficiently stocked according to standards are classified as backlog NSR. Areas harvested or otherwise disturbed since October 1987 are classified as current NSR.

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Old seral	Old seral refers to forests with appropriate old forest characteristics. Ages vary depending on forest type and biogeoclimatic variant.
Operability	Classification of an area considered available 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.
Partial retention VQO	Alterations may be visible but not conspicuous. Up to 15% of the area can be visibly altered by harvesting activity (see **Visual quality objective**).
Partition	A portion of the AAC that is attributable to certain types of timber and/or terrain.
Person-year(s)	One person working the equivalent of one full year, defined as at least 180 days of work. Someone working full-time for 90 days accounts for 0.5 person-years.
Protected area	A designation for areas of land and water set aside to protect natural heritage, cultural heritage or recreational values (may include national park, provincial park, or ecological reserve designations).
Pruning	The manual removal of the lower branches of crop trees to a predetermined height to produce clear, knot-free wood.
Pulpwood agreements	An agreement applying to a fixed geographic area that allows harvesting of timber below sawlog standards if mill residues suitable for the facility under the agreement are not available.
Regeneration delay	The period of time between harvesting and the date at which an area is occupied by a specified minimum number of acceptable well-spaced trees.
Riparian area	Areas of land adjacent to wetlands or bodies of water such as swamps, streams, rivers or lakes.
Riparian habitat	The stream bank and flood plain area adjacent to streams or water bodies.
Scenic area	Any visually sensitive area or scenic landscape identified through a visual landscape inventory or planning process carried out or approved by a district manager.
Selection management	A silvicultural system used to maintain or create areas containing a wide range of tree ages or sizes. The time interval between harvests in such areas is fairly short (usually less than 30 years), and during these harvests either single scattered trees or small groups of trees are removed from across the entire area.

9 Glossary

Sensitivity analysis	A process used to examine how uncertainties about data and management practices could affect timber supply. Inputs to an analysis are changed, and the results are compared to a baseline or base case.
Seral stages	Sequential stages in the development of plant communities that successively occupy a site and replace each other over time.
Site index	A measure of site productivity. The indices are reported as the average height, in metres, that the tallest trees in a stand are expected to achieve at 50 years (age is measured at 1.3 metres above the ground). Site index curves have been developed for British Columbia's major commercial tree species.
Stand-level biodiversity	A stand is a relatively localized and homogeneous land unit that can be managed using a single set of treatments. In stands, objectives for biodiversity are met by maintaining specified stand structure (wildlife trees or patches), vegetation species composition and coarse woody debris levels.
Stocking	The proportion of an area occupied by trees, measured by the degree to which the crowns of adjacent trees touch, and the number of trees per hectare.
Table Interpolation Program for Stand Yields	A B.C. Forest Service computer program used to generate yield projections for managed stands based on interpolating from yield tables of a model (TASS) that simulates the growth of individual trees based on internal growth processes, crown competition, environmental factors and silvicultural practices.
Timber harvesting land base	Crown forest land within the timber supply area where timber harvesting is considered both acceptable and economically feasible, given objectives for all relevant forest values, existing timber quality, market values and applicable technology.
Timber supply	The amount of timber that is forecast to be available for harvesting over a specified time period, under a particular management regime.
Timber supply area (TSA)	An integrated resource management unit established in accordance with *Section 7* of the *Forest Act*.
Tree farm licence (TFL)	Provides rights to harvest timber, and outlines responsibilities for forest management, in a particular area.

9 Glossary

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

Variable Density Yield Prediction model — An empirical yield prediction system supported by the B.C. Forest Service, designed to predict average yields and provide forest inventory updates over large areas (i.e., Timber Supply Areas). It is intended for use in unmanaged natural stands of pure or mixed composition.

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.

Volume estimates (yield projections) — Estimates of yields from forest stands over time. Yield projections can be developed for stand volume, stand diameter or specific products, and for empirical (average stocking), normal (optimal stocking) or managed stands.

Watershed — An area drained by a stream or river. A large watershed may contain several smaller watersheds.

Wildlife tree — A standing live or dead tree with special characteristics that provide valuable habitat for conservation or enhancement of wildlife.

Woodlot licence — An agreement entered into under the *Forest Act*. It allows for small-scale forestry to be practised in a described area (Crown and private) on a sustained yield basis.

Appendix A

Description of Data Inputs and Assumptions for the Timber Supply Analysis

Introduction

In April of 1998 a data package for the 100 Mile House Timber Supply Area timber supply review was released for public review. As a result of public input, a number of data and management assumptions have been revised. This appendix presents the revised data package used to produce the timber supply analysis.

The following tables and commentary outline the methods and inputs used to derive the timber harvesting land base, and to construct the timber supply model for the 100 Mile House TSA timber supply analysis. This information represents current forest management in the area. Current management is defined as the set of land-use decisions and forest and stand management practices currently implemented and enforced. Future forest management objectives that may be intended, but are not currently implemented and enforced are not included in this appendix. The purpose of the timber supply review is to provide information on the effects of current management on both short- and long-term timber supply in each timber supply area in the province. Any changes in forest management objectives and practices, and any improvements to the data will be included in subsequent timber supply analyses.

A.1 Inventory Information

Table A-1. Forest inventory information

Data	Source	Vintage	Update	Scale
Standard				
Forest District/Timber Supply Area	MoF		1997	1:15 840
Forest cover mapsheet numbers 93 A 003	MoF	1972	1993	1:20 000
92 I 091 ,092, 093, 094, 095, 096 92 O 010, 020, 92 P 099, 93 A 014	MoF	1972, 1973, 1976	1994	1:20 000
92 O 030, 040, 050 92 P 001, 002, 006, 011, 012, 013, 014, 017, 018, 021, 022, 023, 024, 028, 038, 048, 061, 062, 063, 064, 072, 073, 074, 075, 076, 077, 078, 082, 083, 084, 085, 086, 087, 088, 092, 093, 094, 095, 096, 097, 098 93 A 004, 005, 006, 007, 008, 009, 015, 016, 017, 018, 019	MoF	1972, 1973, 1976	1995	1:20 000
92 O 029, 039, 049, 059, 060, 070 92 P 003, 005, 015, 016, 025, 026, 027, 035, 036, 037, 045, 046, 047, 055, 056, 057, 058, 065, 066, 067, 068, 071, 081, 091	MoF	1972, 1973, 1976	1996	1:20 000
92 P 004, 031, 032, 033, 034, 041, 042, 043, 044, 051, 052, 053, 054	MoF	1972, 1973, 1976	1997	1:20 000
Non-standard				
Resource management zones Cariboo Chilcotin Land Use Plan (CCLUP)	LUCO	1995		1:250 000
Parks (from CCLUP)	LUCO	1995		1:20 000
Caribou habitat	MELP	1985		1: 50 000
Road atlas	MoF	1997		1: 20 000
Mule deer winter ranges	MELP	1989		1: 20 000
Clinton Creek watershed	CCLUP	1995		1:250 000
Class A lakes	MoF	1997		1: 20 000
Draft landscape units	MoF	1997		1: 20 000
Biogeoclimatic zones	MoF	1996		1: 20 000
Draft scenic areas	MoF	1996		1: 50 000
Operability classes	MoF	1995-1996		1: 30 000

MoF = Ministry of Forests;

MELP = Ministry of Environment, Lands and Parks;

LUCO = Land Use Coordination Office.

A.1 Inventory Information

Data source and comments:

Forest cover inventory

The forest cover inventory maps have been updated to the dates shown above and have all been projected to 1998. Some irregularities have been found in map labels of leading-deciduous species. The original classification was essentially correct, however in some cases the stands, through ecological succession, have become conifer dominated. For this analysis the classification and updates, as shown in the inventory file, will be used.

Resource management zones (CCLUP)

The Cariboo-Chilcotin Land Use Plan (CCLUP) zones define the overall management strategies that are to be followed. While there are no specific constraints applied to the CCLUP zones they are incorporated into the analysis for reporting purposes.

Additional resource inventory information

The additional inventory information listed above defines the location of other resources to be managed over the landscape. The mule deer winter ranges, eastern caribou habitat, operability classes and refinements to biogeoclimatic zones were all developed over the last 10-15 years from various data sources by the Ministry of Environment, Lands and Parks (MELP) and the Ministry of Forests (MoF). The wildlife management zones will be used to constrain forest management activities within defined areas.

The visual quality objectives (VQOs) are applied to the draft scenic areas, which were compiled as part of *FPC* implementation. Class A lakes and the Clinton Creek watershed information are a result of local resource use plan (LRUP) processes. The Clinton Creek watershed has been designated a community watershed under the *FPC*. Operability data were a result of an in-district study conducted in 1995.

A.2 Zone and Analysis Unit Definition

A.2.1 Management zones (groups)

Management zones represent areas with distinct management emphasis. For example, a zone may be based on a harvesting system, silviculture system, visual quality objective or wildlife consideration. Some areas may be subject to more than one management objective. Grouping enables the analyst to apply overlapping constraints to such areas.

Table A-2. provides general descriptions of the management objectives and related information to be tracked in the analysis. The non-contributing forest (i.e., forested land not available for timber harvesting) is included for consideration in attaining forest cover objectives for landscape-level biodiversity, community watersheds, visual quality objectives and caribou habitat. Further information on the forest cover requirements to be applied to these areas can be found in Section A.4.10, "Forest cover requirements."

Table A-2. Objectives to be tracked

Zone/group	Management issue
Landscape units	There are 24 draft landscape units modelled in this analysis. This group is used to model draft biodiversity emphasis options and to apply other forest cover constraints.
CCLUP resource management zones: Integrated resource management Enhanced resource development Special resource development	For reporting purposes only.
Mule deer winter range	Modified harvesting practices to manage for mule deer winter ranges.
Caribou habitat	Modified harvesting practices to manage for caribou habitat.
Visual quality objectives	Limits are placed on the amount of forest that can be disturbed in an area managed for visual quality.
Clinton community watershed	Community watersheds are subject to maximum disturbance limits that are applied to the Crown forest area within each watershed.
Selection harvesting	Modelling the selection silviculture system use in the TSA.
Pulpwood agreement #16 supply	This group was created to track the harvest contribution from these stand types.
Multiple use zone	This zone covers areas in the timber harvesting land base not in any other zone. A 3-metre green-up requirement is applied to limit the rate of harvest of this zone in each landscape unit.

Data source and comments:

See Section A.1, "Inventory information," for the sources of the management zone information mentioned above.

A.2 Zone and Analysis Unit Definition

A.2.2 Analysis unit characteristics

An analysis unit represents forest stands with similar tree species (as indicated by the inventory type group), similar timber growing capability (as indicated by the site index in the forest inventory file) and similar management regimes. Each analysis unit was assigned its own timber volume projection (growth curve).

Yield tables for existing natural stands were derived using the variable density yield prediction (VDYP) yield model. Yield tables for recent plantations and future stands were derived using the table interpolation program for stand yields (TIPSY).

A.2 Zone and Analysis Unit Definition

Table A-3a. Definition of pulpwood agreement 16 analysis units

Analysis unit #	Inventory type group	Site index	Old site class	Age (years)	Stocking class	Height class	PSYU	Per cent (%) area available	Area (hectares)
21	1-26, 32	< = 7.6	Low				141, 142 159, 261	100	12 003
22	27-31	< = 7.6	Low				141, 142 159, 261	100	21 286
23	35-36, 40, 41-42	< = 7.6	Low				141, 142 159, 261	100	815
24	35-36, 40, 41, 42	> 7.6	Good, medium, poor				141, 142 159, 261	100	37 880
25	1-8, 32	> 7.6	Good, medium, poor	GT 120			142	3	
25	1-8, 32	> 7.6	Poor		2	LE 2	159, 261	85 50	
25	9-17	> 7.6	Good, medium, poor	GT 110			TSB, 23H, 23G & PSYU 159	20	
	9-17	> 7.6	Good, medium, poor	LE 110			TSB, 23H, 23G& PSYU 159	50	
	9-17	> 7.6	Poor			LE 2	159, 261	85, 50	
25	18-26	> 7.6	Good, medium, poor	LE 110			TSB, 23H23G& PSYU 159	10	
25	18-26	> 7.6	Good, medium, poor	GT 110		LE 2	141	60	7 694
	18-26	> 7.6	Poor		2	LE 2	159, 261	85, 50	
26	28-31	> 7.6	Good, medium, poor	GT 80		LE 2	141	10	
26	28-31	> 7.6	Good, medium, poor		4		142	95	
26	28-31	> 7.6	Good, medium, poor	GT 80		LE 2	142	10	
26	28-31	> 7.6	Good, medium, poor	LE 90			TSB, 23D, 23F	5	
26	28-31	> 7.6	Good, medium, poor	LE 100			TSB 23E	10	
26	28-31	> 7.6	Poor		2	LE 2	159, 261	85, 50	
26	28-31	> 7.6	Good, medium, poor		3		159, 261	60, 10	
26	28-31	> 7.6	Good, medium, poor		4		159, 261	90	13 478

A.2 Zone and Analysis Unit Definition

Table A-3b. Definition of non-pulpwood agreement 16 analysis units

Analysis unit	Analysis unit #	Area (hectares)	Inventory type groups	Site index range
Douglas-fir (poor, even-aged)	2	5 308	1–8, 33, 34	=> 7.6 < = 13.5
Douglas-fir (good/medium, even-aged)	3	18 333	1–8, 33, 34	> 13.5
Cedar, hemlock (poor)	4	654	9–17	=> 7.6 – < = 13.0
Cedar, hemlock (good/medium)	5	1 196	9–17	> 13.0
Spruce, balsam (poor)	6	19 135	18–26	=> 7.6 – < = 13.0
Spruce, balsam (good/medium)	7	37 372	18–26	> 13.0
Lodgepole pine (poor)	8	72 402	28–31	=> 8.0 – < = 12.5
Lodgepole pine (good/medium)	9	215 112	28–31	> 12.5
Dry-belt fir, selection (IDF and SBPS)	10	106 799	1–8	=> 7.6
Mule deer selection (> = 40% fir) low crown closure class	11	15 785	1–34	=> 7.6 – <= 12.0
Mule deer selection (> = 40% fir) moderate and high crown closure classes	13	24 611	1–34	> 12.0
Mule deer even-aged (< 40% fir)	12	31 667	1–34	=> 7.6
Eastern caribou, modified harvest arboreal	31	609	See footnote	=> 7.6

Note: Caribou modified harvest area is defined by mapsheet number 93A 008; landscape units — Deception Mountain and Spanish; biogeoclimatic ESSFwk1; and LUP number E-8.

A.2 Zone and Analysis Unit Definition

Table A-3c. Existing managed analysis units

Analysis unit	#	Area (hectares)	Inventory type groups	Site index range
Fd (poor, non-selection)	102	161	1-8, 33, 34	> 7.6 < = 13.5
Douglas-fir (good/medium, non-selection)	103	2 371	1-8, 33, 34	> 13.5
Cw, Hw (poor)	104	213	9-17	> 7.6 – < = 13.0
Cw, Hw (good/medium)	105	478	9-7	> 13.0
Sx, Ba (poor)	106	654	18-26	> 7.6 – < = 13.0
Sx, Ba (good/medium)	107	5 075	18-26	> 13.0
Pl (poor)	108	29 199	28-31	> 8.0 – < = 12.5
Pl (good/medium)	109	47 178	28-31	> 12.5
Mule deer even-aged (< 40% fir)	112	3 562	1-34	= > 7.6

Data source and comments:

See Section A.4.7, "Existing managed stands," for the age criteria of the stands mentioned above.

A.3 Definition of the Timber Harvesting Land Base

A.3.1 Existing classified roads

Data on existing classified roads was provided as a separate layer in the geographic information system. All land included in this layer were removed from the productive forest area.

A.3.2 Land not managed by the B.C. Forest Service

The total land base is stratified into various ownership codes. Land must be British Columbia Crown land under provincial administration for it to contribute to the land base used to determine timber supply. However, even some areas under provincial administration, such as woodlot licences, do not contribute to timber supply in this analysis. The following ownership types within the district were not considered to contribute to the timber harvesting land base or other forest management objectives in the TSA, and were excluded from the land base modelled in the analysis:

Table A-4. Ownership categories that do not contribute to the timber harvesting land base or other forest management objectives in the 100 Mile House TSA

Ownership code	Definition
40N	Private Crown grant
50N	Federal reserve
52N	Indian reserve
77N	Woodlot licence
99N	Small leases

Woodlot licences are managed for timber production but are administered separately from the TSA. While the Minister of Forests initially apportions a part of the TSA AAC to woodlots, once an AAC is allocated to a specific woodlot licence, the area and the associated AAC are no longer administered as part of the TSA. Consequently, allocated woodlots do not contribute to the TSA timber harvesting land base.

Using ownership code '77N' to identify these areas, 17 938 hectares of woodlot licences have been excluded from the timber harvesting land base. The AAC attributable to these areas is not included in the assessment of the current AAC for the 100 Mile House TSA. At the time this timber supply analysis was undertaken, the total volume allocated to woodlot licences was 26 400 cubic metres per year. This woodlot licence volume has been deducted from the total AAC of the 100 Mile House TSA, resulting in the current AAC volume used in the analysis.

Land under provincial Crown administration may contribute to forest management objectives even if it is not available for timber harvesting. For example, provincial park land provides old-growth to help achieve biodiversity objectives. Areas with the following ownership codes do not contribute to timber supply in the analysis, but are considered in the assessment of forest cover requirements.

A.3 Definition of the Timber Harvesting Land Base

Table A-5. Ownership categories that are excluded from the timber harvesting land base but contribute to other forest management objectives

Ownership code	Definition
60N	Crown / ecological reserves
61C, 61N	UREP (use, recreation, enjoyment of the public)
99C	Miscellaneous leases
63N	Class A parks
67N	Provincial parks, park equivalents, or reserves

Of the provincial Crown ownership codes occurring within the 100 Mile House TSA, only the following are considered to contribute to timber supply for harvest forecast and AAC determination purposes.

Table A-6. Ownership categories that are included in the timber harvesting land base.

Ownership code	Definition
62C	Crown forest management unit
69C	Large Crown reserves

A.3.3 Land classified as non-forest or non-productive forest

Alpine, lakes, rock, etc., represented by inventory type identities 6 and 8, were excluded from the timber harvesting land base.

A.3.4 Non-commercial cover

Inventory type identity 5 represents areas currently occupied by non-commercial brush species. These areas are considered unlikely sites for timber production and were excluded from the area available for timber harvesting.

A.3.5 Environmentally sensitive areas (ESAs)

Some forest lands are environmentally sensitive and/or significantly valuable for other resources. These areas are identified and delineated during a forest inventory and are called environmentally sensitive areas (ESAs). Table A-7. lists the types of ESAs where the area was removed from the timber harvesting land base.

Table A-7. Environmentally sensitive areas considered unavailable for harvesting

ESA category	ESA description	Per cent (%) reduced
Es1	Highly sensitive soils	100
Ep1	High concern for regeneration problem	100
Ea1	High avalanche hazard	100

A.3 Definition of the Timber Harvesting Land Base

A.3.6 Inoperable areas

Operability codes are generally used to classify areas based on physical or economic considerations that affect the ability to harvest stands. Operability can change over time with new harvesting technologies and changing economies. All areas described as inoperable were excluded from the timber harvesting land base.

Table A-8. Description of operability classes

Operability class	Reduction per cent (%)
Class 1 — slope < = 50%	0
Class 2 — slope > 50% < = 70% (cable yarding)	50
Class 3 — slope > 70% inoperable	100
Class 4 — Ministry of Forests defined areas (heli-logging)	50
Class 5 — no potential for producing forest crops	100

A.3.7 Unclassified roads, trails and landings

Separate estimates are made to reflect the loss in productive forest land due to existing and future roads, trails and landings (RTL). Existing RTL estimates are applied as reductions to the current productive forest considered available for harvesting and future RTL reductions are applied after stands are harvested for the first time in the simulation model. Estimates are applied as the percentages of area to be removed from specified age classes and account only for the area that will be permanently removed from the timber harvesting land base.

Table A-9. Estimates for existing and future roads, trails, and landings

Location	Age class	Reduction area (hectares or per cent %)
Existing classified roads		Non-standard GIS layer (road atlas information)
Existing unclassified roads, trails and landings	< age class 3	2.5% of timber harvesting land base
Future roads, trails and landings	> age class 3	3.8% of timber harvesting land base

Data source and comments:

The current on-block area lost to RTLs was assessed using the most current data from post-harvest reports in the integrated silviculture information system (ISIS) and major licensee silviculture information system (MLSIS) databases. The data examined covered the period from 1988 to 1997, for all biogeoclimatic zones. These systems reported that RTLs occupy 3.8% of the on-block area in the 100 Mile House Forest District based on actual performance over the 8-year period. This figure was reduced to 2.5% to account for the overlap with existing classified roads already removed from the timber harvesting land base. For future roads, the figure (3.8%) was unchanged since it was assumed that future road reductions would be similar to the recent past.

A.3.8 Lake buffers

When this data was assembled in 1997, eight Class-A lakes were identified on the forest inventory files. A no-harvest zone of 200 metres was removed from the land base to approximate the reserves to be established on the ground. This information is available on a non-standard geographic information system (GIS) layer.

A.3 Definition of the Timber Harvesting Land Base

A.3.9 Riparian reserves and management zones

A 1997 GIS study of twelve randomly chosen mapsheets in the 100 Mile House TSA classified streams and assigned riparian reserve and riparian management zones according to the *Forest Practices Code Riparian Management Area Guidebook*. This study showed the following proportion of the timber harvesting land base occupied by riparian areas:

riparian reserve zones (RRZ)	1.3%
riparian management zones (RMZ)	7.58%

The timber harvesting land base was reduced by the following amounts:

Table A-10. Estimates for riparian reserve zones and management zones

Area	Per cent (%) reduction
Riparian reserve zones	1.3
Riparian management zones	5.39
Total	6.69

Data source and comments:

The 5.39% reduction for the riparian management zones is made up of two parts:
first, 3.2% of the 7.58% of riparian management zones are managed at 100% retention; and second, the remaining 4.38% is managed at 50% retention resulting in a 2.19% reduction, for a total of 5.39%.

A.3.10 Caribou habitat

The CCLUP provided direction for management of mountain caribou habitat for two distinct herds known as the Eastern and Itcha-Ilgachuz herds. Detail is provided under option A of the *CCLUP Caribou Management Strategy Report* and in the *CCLUP Integration Report*.

The *1998 Caribou Strategy Update* revised the modified harvest and no harvest areas that will be specifically managed for caribou. The linework of the *1998 Caribou Strategy Update* is considered during operational planning decisions and is modelled as current management. All areas identified as "no harvest" were removed from the timber harvesting land base. See footnote at Table A-3b. for a description of areas under modified harvest.

A.3.11 Stand-level biodiversity reductions

Wildlife tree patches are retained on cutblocks within the 100 Mile House TSA to provide for the maintenance of stand structure over time. Studies conducted by 100 Mile House Forest District staff showed that 6% of the forested area in each landscape unit was removed to account for wildlife tree patches in the TSA. To account for wildlife trees retained on cutblocks, the yield curves of all the even-aged analysis units were reduced by a further 6.3% during the analysis.

A.3.12 Sites with low timber growing potential

Sites may have low timber growing potential either because of inherent site factors (nutrient availability, exposure, excessive moisture, etc.) or they are not fully occupied by commercial tree species. The stands excluded from the timber harvesting land base due to low timber growing potential did not fit the criteria for any of the analysis units described in Tables A-3a. and A-3b. The average site index for the 8507 hectares in this category was 5.8 metres at a breast-height age of 50 years.

As well, all yellow pine-leading stands (453 hectares) were removed from the timber harvesting land base since this species has not been harvested in the past.

A.4 Forest Management Assumptions

A.4.1 Utilization levels

Timber utilization levels define the maximum stump height, minimum top diameter inside bark (dib) and minimum diameter at breast height (dbh) by species and are used in the analysis to calculate merchantable volume. Table A-11. shows the standards and licence requirements currently in place for wood utilization in the 100 Mile House TSA.

Table A-11. Utilization levels

Analysis unit	Utilization		
	Minimum dbh (cm)	Maximum stump height (cm)	Minimum top dib (cm)
Pine leading	12.5	30	10
All other species	17.5	30	10
Pulpwood agreement 16 types	12.5	30	8

A.4.2 Volume exclusions for mixed species stands

All deciduous species were excluded from the estimation of volume in coniferous-leading mixed species stands for analysis units 2 to 10. These deductions do not apply to pulpwood agreement 16 analysis units.

A.4.3 Minimum harvestable ages

Minimum harvestable ages provide an estimate of the minimum age a stand must reach before it can be harvested. They define the lower limit for harvesting. Harvesting may occur in stands at the minimum requirements (for example, to maintain harvest levels for a short period of time or avoid large disruptions in harvest levels). However, most stands will not be harvested until well past the minimum timber production ages because management objectives for other resource values take precedence (e.g., requirements for the retention of older forest).

For this analysis, stands were considered merchantable at the earlier of the age when they attained a volume of 65 cubic metres per hectare or 80 years for pine-leading stands and 120 years for all other stands. These criteria applied only to the stands managed under the even-aged system. Table A-12. shows the minimum harvestable ages as well as the culmination ages for the even-aged analysis units used in this TSA. The volume reduction factors shown in Table A-12. means that the volume numbers shown in Tables A-19., A-20. and A-22. were multiplied by the reduction factors (to account for wildlife trees) when projecting volume growth in this analysis.

A.4 Forest Management Assumptions

Table A-12. Minimum harvestable ages

Analysis unit	Minimum harvestable age (years)	Culmination age (years)	Volume reduction factor
Existing even-aged stands			
2	90	150	0.937
3	50	110	0.937
4	90	100	0.937
5	55	90	0.937
6	85	180	0.937
7	53	110	0.937
8	75	130	0.937
9	45	100	0.937
12	60	130	0.937
21	120	120	0.937
22	120	120	0.937
23	120	120	0.937
24	60	100	0.937
25	60	150	0.937
26	65	100	0.937
Regeneration even-aged stands			
102	120	160	0.937
103	58	130	0.937
104	70	140	0.937
105	44	90	0.937
106	93	170	0.937
107	58	110	0.937
108	71	120	0.937
109	40	80	0.937
112	75	150	0.937
121	120	120	0.937
122	120	120	0.937
123	120	120	0.937
124	55	100	0.937
125	63	150	0.937
126	55	100	0.937

A.4 Forest Management Assumptions

A.4.4 Harvest scheduling priorities

For the 100 Mile House TSA base case, the Forest Service Simulator (FSSIM) timber supply model selected stands to harvest based on "relative oldest first" (highest priority given to stands that are furthest above their respective minimum harvestable age).

In addition to prioritizing generally older stands, there is also a high priority to harvest pulpwood stands during the first 20 years in the analysis. This priority has been established to ensure that the full amount of the partition is harvested at the start of the planning horizon when the age of these stands makes them less likely candidates for harvesting under the relative oldest first harvest priority.

A high priority was also given to stands managed under the selection harvesting system to ensure that the management prescription for these stands was followed.

A.4.5 Unsalvaged losses

Table A-13. provides an estimate of average annual volume of timber on the timber harvesting land base that is damaged or killed and **not** salvaged. The unsalvaged losses are deducted from all harvest forecasts shown in the timber supply analysis. The purpose of the unsalvaged losses estimate is to account for catastrophic events and other factors not recognized in yield estimates.

Table A-13. Unsalvaged losses

Cause of loss	Annual unsalvaged loss (m^3/year)
Fire	1 370
Insects	11 170
Wind	21 830
Total loss	**34 370**

Data source and comments:

Information regarding unsalvaged losses was collected from 100 Mile House Forest District staff, licensees, the fire protection reporting system, major licensee silviculture information system (MLSIS) / integrated silviculture information system (ISIS) (harvesting databases), annual reports, and Forest Insect Disease Survey (FIDS) reports. This information was modified using professional judgment to produce the data in Table A-13. A permanent database has been constructed to update unsalvaged losses on an annual basis and to provide more accurate results for preparing future timber supply review data packages.

A.4.6 Basic silviculture and regeneration assumptions

The silviculture program guides the mix of treatments to be carried out in the 100 Mile House TSA. It is assumed that basic silviculture is undertaken on all sites, plus incremental silviculture on some sites. Table A-14. shows the proportion of each analysis unit to be treated under each silviculture regime and the expected average regeneration delay.

All existing stands older than 40 years and 75% of existing stands between 31 and 40 years old were assigned to VDYP curves initially, then assigned to TIPSY managed stand yield curves following their first harvest in the simulation. For example, a stand currently in AU 9 would regenerate to AU 109 following harvest, as indicated in Table A-14.

A.4 Forest Management Assumptions

Table A-14. Regeneration assumptions by analysis unit

Source analysis units	Regenerated analysis unit	Regen delay (years)	Regen method	Per cent (%)	Species	Species per cent (%)	Density initial
21	121	5	Natural	100	Fdi Ba Sx	40 20 40	4500
22	122	5	Natural Plant	90 10	Pli	100	4500
23	123	3	Natural	100	Cot A	50 50	6000
24	124	3	Natural	100	Cot A	50 50	6000
25	125	5	Natural	100	Fdi Ba Sx	40 20 40	4500
26	126	5	Natural Plant	90 10	Pli	100	4500
2, 102	102	3	Plant	100	Fdi	100	4800
3, 103	103	3	Plant	100	Fdi	100	4800
4, 104	104	3	Plant Natural	90 10	Pli Fdi Sx Hw	50 15 25 10	4500
5, 105	105	3	Plant Natural	90 10	Pli Fdi Sx Hw	50 15 25 10	4500
6, 106	106	3	Plant	100	Sx	100	4000
7, 107	107	3	Plant	100	Sx	100	4000
8, 108	108	5	Natural Plant	90 10	Pli	100	6000
9, 109	109	5	Natural Plant	90 10	Pli	100	6000
10	100	–	Natural	100	Fdi	100	–
11	111	–	Natural	100	Fdi	100	–
13	113	–	Natural	100	Fdi	100	–
12, 112	112	3	Plant	100	Fdi	100	4500
31	131	–	Natural	100	Sx Ba	50 50	–

A.4 Forest Management Assumptions

Data source and comments:

Regeneration delay reflects current operational practice and is defined as the time after harvest but before planting.

Provincial average operational adjustment factors (OAFs) were applied to the managed stand yield curves as recommended by the Ministry of Forests, Research Branch — since no local factors were available. OAF1 (15%) reflects small stocking gaps in stands, while OAF2 (5%) reflects the estimate for decay, waste and breakage that increases with age, passing through 5% at 100 years of age.

A.4.7 Existing managed stands

Existing managed stands are those areas of immature forest where the density (stems per hectare) was controlled which justifies assigning the stands to managed stand yield tables (MSYT). Table A-15. shows the criteria for the selection of existing managed stands.

Growth in existing managed stands and future stands was projected using the B.C. Forest Service table interpolation program for stand yields (TIPSY) growth and yield model.

Table A-15. Immature forest history

	Area managed (%)	
Analysis unit (AU)	**Age 1-30**	**Age 31-40**
All even-aged AUs	100	25

A.4.8 Not satisfactorily restocked (NSR) areas

Forest district silvicultural records (MLSIS/ISIS) show 7439 hectares of backlog NSR (i.e., harvested prior to 1987) and 28 440 hectares of current NSR.. The forest inventory file indicated that there were 38 152 hectares of NSR. The difference (2273 hectares), was assumed to have already been restocked and assigned an age between one and five years old. Current NSR was assumed to regenerate within the regeneration delays provided in Table A-14. All backlog NSR was assumed to be restocked within 10 years.

NSR is restocked in proportion to the current area of each analysis unit in stands less than 30 years old on the assumption that the overall distribution of harvest within analysis units has not changed significantly over this period of time.

A.4.9 Selection harvesting

Approximately 14% of the volume projected to be harvested in the next decade from the 100 Mile House TSA is through selection harvesting. The goal of the selection harvesting is to create forest stand ages that maintain old-seral characteristics. The stand attributes listed in the *Biodiversity Guidebook* (such as standing dead trees, coarse woody debris, species diversity, and structural diversity) will be maintained after harvesting. The following types of selection harvesting are practiced in the 100 Mile House TSA.

Dry-belt Douglas-fir selection — the management prescription for these fir-leading stands is to remove 50% of the stand volume in the first entry, re-enter the stand every 30 years thereafter and remove only the growth that has occurred during the 30 year interval.

Mule deer winter range, greater than 40% Douglas-fir, low crown closure — the management prescription for these stands is to remove 50% of the stand volume in the first entry, re-enter the stand every 30 years thereafter and remove only the growth that has occurred during the 30 year interval.

Mule deer winter range, greater than 40% Douglas-fir with moderate or high crown closure — the management prescription for these stands is to remove 20% of the stand volume in the first entry, re-enter the stands every 50 years thereafter and remove only 66% of the growth that has occurred during the 50-year interval.

A harvest schedule was also applied to mule deer winter ranges based on the risk rating for each winter range developed in the *Cariboo Regional Mule Deer Winter Range Strategy*.

Caribou modified harvest — in these areas the management prescription is to remove 33% of the stand volume in the first entry, re-enter the stand every 80 years thereafter and remove only 33% of the volume in the stand.

A.4.10 Forest cover requirements

As noted in Section A.2.1, "Management zones (groups)," forest cover requirements were applied to model management for a number of objectives. All forest cover requirements were modelled at the landscape unit level. Where forest cover requirements are expressed using a height criterion, the age at which regenerated stands achieve this height was estimated using *SiteTools batch 2.3*. Then the ages were averaged within the landscape unit used. (For example, the age at which all stands within the Big Bar landscape unit 3 metres was averaged to arrive at the green-up age of 18 years).

A.4.10.1 Forest cover requirements — landscape-level biodiversity

Only the old-seral guidelines were modelled in the base case, consistent with the assumptions used in the February, 1996 *Forest Practices Code Timber Supply Analysis*. As biodiversity-emphases had not yet been approved for landscape units in the 100 Mile House TSA when the timber supply analysis was underway, an average old-seral prescription was applied to all landscape units. This average prescription was calculated assuming a distribution of area between biodiversity-emphases of 45% low-biodiversity, 45% intermediate-biodiversity and 10% high-biodiversity. The per cent area of old-seral forest to be maintained over time under each biodiversity-emphasis is based on values from the *Forest Practices Code Landscape Unit Planning Guide* for each of the biogeoclimatic variants in the 100 Mile House TSA. In addition, old-seral targets for the low emphasis portion of the old-seral constraint have been reduced to one-third the *Planning Guide* value for the first rotation (0 to 70 years), two-thirds of the target for the second rotation (71 to 140 years), and the full target for the remainder of the planning horizon (141 years onward). The final old-seral requirements calculated using this method for each landscape unit/variant combination are shown in Table A-16.

Table A-16. Old seral requirements by natural disturbance type (NDT)

		Old-seral stage across the entire landscape				
		Minimum retention area by decade (%)				
Biogeoclimatic unit	NDT	1	7	14	Minimum age (years)	Application
ESSF	1	14	17	20	250	Forested area
ICH	2	7	8	9	250	Forested area
ESSF	3	11	13	15	140	Forested area
MS	3	11	13	15	140	Forested area
SBPS	3	5	6	7	140	Forested area
SBS	3	8	10	12	140	Forested area
ICH	3	11	13	15	140	Forested area
IDF	4	10	12	14	250	Forested area

A.4 Forest Management Assumptions

A sensitivity analysis was performed to evaluate the impact of applying the full old-seral requirements as outlined in the *Landscape Unit Planning Guide* using the draft biodiversity emphasis options. A second sensitivity analysis was performed to evaluate the impact of applying the old- and the mature-seral requirements using the draft biodiversity emphasis options. Table A-17. shows the draft biodiversity emphasis options (BEOs) for the 100 Mile House TSA.

Table A-17. Draft biodiversity emphases by landscape unit for the 100 Mile House Forest District

Landscape unit	BEC variant	Biodiversity emphasis	Landscape unit	BEC variant	Biodiversity emphasis
108 Mile Lake	All	Intermediate	Deception Mtn.	All	Low
Bridge Creek	All	Low	Dog Creek	All	Intermediate
Big Bar	All	High	Forest Grove	All	High
Bonaparte Lake	All	Low	Green Lake	All	Low
Bradley	All	Low	Helena	All	Low
Bridge Lake	All	Intermediate	Hendrix Lake	All	Intermediate
Canim Lake	All	Low	Kelly Lake	All	Intermediate
Caniimred Creek	All	Low	Loon	All	Intermediate
Chasm	All	Intermediate	Mckinley	All	High
Clinton	All	Intermediate	Meadow Lake	All	Intermediate
Cunningham Lake	All	Intermediate	Murphy Lake	All	Intermediate
Deadman	All	Intermediate	Spanish	All	High

A.4.10.2 Forest cover requirements — resource management zones

The timber supply model used in this analysis (FSSIM Version 3.0) can incorporate forest cover requirements that specify both the maximum proportion of an area allowed in a disturbed condition, and the minimum required area of old-age forest. The forest cover requirements applied in the analysis approximate current forest management practices. The following forest cover requirements were applied to each resource management zone within each landscape unit.

A.4 Forest Management Assumptions

Table A-18. Forest cover requirements for resource management zones

Zone	Height criterion (metres)	Maximum allowable disturbance (% area)	Land base constraints apply to
Multiple use areas	3	35	Timber harvesting land base
Scenic areas (VQO = partial retention)	3	10	Forested area
Clinton Creek community watershed		No more than 1% per year	Timber harvesting land base

Data source and comments:

Since 10-year time steps were used in the model, the community watershed constraint was modified to limit harvest to no more than 10% in 10 years.

A.5 Volume Estimates for Existing Stands

The variable density yield projection (VDYP) model, version 6.5a developed and supported by the B.C. Ministry of Forests, Resources Inventory Branch, was used to estimate timber volumes for existing natural stands. Table A-19. shows the volume estimates by analysis unit for existing natural stands.

The volumes shown in Tables A-19. and A-20. were reduced by a further 6.3% when the timber supply model was run to account for the impact of wildlife trees retained on all cutblocks in the 100 Mile House TSA.

Table A-19. Timber volume tables for existing natural stands — non-PA 16 (cubic metres/hectare)

	Analysis units (existing stands)								
Age	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**12**
10	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
30	0	4	0	0	0	0	0	9	4
40	0	34	0	17	0	16	0	45	21
50	2	73	6	56	1	56	9	85	43
60	15	111	23	93	7	108	33	120	67
70	31	148	41	129	27	156	56	152	90
80	48	183	57	160	52	199	78	180	111
90	65	215	69	180	79	237	99	207	132
100	81	245	78	195	104	271	119	231	151
110	97	272	85	205	128	300	137	253	169
120	111	296	90	211	149	326	155	274	185
130	125	318	99	228	169	350	172	293	201
140	136	337	108	246	187	370	184	307	212
150	147	354	117	263	204	387	194	317	222
160	155	366	125	280	220	401	202	324	230
170	163	381	133	295	234	413	207	329	236
180	169	393	140	310	247	424	209	329	240
190	176	403	148	324	258	433	210	329	243
200	182	413	155	338	269	441	213	331	248
210	188	423	162	352	280	449	216	334	252
220	194	433	170	367	289	457	218	336	257
230	200	442	177	383	298	463	221	339	261
240	206	450	185	398	306	469	223	341	265
250	211	458	193	413	314	475	226	344	269
260	211	458	193	414	319	478	228	346	270
270	212	459	194	415	323	482	229	347	271
280	212	459	194	416	327	485	231	349	272
290	212	460	195	416	330	487	232	351	273
300	212	460	196	417	334	490	234	352	274
310	212	460	196	418	337	492	235	353	274
320	212	460	196	418	339	494	236	354	275
330	212	460	197	419	342	495	236	355	276
340	212	460	197	419	344	497	237	356	276
350	212	460	198	420	346	498	237	357	276

A.5 Volume Estimates for Existing Stands

Table A-20. Timber volume tables for existing natural stands — PA 16 (cubic metres/hectare)

	Analysis units					
Age	**21**	**22**	**23**	**24**	**25**	**26**
10	0	0	0	0	0	0
20	0	0	0	0	0	0
30	0	0	0	4	2	2
40	0	0	0	23	9	15
50	0	0	0	48	33	36
60	0	0	0	76	69	62
70	1	0	0	102	106	86
80	2	3	0	124	140	107
90	5	12	0	143	171	128
100	9	24	1	159	199	147
110	15	36	3	173	223	165
120	22	47	6	184	245	182
130	29	59	8	192	266	197
140	36	69	11	199	285	208
150	42	77	13	205	301	217
160	48	84	14	207	315	223
170	54	90	15	209	328	227
180	60	95	15	210	339	229
190	66	98	15	211	349	229
200	72	101	16	212	358	231
210	77	105	16	214	367	234
220	82	108	17	215	375	235
230	87	111	17	216	383	238
240	92	114	17	217	390	240
250	95	117	17	218	396	242
260	98	119	18	218	400	244
270	99	120	18	219	403	245
280	101	122	18	219	406	247
290	102	123	18	220	409	248
300	103	125	18	220	411	249
310	105	126	18	221	414	350
320	106	127	19	221	416	250
330	107	127	19	221	417	252
340	108	128	19	221	418	252
350	109	128	19	223	420	253

A.5 Volume Estimates for Existing Stands

Table A-21. Timber volume tables for stands harvested by selection methods (cubic metres/hectare)

	Analysis units			
Age	**10**	**11**	**13**	**31**
0	0	0	0	0
10	0	0	0	0
20	0	0	0	0
30	0	0	0	1
40	3	0	11	8
50	10	0	34	23
60	24	5	60	47
70	40	15	85	77
80	56	26	108	35
90	72	38	131	
100	88	49	153	
110	103	60	173	
120	59	35	38	

A.6 Volume Estimates for Regenerated Stands

WinTIPSY (Windows™ version of the Table Interpolation Program for Stand Yields) version 1.4, supported by the B.C. Ministry of Forests, Research Branch, was used to estimate growth and yield for existing and future managed stands. Table A-3c. lists the existing managed stands in this TSA. The area-weighted site index for each analysis unit along with the regeneration assumptions in Table A-14. were used as inputs to TIPSY.

Table A-22. displays the volume tables for managed stands. These volume tables are generated from TIPSY for ages where TIPSY data exists, and estimated for ages beyond the TIPSY data set. Volumes are assumed to remain constant after 300 years of age.

Table A-22. Projected volumes for managed stands (cubic metres/hectare)

	Analysis units								
Age	**104**	**105**	**106**	**107**	**102**	**103**	**108**	**109**	**112**
0	0	0	0	0	0	0	0	0	0
10	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0
30	0	13	0	0	0	0	0	15	0
40	4	55	0	1	0	3	2	68	0
50	15	118	0	22	0	26	15	131	3
60	35	180	0	78	1	75	37	186	17
70	63	234	6	159	4	140	63	229	44
80	95	279	28	226	11	192	89	266	81
90	126	316	59	298	24	238	114	299	123
100	156	345	100	351	41	284	135	321	158
110	184	367	145	392	59	321	153	339	187
120	209	386	183	419	79	357	170	355	214
130	229	401	220	437	100	391	184	368	239
140	249	413	257	455	119	419	196	379	264
150	265	425	295	468	137	446	204	389	284
160	278	434	323	482	151	467	213	398	302
170	291	443	349	489	163	485	221	402	318
180	301	448	367	496	176	504	227	408	333
190	309	454	382	498	186	521	234	411	349
200	318	455	395	496	196	535	239	413	363
210	323	458	404	498	202	550	245	417	374
220	329	465	412	497	210	559	248	420	385
230	337	461	420	497	219	570	251	422	393
240	340	463	426	495	225	579	253	423	402
250	343	461	432	493	233	588	256	425	411
260	343	462	436	492	239	594	258	426	418
270	346	460	442	490	246	599	261	424	424
280	347	460	446	489	250	604	263	418	429
290	347	460	447	485	255	610	264	412	433
300	348	460	447	485	260	615	267	406	438
310	348	460	447	485	260	615	267	406	438
320	348	460	447	485	260	615	267	406	438
330	348	460	447	485	260	615	267	406	438
340	348	460	447	485	260	615	267	406	438
350	348	460	447	485	260	615	267	406	438

(continued)

A.6 Volume Estimates for Regenerated Stands

Table A-22. Projected volumes for managed stands (cubic metres/hectare) (concluded)

	Analysis units					
Age	**121**	**122**	**123**	**124**	**125**	**126**
0	0	0	0	0	0	0
10	0	0	0	0	0	0
20	0	0	0	4	0	0
30	0	0	0	23	0	1
40	0	0	0	48	1	16
50	0	0	0	76	13	49
60	0	0	0	102	44	91
70	0	1	0	124	91	127
80	0	2	0	143	139	160
90	0	4	1	169	189	188
100	1	10	3	173	231	210
110	1	14	5	184	269	229
120	2	20	8	192	304	245
130	3	27	11	199	335	260
140	6	34	13	205	363	273
150	8	41	14	207	389	284
160	11	47	15	209	409	294
170	14	52	15	210	425	302
180	16	59	15	211	441	304
190	21	66	16	212	456	310
200	25	70	16	214	470	314
210	29	70	17	215	482	317
220	31	80	17	216	494	321
230	35	84	17	217	503	323
240	39	88	17	218	513	325
250	42	91	18	218	524	329
260	44	93	18	219	529	329
270	48	97	18	219	539	329
280	51	99	18	220	540	327
290	53	101	18	220	547	322
300	54	104	18	221	549	320
310	54	104	19	221	549	320
320	54	104	19	221	549	320
330	54	104	19	221	549	320
340	54	104	19	221	549	320
350	54	104	19	221	549	320

Appendix B

Socio-Economic Analysis Background Information

B.1 Limitations of Economic Analysis

The socio-economic analysis portion of this report identifies employment and income impacts, changes in government revenues and community impacts as a result of changes in the TSA's harvest levels over time. Some of the assumptions used in this report are as follows:

- **Employment multiplier** — employment multipliers are used to estimate indirect and induced employment impacts of a change in direct industry activity. The calculation of employment multipliers is based on analytical assumptions and data collected at a specific time period. The multipliers reflect industry and employment conditions at that time and may not accurately reflect industry and employment conditions in the future.
- **Employment coefficient** — employment coefficients are ratios of person-years of employment per 1000 cubic metres of timber harvested. These ratios are used to estimate employment levels associated with alternative harvest rates. This method of analysis assumes that the industry structure will be the same in the future as it is today. While reasonably accurate in the short term, employment coefficients may change in the future due to changes in market conditions, product mix or production technologies.
- **Timing of impacts —** employment impacts are shown to occur simultaneously with a change in the harvest level. While this assumption is reasonably accurate for the harvesting sub-sector, employment estimates for the silviculture and timber processing sub-sectors may not be as coincidental. As well, indirect and induced impacts tend to occur over a longer period, as levels of business and consumer spending adjust to changes in harvest levels.
- **Operating thresholds of mills** — it is unlikely that impacts on timber processing employment due to changes in harvest levels will be in direct proportion to the harvest changes (i.e., a 10% change in harvest may not lead to a 10% change in timber processing employment). Impacts on timber processing employment are more likely to occur step-wise related to operating thresholds of mills. For example, if a mill's timber supply is reduced, its operating threshold is reached when the decrease in timber supply causes it to lay off a shift of workers or to close the mill, either temporarily or permanently. Conversely, if the timber supply to the mill is increased, a processing threshold is reached when the mill has to decide whether to add another shift of workers or new capacity to process the increase in timber supply. In both cases, the percentage change in employment in the mill would probably differ from the percentage change in the timber processed. Because mills have many different operating configurations, accurately predicting an individual mill's operating threshold is impossible. As a result, impact figures pertaining to employment in timber processing are best interpreted as size of change rather than as precise changes in employment levels.
- **Government expenditures** — provincial government expenditures are more related to government policy and population levels than to industry activity. As such, expenditures on education, health care and other government services are assumed to remain unchanged despite changes to the harvest level and subsequent changes in government revenues from the forestry sector. However, provincial government expenditures would likely change if a community's population significantly changes. This would amplify the community impacts of losses or gains in forestry sector jobs.
- **Proportional harvest reductions** — harvest reductions are assumed to be proportionately distributed among all licensees and all forms of tenure within the TSA.

B.2 Economic Impact Analysis Methodology

Data sources

Data for the socio-economic analysis were obtained from several sources. Harvest volume and stumpage data are from the Ministry of Forests. Timber flow and employment data are from responses to questionnaires that were sent to licensees, operators and processing facilities in the TSA. Other general economic data are from B.C. STATS, the Ministry of Finance, Statistics Canada and local communities. Estimates of taxes paid by the forest industry are from PricewaterhouseCoopers.

Person-year of employment

The unit of measurement for employment is a person-year. A person-year of employment is defined as a full-time job, which lasts at least 180 days per year. Part-time jobs were converted to equivalent full-time person-years of employment.

To estimate employment and income impacts associated with changes in TSA timber harvest levels, the forestry sector was divided into three sub-sectors:

1. harvesting;
2. silviculture; and
3. timber processing.

Employment and income impacts were estimated in several steps. The first step was to assess current activity in each of the three sub-sectors. Then, indirect and induced employment and employment income impacts were estimated, using data from Ministry of Finance and Corporate Relations (1996) and Statistics Canada. Next, employment coefficients were calculated and then applied to the base case harvest forecast. Other indicators of the forestry sector's contribution to the provincial economy, such as government revenues and industry taxes were also calculated, using Ministry of Forests stumpage estimates and other data sources.

Employment —harvesting

Direct employment in harvesting consists of all woodlands-related jobs including harvesting, log salvage, planning and administration functions and log transportation. The employment multipliers used in this analysis define activities such as road building or maintenance work as indirect employment rather than direct employment because the forestry sector and other basic sectors purchase these services.

Data on employment, place of residence and timber flows were obtained from responses to questionnaires that were sent to licensees and operators in the TSA. The information was then used to estimate employment averages associated with harvest changes and the proportion of residents *versus* non-residents who work in the TSA.

Two estimates of direct employment in harvesting were calculated:

1. TSA direct employment in harvesting consists of employees who are engaged in harvesting and related activities within the TSA and who reside in communities within the TSA; and
2. Provincial direct employment in harvesting consists of employees who are engaged in harvesting, as above, plus those workers who reside outside the TSA, but who come to the TSA to work in harvesting and harvesting-related activities.

The estimates of TSA and provincial direct employment in harvesting were used to calculate employment coefficients per 1000 cubic metres. These employment coefficients were then used to estimate harvesting employment associated with the different harvest levels in the base case forecast.

Employment — silviculture

Silviculture employment consists of all basic and intensive reforestation activities, including surveys, site preparation, planting, fertilization, pruning and spacing. Silviculture employment data were collected from the Ministry of Forests and licensees whose tenures require post-harvest silviculture work. Most silviculture work is seasonal and silviculture employees usually only work part-time during the year. Because of this, information on silviculture employment was converted into equivalent full-time person-years of employment. Respondents were also asked to estimate the percentage of their silviculture employees who resided within the TSA and outside the TSA.

As with the harvesting sub-sector, two estimates of direct employment in silviculture were calculated: one for the TSA and another for the province. These employment figures were used to calculate employment coefficients for silviculture employment in the same manner as the employment coefficients for harvest employment.

Employment — timber processing

Information about employment, production and sources of timber was gathered from mills. Information was also gathered as to whether timber harvested from the TSA was processed within the TSA or outside the TSA. This information indicates the degree of dependence the mills have on timber harvested within the TSA. To estimate the share of processing employment supported by TSA timber, mill employment was prorated by the relative contribution of timber from the TSA to a mill's total timber requirement. For example, if 80% of a plant's timber supply is harvested from the TSA, then 80% of the employment in the plant would be attributable to the TSA harvest. Employment figures were also adjusted to reflect the residences of workers (i.e., those who lived within the TSA and those who lived outside the TSA). Employment in timber processing that is supported by chip by-products from milling operations was also similarly estimated.

As with the harvesting sub-sector, two estimates of direct employment in timber processing were calculated: one for the TSA and another for the province. These employment figures were used to calculate employment coefficients for timber processing employment in the same manner as the employment coefficients for harvest employment.

Indirect and induced employment estimates

Indirect employment in the forestry sector refers to those who provide goods and services to firms directly engaged in the basic forestry sector (for example, those who build or maintain road for log transport). Induced employment refers to those who provide the goods and services purchased by employees who are directly and indirectly engaged in the industry (for example, those who work in retail outlets). Indirect and induced employment figures were calculated using TSA and provincial employment multipliers developed by the Ministry of Finance.

Two sets of employment multipliers were calculated for this report: a migration multiplier and a no-migration multiplier. The migration multipliers assume that displaced workers will leave the region, reducing total income in the region by their full wage. The no-migration multipliers assume that displaced workers remain in the area, at least in the short term, and unemployment and other social safety net payments temporarily offset some of the income loss. Using the no-migration multipliers diminishes the degree of induced impacts associated with a change in direct employment.

B.2 Economic Impact Analysis Methodology

The TSA and provincial employment multipliers used in the 100 Mile House TSA analysis are shown in Table B-1.

Table B-1. Employment multipliers — 100 Mile House TSA

Forestry sub-sector	100 Mile House TSA migration multiplier	100 Mile House TSA no-migration multiplier	Provincial (interior) migration multiplier	Provincial (interior) no-migration multiplier
Harvesting	1.52	1.34	2.14	1.80
Solid wood processing	1.55	1.35	2.29	1.93
Plywood	1.55	1.35	1.93	1.64
Pulp	2.09	1.77	3.02	2.48

Sources: Ministry of Finance and Corporate Relations. 1999. The 1996 forest district tables.

Ministry of Finance and Corporate Relations. 1996. A provincial impact estimation procedure for the British Columbia forestry sector.

Estimates of employment income

Employment income was calculated using average income estimates for workers in the forest industry. Based on Statistics Canada data, the weighted average annual pre-tax income (less benefits) for forestry sector workers in 1999 was:

$46,956 for those working in logging and forestry services;

$44,980 for those working in solid wood manufacturing; and

$58,136 for those working in pulp and paper mills.

Those in indirect and induced occupations earned approximately $30,732. Income taxes were calculated based on marginal tax rates of 23–28% with one-third of the total income tax paid accruing to the province.

Employment estimates of alternate timber supply levels

To estimate employment generated by alternative timber supplies, the forecast harvest level is multiplied by the calculated employment coefficients. Note that employment coefficients are based on current industry productivity, harvest practices and forest management assumptions and will not likely reflect industry operating conditions in future years. Therefore, the employment estimates should be viewed as indicators of size of change rather than as precise estimates of changes in employment levels.

B.2 Economic Impact Analysis Methodology

Provincial government revenues

Except for stumpage, royalty and rents, which are specific to the TSA, provincial government revenue impacts were estimated by using industry averages. Revenues per 1000 cubic metres of harvest, expressed as dollars per 1000 cubic metres, were calculated and applied to the harvest levels in the base case forecast in a manner similar to how employment impacts were estimated (Table B-2).

Table B-2. Estimates of provincial government revenues — 100 Mile House TSA

	Average annual revenue 1997-1999 ($ millions)	Revenue ($/'000s m^3)
Stumpage and related payments[a]	38.87	29,962
Forest industry taxes[b]	10.03	7,732
Employee income tax[c]	8.06	6,213
Total	56.96	43,907

Estimates are based on the 1997-1999 average annual harvest volume of 1 297 290 cubic metres.

(a) Source: Ministry of Forests, Revenue Branch.

(b) Based on estimates by PricewaterhouseCoopers. Includes taxes for logging, corporate income, corporate capital, sales, property and electricity.

(c) Estimated from Revenue Canada income tax rates and includes only the provincial share of income taxes paid.