FOREST ANALYSIS BRANCH

Strathcona Timber Supply Area Analysis Report

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October 2004

Library and Archives Canada Cataloguing in Publication Data
Main entry under title:
Strathcona timber supply area analysis report

Issued by Forest Analysis Branch.
Previously published 1999.
Includes bibliographical references: p.
ISBN 0-7726-5226-0

1. Timber - British Columbia – Vancouver Island.
2. Forests and forestry – British Columbia - Vancouver Island - Mensuration. 3. Forest management - British Columbia – Vancouver Island. 4. Coast Forest Region (B.C.). I. British Columbia. Ministry of Forests.
II. British Columbia. Forest Analysis Branch.

SD438.B7S77 2004 333.75'11'097112 C2004–960126–1

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Preface

This report contains a timber supply analysis and a socio-economic analysis and is part of the provincial Timber Supply Review (TSR) 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 considered 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* (which is now in transition to the Province's *Forest and Range Practices Act)* and official land-use decisions made by Cabinet.

Focussing the assessment on the implications of current practices rather than looking at a number of different management regimes expedites the analysis process. 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 provide a 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 second of four documents that will be released for each TSA as part of the timber supply review. The first document is the data package, a revised version of which is included as an appendix to this report. A third document called the public discussion paper summarizes the technical information and provides a focus for public discussions of possible timber harvest levels. The fourth document outlines 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 Strathcona 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), mid- (21 years to 70 years from the present) and long- (beyond 70 years from the present) terms. It also examines the potential changes in timber supply stemming for uncertainties about forest growth and management actions. **It is important to note that the various harvest forecasts included in the report only indicate the timber supply implications of current practices and uncertainty associated with various inventories or current practices. The forecasts are intended for discussion purposes only; they are not allowable annual cut (AAC) recommendations.**

Current forest management practices follow existing forest legislation and standards.

In The Strathcona Timber Supply Area (TSA) is located in the Coast Forest Region in the central portion of Vancouver Island. While the productive forest in the TSA occupies approximately 347 000 hectares, the forest available for timber production and harvesting under current management practices is about 160 000 hectares or 46%. In the area available for timber harvesting, most of the forests are dominated by western hemlock, balsam and Douglas-fir. Smaller areas are dominated by western redcedar, spruce, pine, cypress and alder. Hemlock, Douglas-fir and western redcedar are the tree species most commonly used by the forest industry in the area. About 54% of the timber harvesting land base is subject to cutblock adjacency considerations. The remaining 46% of the land has some additional consideration such as visuals, community watershed or wildlife habitat of some type. The entire timber harvesting land base is subject to biodiversity considerations.

The current allowable annual cut (AAC) for the Strathcona TSA is 1.278 million cubic metres per year. Given current management assumptions, the analysis shows that the current harvest cannot be maintained and the base case initial harvest level is about 1.12 million cubic metres per year which is a 13% reduction from the current AAC. Two additional declines of about 12% of the current AAC per decade bring the mid-term harvest level to 800 000 cubic metres per year. The mid-term harvest level increases by 112 000 cubic metres after 70 years and an additional 58 000 cubic metres after 145 years to reach the harvest level of 970 000 cubic metres per year. The first of these future increases coincides with the exclusive shift in harvest to managed second-growth forest while the second increase is a result of additional volume achieved through the planting of genetically improved seedlings. The harvest of managed stands and genetically improved trees does begin earlier than 70 years and 145 years respectively, however, the full impact is not realized until the majority of harvested stands possess the necessary condition or attribute.

The most important factors contributing to the declining timber supply are:

- Improved estimate of riparian habitat — The information on riparian habitat has reduced the current timber harvesting land base by an additional 18 000 hectares (or 11% of the current timber harvesting land base) over the previous timber supply analysis. While the Campbell River Forest District are confident in the riparian management practices that are occurring in the Strathcona TSA, the underlying stream network and stream class assignment used to project riparian practices across the TSA contains some uncertainty. In addition, there will be some interplay between the amount of area reserved for riparian management and the additional area needed to provide wildlife tree patch requirement.
- Transition — The base case assumed that stands are available for harvest upon reaching 95% of the maximum average growth rate and 350 cubic metres per hectare. This does slightly reduce timber supply flexibility in the mid term.

Executive Summary

Due to the amount and complexity of information regarding forest dynamics, there always exists some uncertainty in the data and assumptions used in this analysis which may affect the results. The licensees in the Campbell River Forest District have recently completed a terrestrial ecosystem mapping exercise for a significant portion of the Strathcona TSA and this work can be used to improve productivity estimates. Initial timber supply indications based on assigning growth potential using the Ministry of Forests site index by biogeoclimatic site series projects large increases in timber supply in the long term to 1.13 million cubic metres per year. Also, terrain stability, one of the key impacts on the timber harvesting land base has a general management prescription that may be less restrictive on a stand by stand bases. A sensitivity analysis examined including stands with at least 500 cubic metres per hectare on slopes between 30 and 40 degrees (about 60-80% slope) as areas that may possibly be harvestable which would increase timber supply.

The analysis also indicates that managing harvests in the Kyuquot supply block will not adversely affect the TSA level harvest. It is expected that harvesting activities in the Kyuquot supply block will decline substantially from current levels.

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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 pattern. Decisions about whether a stand is available for harvest often depends on how its harvest could affect other forest values, such as wildlife or recreation.

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. 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 Province's 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 Strathcona TSA. Following a brief description of the area in Section 1, data preparation and formulation of assumptions are discussed in Section 2. Section 3 outlines the timber supply analysis methodology. Timber supply analysis results are presented in Section 4. Section 5 examines the sensitivity of the results to uncertainties in the data and assumptions used, and is followed by a summary and conclusions in Section 6. Section 7 shows results of a socio-economic analysis for the Strathcona TSA. Appendixes A and B contain further details about the data and assumptions used in the analysis.

As part of the timber supply review, 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.

The socio-economic analysis considers the current and projected levels of forestry activity associated with the Strathcona 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 assessing employment and income implications of the timber harvesting levels projected in the base case.

The analysis includes estimates 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.

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.

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.

1 Description of the Strathcona Timber Supply Area

The Strathcona timber supply area (TSA) covers a total area of 407 000 hectares on central Vancouver Island and adjacent areas on the mainland. The total productive forest area is approximately 347 000 hectares, and less than half (160 000) is considered available for timber harvesting.

The Campbell River Forest District administers the Strathcona TSA, as well as portions of Tree Farm Licences (TFLs)* 19, 25, 39, 45 and 47. Communities within the western portion of the forest district are Gold River, Tahsis, Zeballos and Kyuquot. Communities in the eastern portion include Campbell River, Courtenay, Comox, Sayward and Cumberland. There are other smaller communities located in the district, mainly along Highway 19.

The Strathcona TSA extends from the west coast of Vancouver Island (Nootka Sound to Brooks Peninsula) to the east coast (from Fanny Bay to Sayward), and includes islands in the Johnstone Strait, northern Gulf Islands, and a large area lying between Knight and Bute Inlets on the mainland. It is made up of three timber supply blocks (subunits of the TSA): the Kyuquot to the west, the Sayward to the east of Strathcona Provincial Park and the Loughborough on the mainland.

The current allowable annual cut for the Strathcona TSA is 1 278 000 cubic metres, as determined by the chief forester in January 2000. This is 10% less than the 1996 determination of 1 420 000 cubic metres a year.

A significant number of large provincial parks, including Strathcona, Tahsish-Kwois and Brooks-Nasparti are located partially or wholly within the TSA.

1.1 The environment

The Strathcona TSA is largely a mosaic of wet, mountainous terrain dissected by streams and rivers, many of which create estuaries as they enter the ocean. The six ecosections occurring in the area are Western Island Mountains, Northern Island Mountains, Leeward Island Mountains, Strait of Georgia, Outer Fjordland and Northern Pacific Ranges.

The TSA consists of three biogeoclimatic zones*: coastal western hemlock (CWH), mountain hemlock (MH) and alpine tundra (AT). Table 1 summarizes the zones and their locations, the tree species present and other conditions such as wildlife values.

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

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

1 Description of the Strathcona Timber Supply Area

Table 1. Biogeoclimatic zones of the Strathcona timber supply area

Zone	Location	Tree species	Other
Coastal western hemlock (CWH)	Low to mid-elevations.	Dominant Western hemlock Minor Douglas-fir Western redcedar Sitka spruce Yellow-cedar Amabilis fir Mountain hemlock Shore pine Big-leaf maple Red alder	High rainfall, cool summers and mild winters. The most productive forest ecosystem in Canada, with some of the greatest diversity and abundance of wildlife habitat of any ecological zone in B.C.
Mountain Hemlock (MH)	Above the CWH zone.	Dominant Mountain hemlock Amabilis fir Yellow-cedar Minor Western hemlock Western redcedar Douglas-fir Western white pine	Short, cool summers and long, wet winters with heavy snow for several months. At higher elevations, the forest thins out into parkland with clumps of trees interspersed with AT. Includes many species of wildlife despite the long, cool winters.
Alpine tundra (AT)	Above the Mountain Hemlock zone.	Treeless, except for stunted trees at lower elevations of zone.	Cold, windy and snowy. Low growing season temperatures. Wildlife species and diversity are low.

1 Description of the Strathcona Timber Supply Area

The BEC classification system includes a further breakdown called variant which is used for biodiversity* conservation by requiring the maintenance of different ages in different forest types*. Table 2 lists the productive forest and the timber harvesting land base* at this finer scale.

Table 2. Biogeoclimatic zones of the Strathcona timber supply area

Biogeoclimatic variant	Timber harvesting land base ('000s hectares)	Forest outside the timber harvesting land base ('000s hectares)	Per cent (%) of the variant in the available for harvest	Per cent (%) of the timber harvesting land base
CWHdm	3.62	2.86	56	2
CWHmm1	10.03	13.29	43	6
CWHmm2	3.47	18.41	16	2
CWHvh1	17.06	46.15	27	11
CWHvm1	72.98	96.79	43	45
CWHvm2	11.79	44.63	21	7
CWHxm1	6.99	5.19	57	4
CWHxm2	32.82	31.73	51	20
MHmm1	2.29	22.77	9	1

Due to the variation in topography and climate, the Strathcona TSA contains a rich and diverse array of wildlife. Of particular importance are the old-growth forests of the CWH zone and the protected, nutrient-rich estuaries that provide critical habitat for over-wintering water birds, many species of mammals, and young salmonids that use the mixed fresh and salt water to acclimatize.

More than 300 species of migratory and resident birds, 45 species of mammals and 13 species of amphibians and reptiles occur in the timber supply area. Native mammals include black-tailed deer, Roosevelt elk, black and grizzly bear, cougar, mountain goat, wolf, beaver, pine marten, wolverine and weasel. Native and migratory birds in the forests of the area include species of particular management concern such as marbled murrelets, Queen Charlotte goshawks (coastal sub-species of northern goshawks), great blue herons and pileated woodpeckers. Adjacent marine habitats and estuaries support populations of species such as Peale's peregrine falcons, bald eagles, trumpeter swans, harlequin ducks and various over-wintering birds.

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.

Forest type
The classification or label given to a forest stand, usually based on its tree species composition. Pure spruce stands and spruce-balsam mixed stands are two examples.

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.

1 Description of the Strathcona Timber Supply Area

The many rivers and streams of the Strathcona TSA are used for spawning and rearing by five species of salmon. These watercourses also support significant numbers of resident and ocean-run trout, including cutthroat and rainbow trout, as well as dolly varden (char). Steelhead is a particularly famed game fish, largely because of its relative rarity. Vancouver Island has more than 200 rivers containing steelhead. Each run is genetically unique, but the overall numbers of fish are small.

The majority of species that occur or potentially may be found in the Strathcona TSA, and that are considered at risk, are presented in Table 3.

In the Strathcona TSA, species that are of particular management concern are those that rely on the characteristics of old-growth forests. As these forests are converted to younger stands, habitat loss and fragmentation may occur.

Current forest management practices follow the standards and legislation set out by the *Forest Practices Code*. The *Forest and Range Practices Act* will guide practices after it fully implemented, which is expected to occur by December 2005. Under the new act, forest companies must outline in forest stewardship plans how they can best achieve objectives set by government for wildlife, fish and biodiversity as well as soils, timber, water and cultural heritage. Government may also require results or strategies for special management of areas of local concern, such as wildlife habitat areas, winter range for animals such as deer and mountain goats, community watersheds*, fisheries-sensitive watersheds, recreation trails and scenic vistas.

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

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

Table 3. Vulnerable, endangered and threatened species that breed in the Campbell River Forest District

Endangered or threatened (red-listed)	Vulnerable (blue-listed)
Common Murre	American Bittern
Common Water Shrew (*brooksi*)	Band-tailed Pigeon
Fisher	Barn Owl
Keen's Long-eared Myotis	Black Petaltail
Killer Whale (northeast Pacific resident population)	Blue Dasher
Killer Whale (west coast transient population)	Canada Goose (*occidentalis*)
Marbled Murrelet	Cassin's Auklet
Northern Goshawk (*laingi*)	Coastal Tailed Frog
Northern Right Whale	Common Branded Skipper (*oregonia*)
Northern Sea Lion	Common Woodnymph (*incana*)
Purple Martin	Cutthroat Trout (*clarki*)
Sea Otter	Dolly Varden
Western Brook Lamprey (Morrison Creek population)	Dun Skipper
Vancouver Island Marmot	Ermine (*anguinae*)
Western Bluebird (Georgia Depression population)	Eulachon
Wolverine (*vancouverensis*)	Great Arctic
	Great Blue Heron
	Green Heron
	Grey Whale
	Grizzly Bear
	Humpback Whale
	Killer Whale (northeast Pacific offshore population)
	Northern Pygmy-Owl (*swarthi*)
	Pine Grosbeak (*carlottae*)
	Red-legged Frog
	Roosevelt Elk
	Short-eared Owl
	Surf Scoter
	Townsend's Big-eared Bat
	Tufted Puffin
	Western Screech-Owl
	Western Sulphur
	White-tailed Ptarmigan (*saxatilis*)
	Wolverine (*luscus*)

Source: B.C. Conservation Data Centre June 2004.

1 Description of the Strathcona Timber Supply Area

Under provisions of the *Forest Practices Code* and the new *Forest and Range Practices Act* and regulations a process exists for identifying species at risk and designating wildlife habitat areas (WHA) with specific management practices. The wildlife species that have been identified within the Campbell River Forest District, which includes the Strathcona TSA are listed in Table 4.

Table 4. Campbell River Forest District identified wildlife

Common name of identified wildlife
Amphibians
Coastal Tailed Frog
Red-legged Frog
Birds
Northern Goshawk
Great Blue Heron
Marbled Murrelet
Short-eared owl
Mammals
Wolverine (2 subspecies)
Vancouver Island Marmot
Keen's Long-eared Myotis
Grizzly Bear

Source: Identified Wildlife Management Strategy (IWMS) 2004.

1.2 First Nations

Fourteen First Nations, ten of which are located in the TSA, have territorial interests in the Strathcona TSA. Four treaties, representing eight First Nations, are currently being negotiated. Treaties are currently being negotiated with the Sliammon First Nation, Homalco First Nation, the Hamatla Treaty Society (Campbell River, Cape Mudge, Comox, Tlowitsis and Kwiakah First Nations) and the Maa-nulth First Nations (Huu-ay-aht First Nations, Uchucklesaht Tribe, Ka:'yu:'k't'h'/Che:k:tles7et'h' Nation, Toquaht Nation, and Ucluelet First Nation). The Maa-nulth First Nations are negotiating a final agreement after signing an agreement in principle in October 2003.

Issues of concern identified by various First Nations include access to tenure, the impact of forest development on treaty land selection and fisheries habitat, the establishment of sustainable harvest levels by individual First Nations' territory, the amount of cedar being harvested relative to its abundance, access to high quality red and yellow cedar for traditional and cultural uses and the protection of an economically viable forestry base that will be accessible in the post-treaty environment.

The Ministry's First Nations Forest Strategy seeks to increase the First Nations participation in the forest sector and reach workable interim accommodation of their interests through Forest and Range Agreements (FRA). These agreements offer First Nations forest tenure and a share in revenue. The Ministry hopes to enter into FRAs with each First Nation in the Strathcona TSA. To date, accommodation offers in the form of tenure and/or revenue sharing have been made to the Nuchatlaht, Ka:'yu:'k't'h'/Che:k:tles7et'h', Mowachaht-Muchalaht and Homalco First Nations. Similar interim accommodation measures for the other First Nations claiming territory in the Strathcona TSA are planned in the future.

Specific examples of First Nations tenures include the Hecate forest licence for which the Ehattesaht First Nation has a controlling interest, Nootka First Nations Forest Products, held by the Mowachaht-Muchalaht First Nations, a five-year timber sale issued to the Hamatla Treaty Society. First Nations involvement includes silviculture crews, salvage licences and shake mills, watershed restoration, cultural heritage assessments and recreation. First Nations in the western portion of the Strathcona TSA are more dependent on forests and the forest sector for their livelihood.

The Homalco Indian Band received economic development funding over three years ending March 31, 2005, to support Homalco in working with forest licensees on multi-year timber access agreements.

1 Description of the Strathcona Timber Supply Area

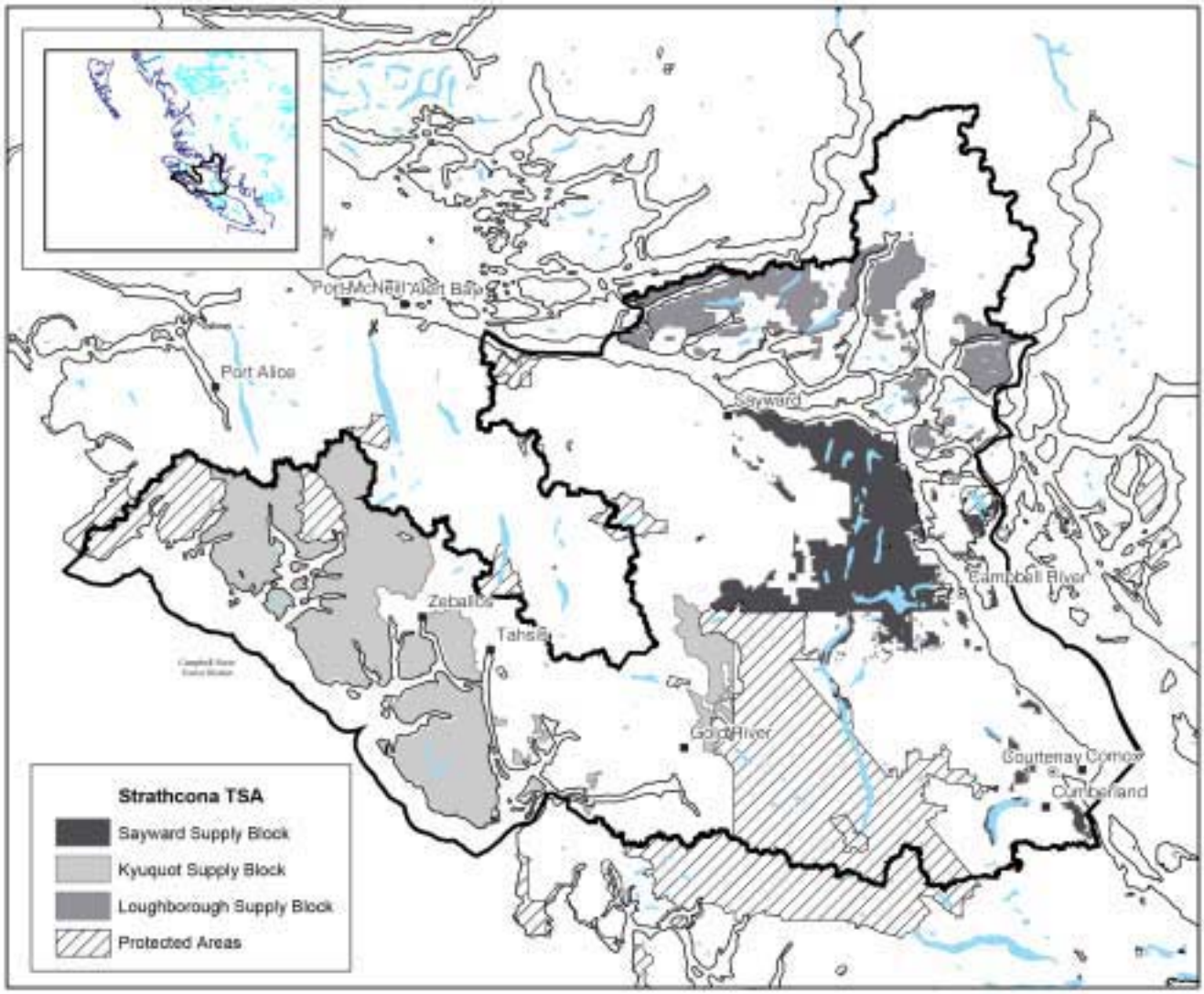


Figure 1. Map of the Strathcona TSA.

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.

2.1 Land base inventory

Land base information used in this analysis came in a number of formats. The forest cover information was compiled in 2001 by the Resource Information Branch, Ministry of Sustainable Resource Management. Additional information such as harvest depletion and resource emphasis mapping (e.g., visual management) was supplied or obtained by the Campbell River Forest District, Ministry of Forests. These files were combined by staff in the district office. The resultant file contains a considerable amount of information on the forest land in the Strathcona 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), nature of land forms and other notable characteristics such as environmental sensitivity and physical accessibility (operability*). Stand characteristics such as tree height, stocking* and age have been projected to January 2001. The inventory file has been updated to account for timber harvesting up to 2001 for the majority of the Strathcona TSA, however some harvesting activities in 2002 are also recorded.

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, and areas in highways, or town sites. A description of these areas specific to the Strathcona TSA is provided. These types of areas do not contribute to the timber supply of the Strathcona TSA. Before assessing timber supply these non-contributing areas are identified and separated from the land base which represents 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. When classifying areas in the data file, care is taken to consider areas sequentially. Where an area possesses more than one characteristic that would make it unavailable for harvesting (for example, where a park area is also suitable for wildlife habitat), the area will be attributed to the first characteristic evaluated.

Identifying areas as not contributing to timber supply does not mean the area is also removed from the Strathcona 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.

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.

2 Information Preparation for the Timber Supply Analysis

For the Strathcona TSA, the following types of areas were considered ineligible for consideration as part of the timber harvesting land base:

- non-Crown area — areas not managed directly by the B.C. Forest Service (e.g., private land, parks).
- non-forest areas — areas not occupied by forest cover (e.g., rock, swamp, treeless alpine areas and water bodies).
- non-productive forest — areas with sparse tree cover.
- 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, elevation and timber quality.
- currently unharvested forest types — areas covered by timber stands that are physically operable and have adequate productivity, but are not yet currently considered for harvesting or have marginal merchantability. These are predominantly maple, cottonwood and pine stands.
- low timber productivity areas — areas exhibiting low growth potential based on volume and site index*.
- unstable and potentially unstable terrain — areas with potential erosion or landslide hazard following logging.
- environmentally sensitive areas (ESAs)* — areas outside of the Sayward landscape unit* required for wildlife
- recreation areas — areas of recreational significance, such as campgrounds, trails, lookout sites and karst features*.
- old-growth management areas — specific areas have been identified the Sayward landscape unit to provide for the conservation of old forest.
- wildlife habitat — this includes ungulate* winter ranges established in the Sayward landscape unit*, potential winter ranges in the other portions of the TSA and wildlife habitat areas for certain identified wildlife species.
- streamside buffers — areas assumed to be unavailable for timber harvesting in order to account for protection of riparian and stream ecosystems.
- archaeological sites — these are sites protected by the *Heritage Conservation Act*. Where areas were identified as a polygon, the entire area was reserved while site specific locations were reserved at the rate of one hectare of forest per site .
- existing roads, trails and landings (RTLs) — areas of forest land that have been removed from timber production due to access development.
- wildlife tree patches (WTPs)— areas of forest that are to be left during timber harvesting to provide stand structure in newly harvested areas.
- future roads, trails, and landings — future losses of productive forest land to access development. These areas are initially included in the timber harvesting land base, and are subsequently removed as part of the first harvest.

Inoperable areas
Areas defined as unavailable for harvest for terrain-related or economic reasons. Operability can change over time as a function of changing harvesting technology and economics.
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.
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.

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.
Karst features
Karst is a distinctive topography that develops as a result of the dissolving action of water on carbonate bedrock (usually limestone, dolomite or marble). Karst features include fluted rock surfaces, vertical shafts, sinkholes, sinking streams, springs, complex sub-surface drainage systems and caves.
Ungulate
A hoofed herbivore, such as deer.

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 5 summarizes the areas in each category, and shows the area of the timber harvesting land base. The column "Productive forest area by classification" provides the total forested area within the given category. For example, while a total of 124 422 hectares of Crown productive forest is in potentially unstable terrain, only 35 853 hectares were removed specifically due to potentially unstable terrain. The difference arises because one area can be in more than one classification (e.g., inoperable and low productivity). The order listed in Table 5 is the sequence used when excluding areas from the timber harvesting land base. If the order were changed, the areas in the various categories would also change but the timber harvesting land base would remain the same.

2 Information Preparation for the Timber Supply Analysis

Table 5. Determination of the timber harvesting land base for the Strathcona TSA

Classification	Productive forest area by classification	Area (hectares)	Per cent (%) of total TSA area	Per cent (%) of Crown forest land
Total area on the file		**1 473 151**		
TFL area outside of the TSA		630 536		
Parks, private land, etc outside of the TSA boundary	96 504[a]	436 036		
Land not managed by the B.C. Forest Service within the TSA boundary		10 715		
Land not classified in the forest inventory		4 029		
Non-forest		39 562		
Non-productive forest and non-commercial brush		5 446		
Total productive forest managed by the B.C. Forest Service (Crown forest)		**346 826**	23.5	100.0
Reductions to the Crown forest available for timber supply				
Stands considered inoperable		86 265	5.9	24.9
Stand types currently not harvested	3 984	1 913	0.1	0.6
Stands exhibiting low productivity	43 800	9 404	0.6	2.7
Stands on unstable or potentially unstable soil	124 422	35 853	2.4	10.3
Wildlife considerations	10 558	4 221	0.3	1.2
Important recreation features	26 965	5 353	0.4	1.5
Old-growth management areas in the Sayward Landscape Unit	1 057	470	0.0	0.1
Deer winter range in the Sayward Landscape Unit	5 102	3 903	0.3	1.1
Lakeshore management areas in the Sayward Landscape Unit	296	37	0.0	0.0
Archaelogical sites	580	515	0.0	0.1
Inventory plot consideration	1 577	1 515		
Riparian reserves and management zones	42 267	26 350	1.8	7.6
Existing unclassified roads	10 060	8 243	0.6	2.4
WTP requirements		2 330	0.2	0.7
Total reductions		186 372	12.7	53.8
Current timber harvesting land base[b]		**160 454**	10.9	46.2
Future reductions				
Future roads trails and landings		776	0.0	0.0
Future timber harvesting land base		**159 678**	10.9	46.2

(a) Forest found in parks that contribute to forest cover requirements in the timber supply analysis.

(b) Timber harvesting land base includes about 2300 hectares of non-vegetated land (recent harvesting), about 21 000 hectares of vegetated non-treed land with logging history, 6800 hectares of NSR and about 17 600 hectares of timber licenses which have reverted or will revert to the Crown over the next 10 years.

2 Information Preparation for the Timber Supply Analysis

Figure 2 shows the current species composition on the timber harvesting land base. Hemlock and balsam (true fir) stands dominate the timber harvesting land base with smaller amounts of fir, cedar, spruce and alder. About 32% of the area within the timber harvesting land base area is currently above the minimum harvest criteria.

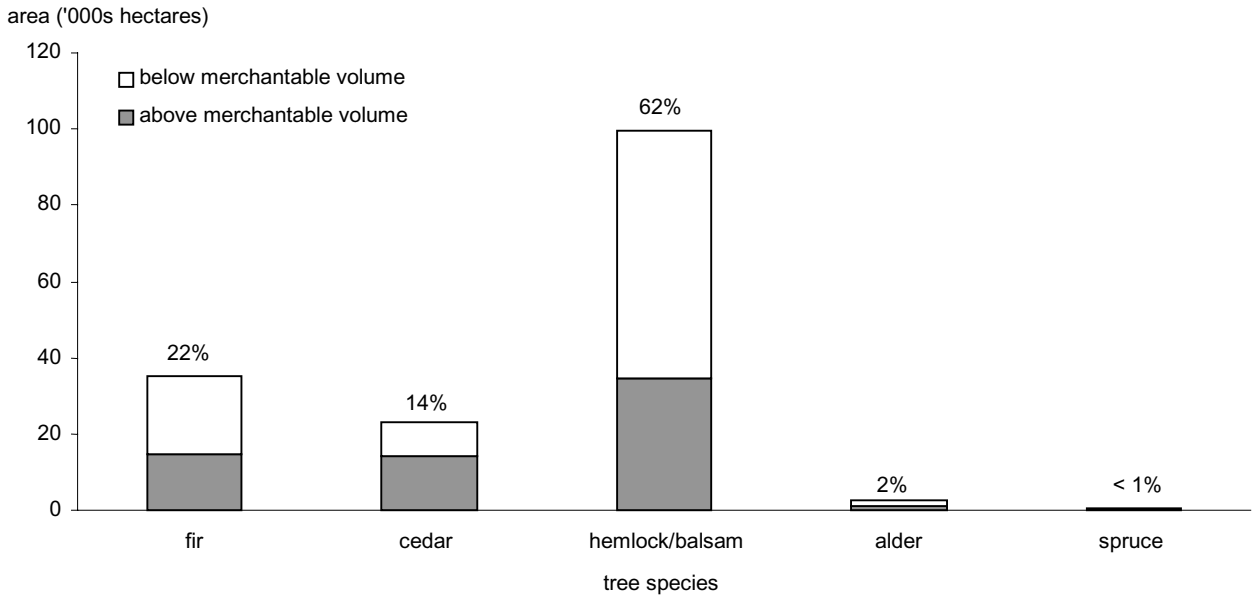


Figure 2. Area by dominant tree species on the timber harvesting land base — Strathcona TSA, 2004.

2 Information Preparation for the Timber Supply Analysis

Figure 3 illustrates the area within the timber harvesting land base by broad age range. About 38% of the area above the minimum merchantability criteria consists of second-growth stands. The transition in harvest from older stands to second-growth stands is one of the key drivers of the timber supply dynamics in the Strathcona TSA. Note that certain stands above 125 years of age are still below the minimum criteria at this time.

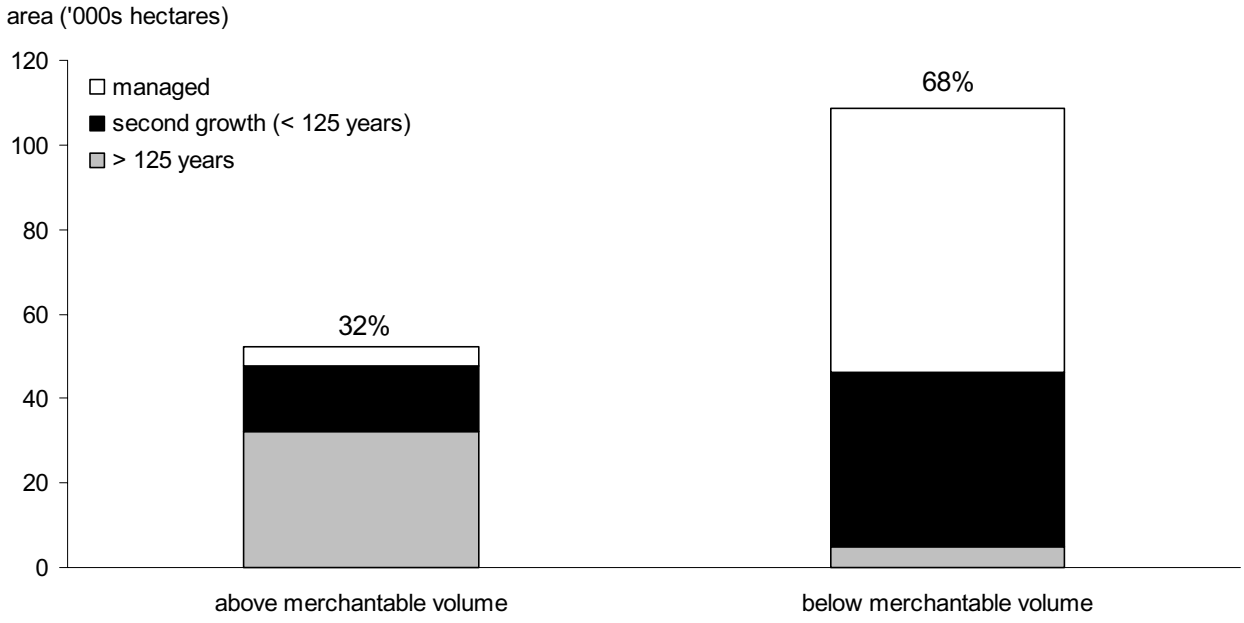


Figure 3. Area by broad age range within the timber harvesting land base — Strathcona TSA, 2004.

2 Information Preparation for the Timber Supply Analysis

The age class composition represented in Figure 4 shows stands available for harvesting and those that will not be harvested. Stands above 250 years of age make up about 19% of the timber harvesting land base and about 46% of the productive forest. About 68% of the timber harvesting land base is below 60 years of age signifying that there will be a substantial shift in harvesting younger stands in the near future.

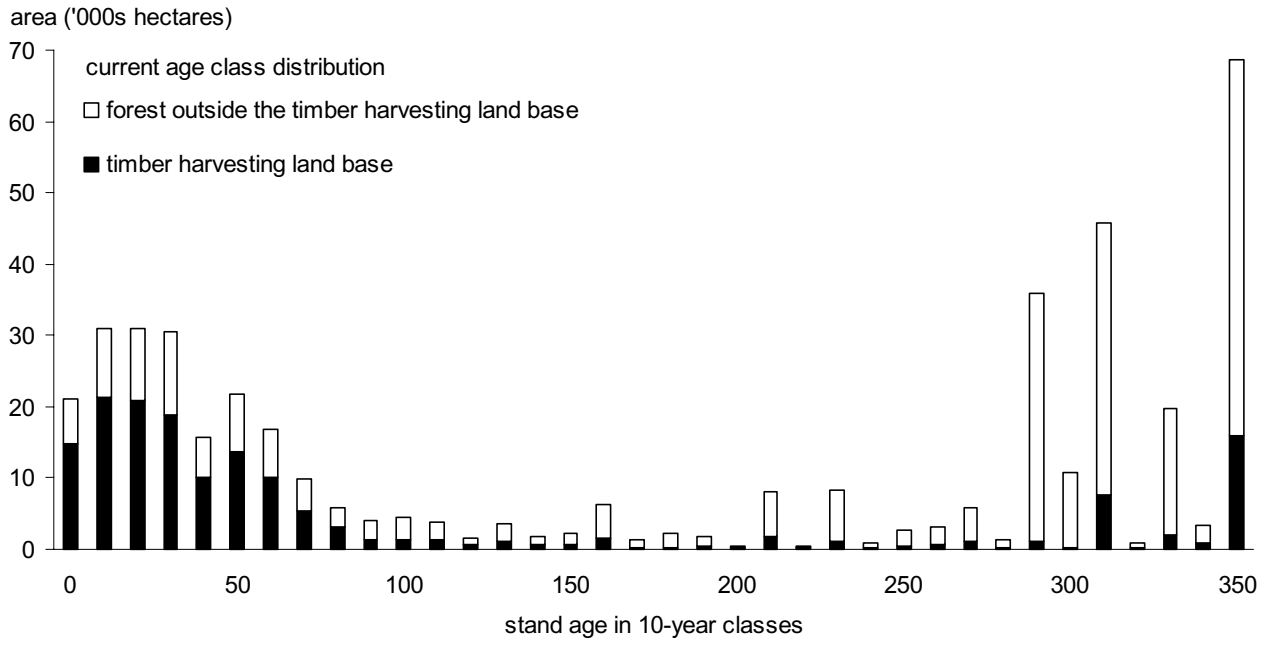


Figure 4. Current age class composition of the timber harvesting land base — Strathcona TSA, 2004.

2 Information Preparation for the Timber Supply Analysis

2.2 Timber growth and yield

Timber growth and yield refers to the prediction of the growth and development of forest stands over time. Forest stands have many characteristics that change with age (for example, number of trees per hectare, tree diameter, tree height, species composition). Since this analysis concentrates on timber volumes available for harvest over time, the most relevant measure for this analysis is volume per unit of area (in British Columbia, cubic metres per hectare). An estimate of timber volume in a stand assumes a specific utilization level, or set of dimensions, that establish the minimum tree and log sizes 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.

Two growth and yield models were used to estimate timber volumes for the Strathcona TSA timber supply analysis. The variable density yield prediction (VDYP)* model supported by the the Ministry of Sustainable Resource Management, Resource Information Branch, was used for estimating timber volumes for all existing natural stands. The table interpolation program for stand yields (TIPSY)*, which was developed by the B.C. Forest Service, Research Branch was used to estimate timber volumes for both existing and future managed stands. Table A-15. immature plantation history shows the age of management for each of the species harvested in the TSA.

Based on timber volume estimates*, the current timber inventory or growing stock* on the timber harvesting land base is approximately 47 million cubic metres. About 33 million cubic metres is currently merchantable; that is, above the minimum harvestable criteria which is 350 cubic metres per hectare and having achieved 95% of the maximum average growth rate. The volume of stands that is available for harvest is about 31 million cubic metres as stands are required to meet various forest objectives.

Variable Density Yield Prediction model
An empirical yield prediction system supported by the Ministry of Sustainable Resource Management, 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 species composition.
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.
Growing stock
The volume estimate for all standing timber at a particular time.

2 Information Preparation for the Timber Supply Analysis

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 process. Forest practices legislation and associated regulations have guided forest management practices in the Strathcona TSA Staff in the Campbell River Forest District provided descriptions for the following management practices:

- Silviculture practices — reforestation activities required to establish free-growing* stands of acceptable tree species.
- Forest health and unsalvaged losses* — average annual unsalvaged losses to natural forces such as insects, fire, wind and disease on the timber harvesting land base are estimated to be 31 750 cubic metres per year for the entire 250 year analysis horizon. These losses have been subtracted from all harvest forecasts* shown in this report. An explicit 7.7% operational adjustment factor increasing with age was applied to account for specific losses in the short- to mid-term expected in young medium and good site Douglas-fir stands in the CWHxm1 and CWHxm2 due to root rot (discussed in Section A.4.10, "Unsalvaged losses").
- Utilization levels — minimum sizes of trees and logs to be removed during harvesting.
- Minimum harvest criteria — the minimum requirement for stands to be considered eligible for harvest. Minimum harvest criteria for this analysis were based on the minimum growth rate and minimum volume that is generally required for licensees to harvest a stand.
- Harvesting priorities — examine the contribution from the Kyuquot supply block.
- Genetic resources — cedar, fir and to a lesser extent hemlock sites may receive genetic gains through the use of select seed. The genetic gains depend on the availability of seed and the respective seed planning unit.

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) that is not harvested.

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.

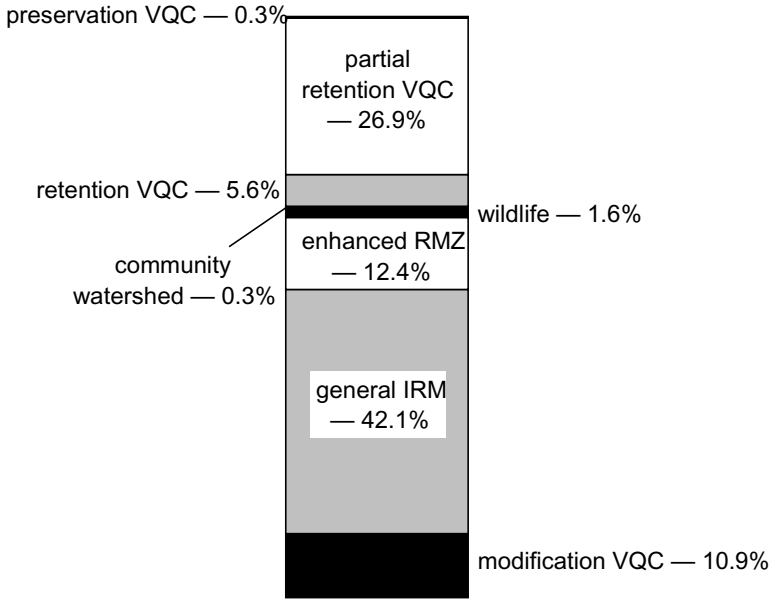
- Fertilization — about 19 000 hectares has been fertilized in the Sayward supply block. However, the spatial data to identify these stands is not complete. About 7300 hectares of forest above 30 years of age are shown in the inventory with either one or two fertilization applications and only these stands reflected fertilization responses in this analysis.
- Commercial thinning* — about 3000 hectares of productive forest have been commercially thinned in the Sayward supply block. These stands are identified and thinning volume is assumed to be 180 cubic metres per hectare and is removed from the projected volume per hectare.
- Forest cover requirements — many of the forest management activities in the Strathcona TSA are guided by forest cover requirements which indicate the maximum area in stands under a certain height or the minimum retention of area above a certain age. Often several management objectives are applied to the same area (for example, a visually sensitive area may coincide with an old-growth forest objective). While showing all of the existing overlaps is not feasible in a simple graph, Figure 5 provides a mutually exclusive listing of the various considerations in the TSA in the order shown in the graph. In addition to these, landscape-level biodiversity* requirements encompass the entire productive forest. More detailed descriptions of the forest cover requirements can be found in Appendix A, "Description of Data Inputs and Assumptions for the Timber Supply Analysis." About 54% of the timber harvesting land base is only subject to cutblock adjacency* and possibly old forest retention for biodiversity (42% in general integrated resource management areas and 12% in enhanced resource management emphasis) while the other 46% will have at least one additional resource emphasis that needs to be considered in planning timber harvesting activities.

Commercial thinning
A silviculture treatment that 'thins' out an overstocked stand by removing trees that are large enough to be sold as products such as poles or fence posts (see also, ***Juvenile spacing****). It is carried out to improve the health and growth rate of the remaining crop trees.*

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.*

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.

2 Information Preparation for the Timber Supply Analysis



Note: In order to provide a simple representation, resource emphasis were ordered as shown in the (e.g., consider more constraining visual areas followed by wildlife then community watershed.)

Figure 5. Timber harvesting land base by resource emphasis — Strathcona TSA, 2004.

3 Timber Supply Analysis Methods

The purpose of this analysis was to examine both the short- and long-term timber supply in the Strathcona TSA under current forest management practices. A timber supply model, as distinct from a growth and yield model, assists the timber supply analyst in determining how an entire 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 practices to represent how forests grow and are harvested over hundreds of years.

A spatial timber supply computer simulation model developed using the Spatially Explicit Landscape Event Simulator (SELES) was used for this analysis. SELES was developed by Fall and Fall (1996). SELES is a high-level language that was created for the purpose of facilitating spatial and temporal modelling. A spatial timber supply model patterned after the Forest Service Simulator (FSSIM) was created using SELES by Dr. Andrew Fall in collaboration with the Forest Analysis Branch of the B.C. Forest Service. The basic model has been benchmarked against FSSIM.

SELES allows for modelling of the spatial relationships among areas (e.g., adjacency), as well as control of the size and shape of spatial units such as harvest units and reserve areas. SELES is a raster, or grid-based modelling language, and the spatial input files for the timber supply analysis were created at a one hectare pixel size with linear features such as roads and riparian areas* being captured as the per cent of the pixel. Hence, the approximate spatial location of road and riparian networks could be tracked.

Generally, only the results for the first 250 years are shown graphically in this report because the projected harvest remains constant after that time.

Similar to other models, the spatial timber supply model assumes that trees grow according to specified yield projections and are harvested according to either a volume target or a specified objective set by the analyst. The 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 cutblock adjacency and green-up* prescriptions. For example, guidelines might specify that no more than some maximum percentage of the forest can be younger than a specified green-up age or height, or that some minimum percentage of the forest must be in older age classes to provide wildlife habitat. The simulation model facilitates examination of the effects of such guidelines on timber supply.

This type of analysis is used to determine the timber supply implications of a particular 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 or any particular spatial pattern of harvest on the landscape.

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

Riparian area
Areas of land adjacent to wetlands or bodies of water such as swamps, streams, rivers or lakes.

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.

4 Results

This section provides the results of timber supply analysis for the Strathcona TSA. The base case harvest forecast* uses the most recent assessments of 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." It is important to keep in mind that the base case provides only part of the timber supply picture for the Strathcona TSA, and should not be viewed in isolation of the sensitivity analyses.

4.1 Base case harvest forecast

The base case harvest forecast for the Strathcona TSA incorporates current management as described in various sections of Appendix A of this report and the *Timber Supply Review 3 Strathcona TSA Timber Supply Analysis Data Package*. The base case harvest forecast found in Figure 6 shows that the current AAC of 1.27 million cubic metres per year cannot be maintained in the short term if a timely transition to a mid-term harvest level of 800 000 cubic metres per year is desired. The base case begins at 1.117 million cubic metres per year followed by two reductions of about 150 000 cubic metres per decade (roughly 12% of the current AAC) to a mid-term harvest level of 800 000 cubic metres per year. A modest increase of 14%, 70 years from now, represents the transition to harvesting of predominantly managed stands while an additional increase of 6%, 145 years from now, reflects the

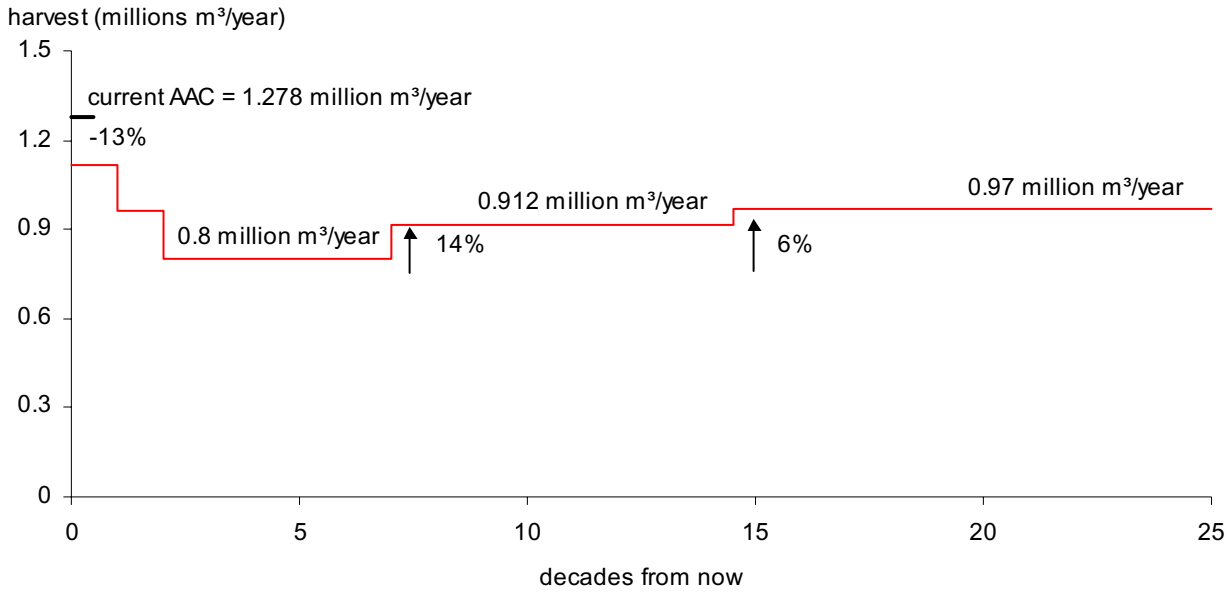


Figure 6. Base case harvest forecast for the Strathcona TSA, 2004.

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.

4 Results

expected timber supply gain of genetically improved trees. The harvest of managed stands and genetically improved trees does begin earlier than 70 years and 145 years respectively, however, the full impact is not realized until the majority of harvested stands possess the necessary condition or attribute. The base case harvest forecast represents a reduction in timber supply consistent with previous analyses shown for this unit. The most important factor contributing to this reduction is the reduction in the size of the timber harvesting land base due in part to improved riparian habitat* mapping.

The Strathcona TSA is separated into three timber supply blocks: Sayward, Kyuquot and Loughborough. As the amount of old growth available for harvest in the Kyuquot supply block declines, more harvesting must be allocated to the other supply blocks. Figure 7 shows two potential harvest flows within the Kyuquot supply block using the base case management assumptions*. Either forecast ensures the base case can be achieved.

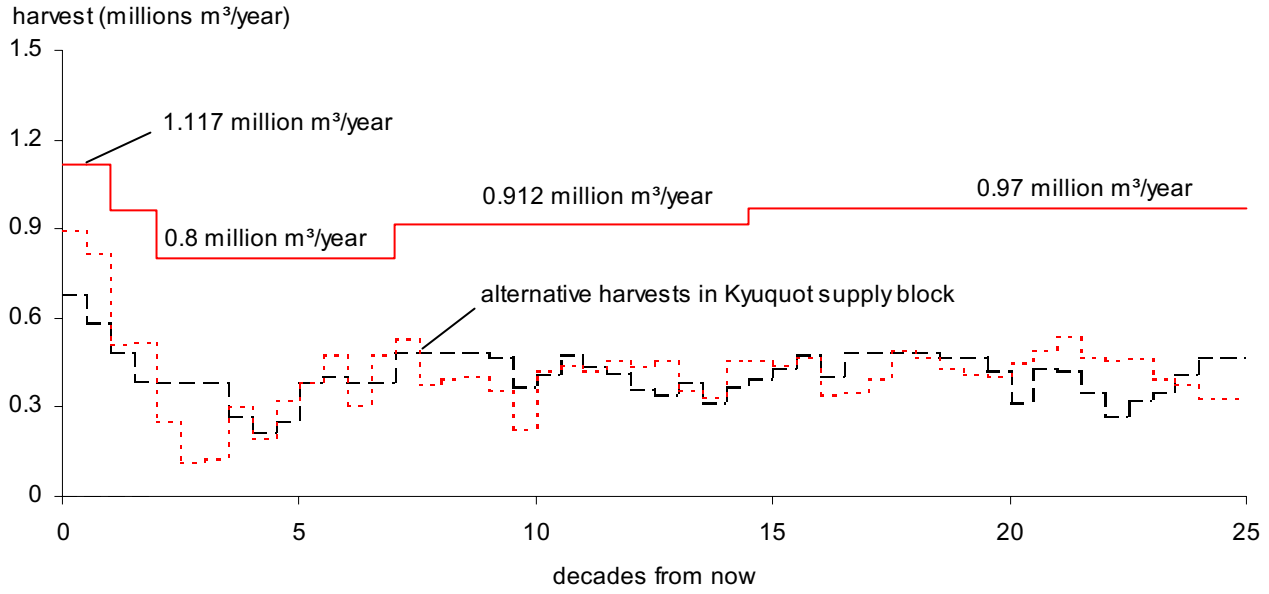


Figure 7. Contributions from the Kyuquot supply block in the Strathcona TSA, 2004.

Riparian habitat
The stream bank and flood plain area adjacent to streams or water bodies.

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.

4 Results

4.2 Base case harvest characteristics

Figure 8 shows the two transitions that are instrumental in defining the timber supply in the Strathcona TSA. Current old forest harvesting is expected to continue at some significant level for the next 20 years with an increasing amount of harvest in second-growth stands, which are currently below 125 years of age. Once old-forest harvesting is essentially completed, it is expected that managed stands will become steadily more important. Even after the rise to the long-term harvest level* in 70 years, harvest from existing natural stands, both old- and unmanaged- second growth is expected due to various forest cover requirements impacting the rate of harvest in these stands.

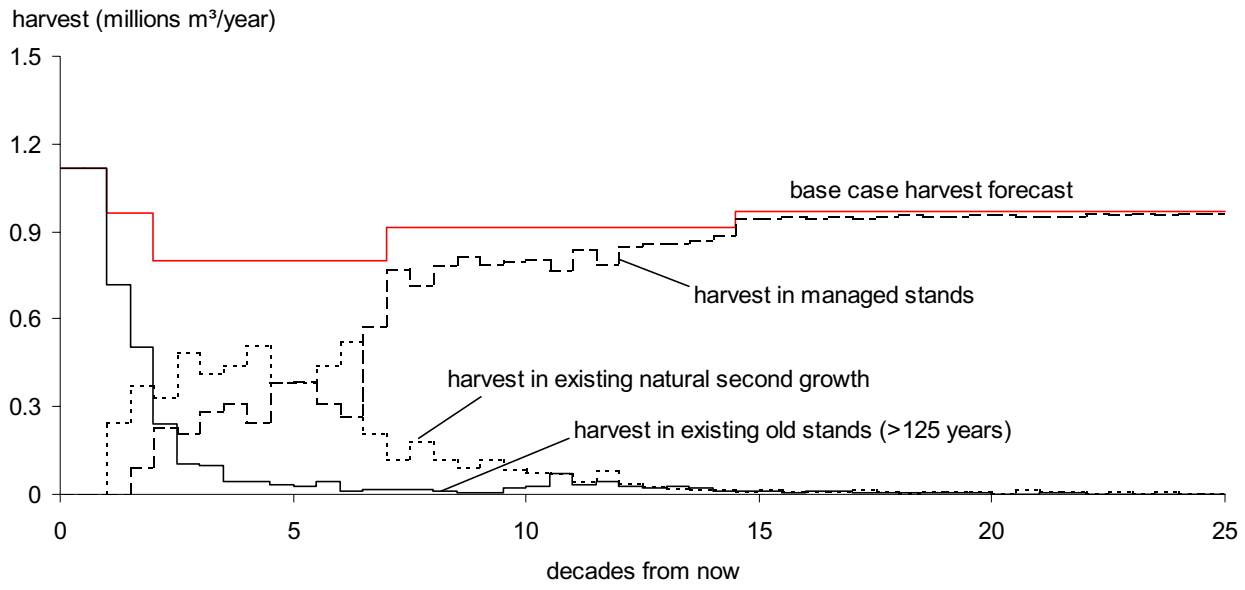


Figure 8. Harvest contribution from existing, second-growth and managed stands — Strathcona TSA base case, 2004.

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

Area harvested in the analysis is shown in Figure 9, along with the average area-weighted volume harvested per hectare. The area harvested is generally about 1500 hectares per year over the entire modelling horizon and average volume per hectare is projected to be about 650 cubic metres.

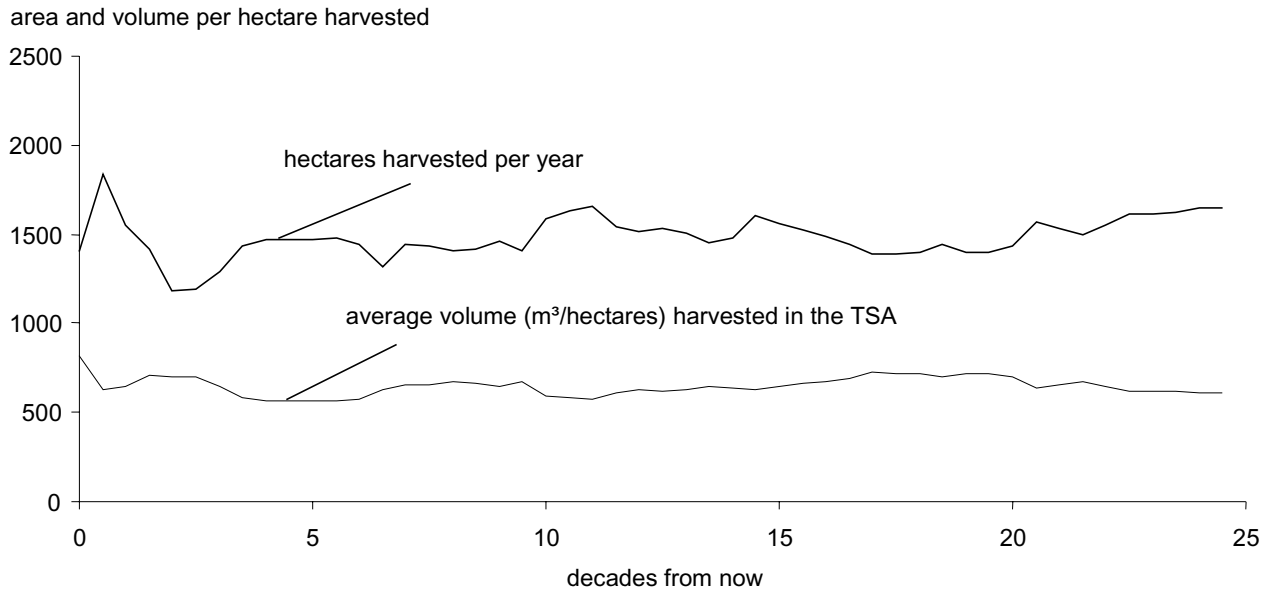


Figure 9. Average annual area and volume harvested over time — Strathcona TSA base case, 2004.

4 Results

Minimum harvest criteria were derived as a function of the volume necessary to make a stand operationally feasible to harvest and the maximum average growth rate. In many cases, forest cover requirements can extend the time between when a stand is considered to be merchantable for harvest and when it is available for harvest. Figure 10 shows the area-weighted harvest age by the visual quality classes (VQC) and the general integrated resource management (IRM)* emphasis. It can be seen that only the recommended visual quality class R (i.e., retention) results in significantly higher average harvest ages relative to IRM areas in the mid- and long-term. The other listed visual quality classes do have higher average harvest ages through the mid-term, indicating that the rate of access in modification and partial retention visual quality classes will be reduced compared to the general IRM emphasis. In the long term, harvest ages in modifications and partial retention areas are within 7 years and 18 years of the general IRM portion of the TSA respectively, indicating similar levels of access.

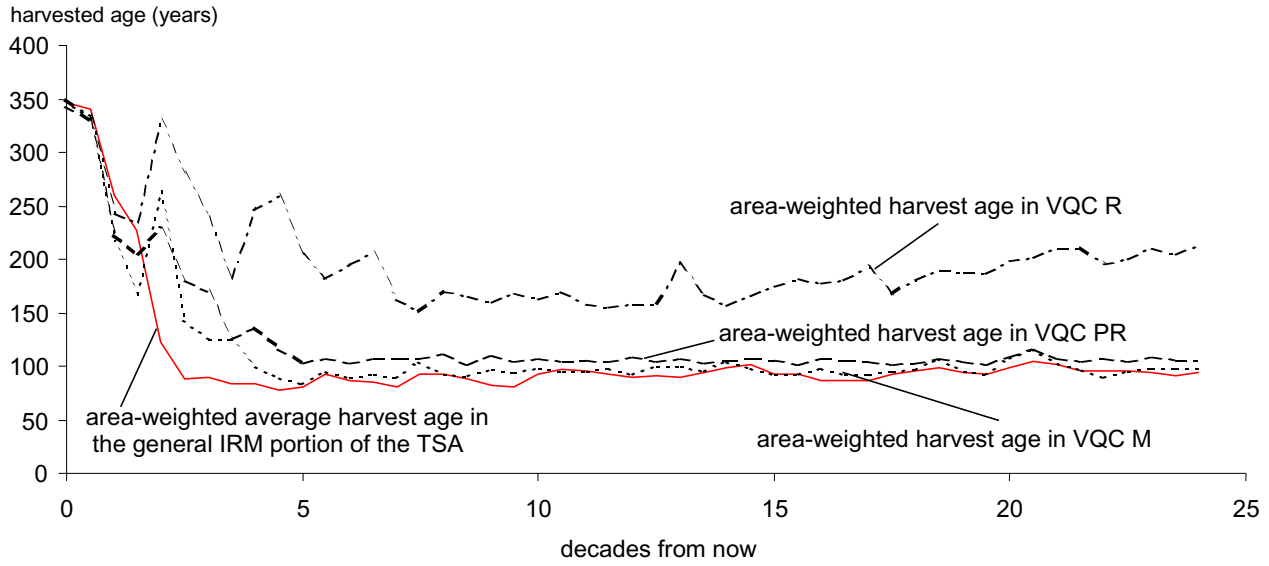


Figure 10. Average area-weighted harvest age by certain resource emphasis over time — Strathcona TSA base case, 2004.

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

4.3 Base case forest characteristics

As noted earlier in Section 2.2, "Timber Growth and Yield," the current standing inventory is about 46.7 million cubic metres. This is projected in Figure 11 to decline slightly to about 38 million cubic metres, rising to about 44 million cubic metres between 100 and 150 years from now. The short- and mid-term stability of the inventory shows that while harvesting is occurring, growth on the young forest is counter-balancing it. Volume in existing second-growth stands is projected to increase for the next twenty years at which time second-growth stands support about 70% of the harvest. Available timber supply is most limiting 50 years from now. This coincides with the lowest point in the dashed line in Figure 11, which represents the growing stock above the minimum harvest criteria.

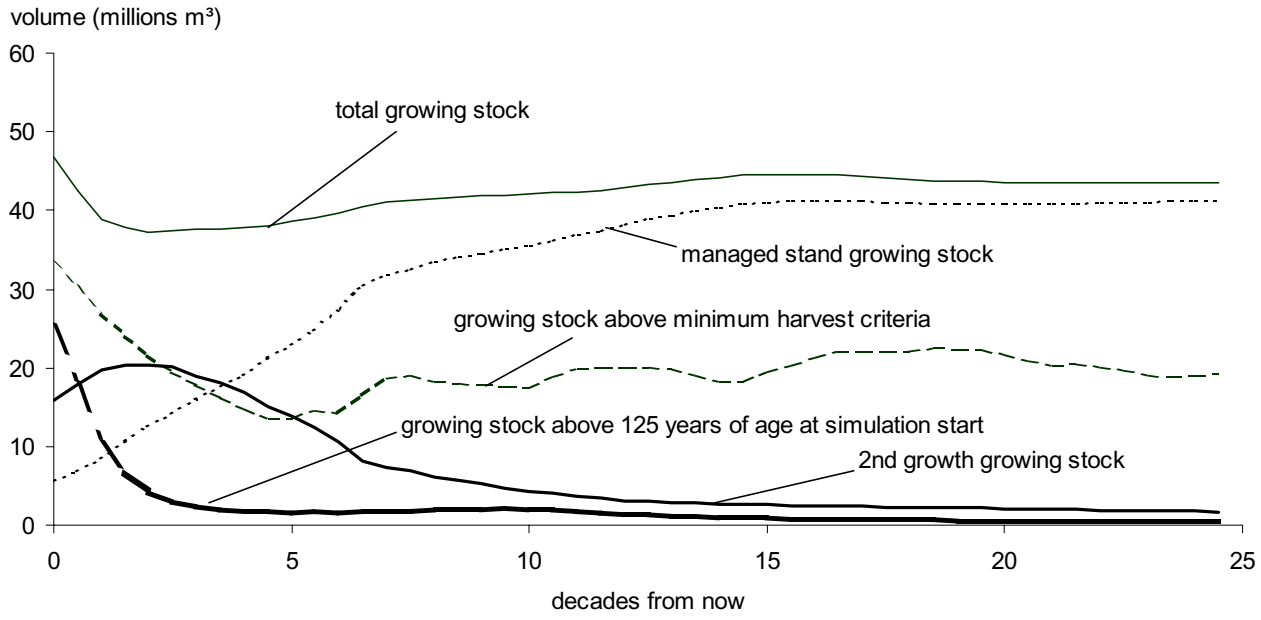


Figure 11. Changes in timber growing stock over time — Strathcona TSA base case, 2004.

4 Results

The series of charts in Figure 12 show how the age composition of the Crown forest within the Strathcona TSA will change over the next 250 years under the base case harvest forecast. The dark bars represent the timber harvesting land base while the unshaded bars show the stands outside of the timber harvesting land base. The Strathcona TSA will experience significant volume increment as the areas of stands under 60 years of age begin to reach sizes where merchantable volume is calculated.

An important assumption in the base case is that stands will continue to age indefinitely, as can be seen by the increase in area in stands above 350 years of age as time progresses. Since stands outside of the timber harvesting land base will possibly be disturbed by natural processes such as fire, windthrow or biotic agents such as insect and disease, special sensitivity analysis* examined , the implications of natural disturbance based succession using the *Biodiversity Guidebook* return intervals (Section 5.12).

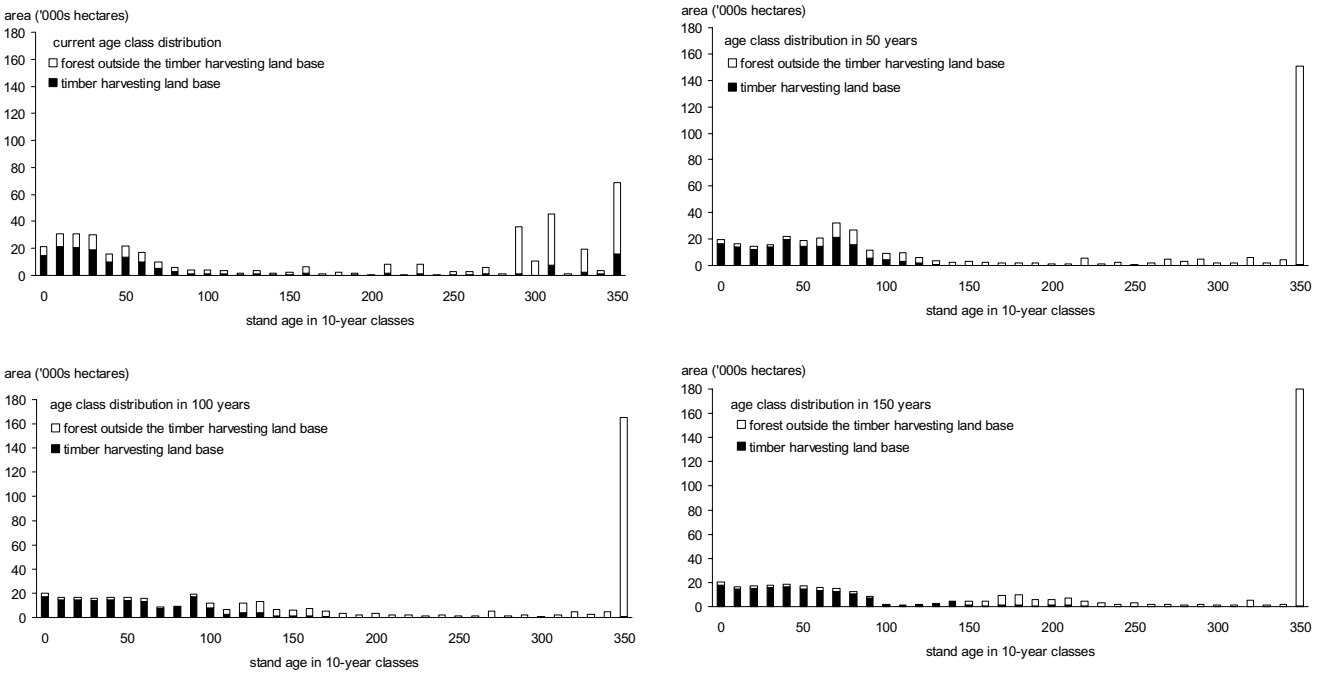


Figure 12. Changes in age composition on the Crown forest land base over time — Strathcona TSA base case, 2004.

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.

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 life spans. It is therefore often useful to understand the long-term effects of changes or uncertainties in the information used for short-term decisions.

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 how 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 analysis, and show which variables, and associated uncertainties, have the most significance for decisions. It can clarify whether current best estimates provide a reliable basis for decisions, or whether a high level of uncertainty about an important variable suggests a more cautious approach to decision-making.

In this section, the results of a number of 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. Short term refers to the first 20 years of the harvest forecast, mid term is 21 to 70 years from now, and long term is after 70 years from now.

5 Timber Supply Sensitivity Analyses

5.1 Alternative harvest flow

Two alternative harvest forecasts are shown in Figure 13. The first forecast depicted by the long-dashed line, shows the mid-term implications of maintaining the current AAC for 20 years. At this short-term harvest level, significant reductions in mid-term timber supply would be experienced as managed stands are being harvested as quickly as they become available for harvest. Alternatively, a non-declining yield forecast shown by the short-dashed line would provided the highest mid-term harvest level at about 870 000 cubic metres per year however, this requires an immediate 250 000 cubic metres per year or 22% reduction in short-term harvest level from the base case initial harvest level. The extended length of time at 870 000 cubic metres per year is a result of the rapid reduction in harvest, as stands that were converted to a managed condition in the base case are converted at a later time in this sensitivity analysis. In contrast, it can be seen by the dashed line, that harvesting more area in the short term could initiate an earlier rise to the initial long-term level than the base case.

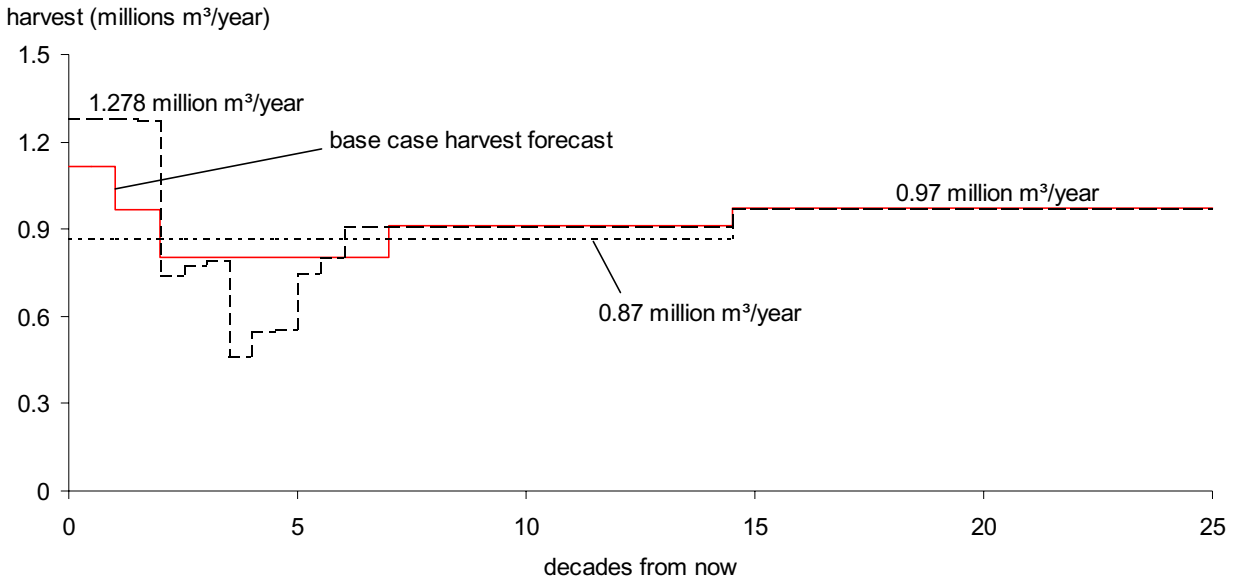


Figure 13. Alternative harvest forecasts — Strathcona TSA base case, 2004.

5.2 Implications of site index assignment based on terrestrial ecosystem mapping

A terrestrial ecosystem mapping (TEM) project has been recently completed for part of the Strathcona TSA. This information was merged with site index by biogeoclimatic ecosystem classification (2003) provided by the Research Branch of the Ministry of Forests to create potential productivity estimates (SIBEC) for the TSA. Additional information on SIBEC is available at http://www.for.gov.bc.ca/hre/sibec/, while TEM and mapping standards are available at http: //srmwww.gov.bc.ca/ecology/tem/ manuals.html.

Figure 14 shows the results of the increased productivity which occurs when the potential site index is used. This new data is assigned to about 88 000 hectares of timber harvesting land base and increases the average site index on these stands from about 22.5 metres to 25 metres. The long-dashed line shows the implications if the potential site productivity is assigned to stands after first harvest in the model while the short-dashed line shows the improvement in mid-term timber supply if stands under the age of 20 and all future regeneration are assigned an improved site index estimate. Under these sensitivity analyses, average harvested age declines by about 10 years and average stand volumes increase by about 4% to about 675 cubic metres per hectare after 85 years time. Area harvested increases by about 15 % in the long term.

Another sensitivity analysis was performed that took the average site productivity change for managed stands by analysis unit* within the area covered by the TEM is extrapolated to the unmapped portion of the TSA and applied to stands after first harvest in the model, a further improvement in timber supply would occur (not shown in Figure 14). The initial rise in seventy years time would be to 1.12 million cubic metres followed by and increase to 1.25 million cubic metres in 125 years time. Average harvested ages are about 85 years over the long term while area harvested increases by 20% over the base case during this same time.

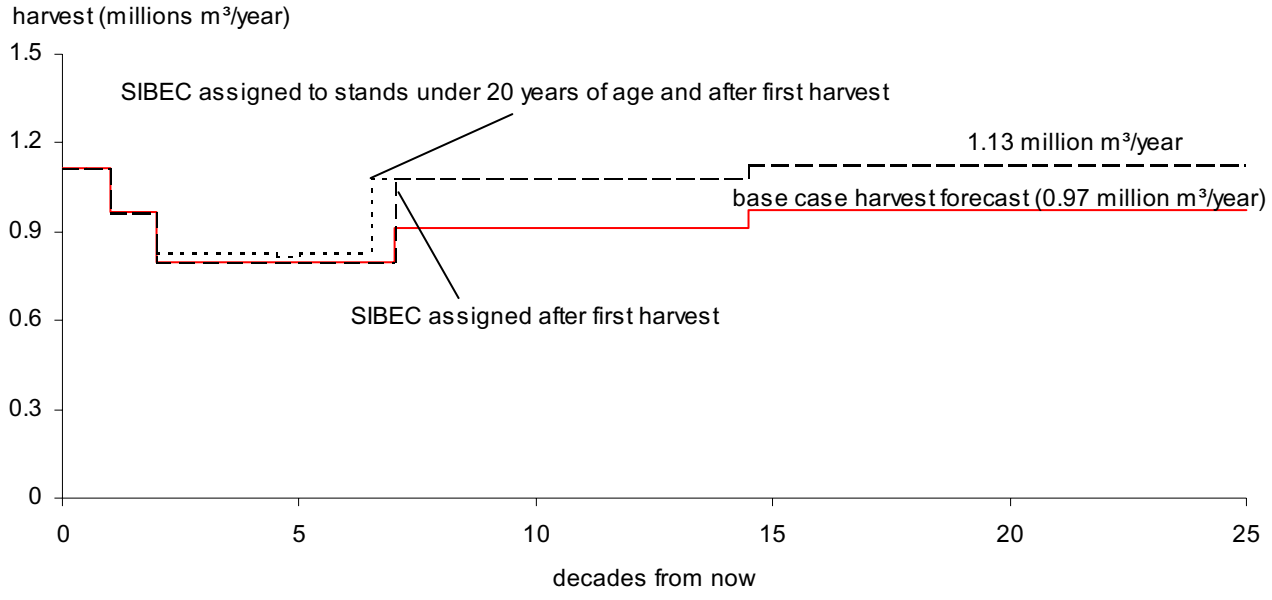


Figure 14. Harvest forecast reassigning site index based on terrestrial ecosystem mapping — Strathcona TSA, 2004.

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.

5.3 Implications of volume per hectare based merchantability and harvest order

In the last timber supply analysis (TSR 2), merchantability, which is when stands are assumed to be eligible for harvest, was based solely on stands having enough volume to be considered for harvest and was defined through the assignment of minimum volume thresholds. While the Campbell River Forest District staff were confident in the minimum volumes used to define merchantability in old stands, there was concern that the previous analysis assumptions may project the harvest of young stands at uneconomic volumes. For this reason, the base case in this analysis required both a volume threshold and a growth rate threshold (achievement of 95% of maximum average growth) to define merchantability.

Figure 15 shows the timber supply implications of returning to only the minimum volume thresholds used in the previous analysis to define merchantability and is represented by the dark-dashed line. Using only minimum volume thresholds to define stand merchantability, and using the flexibility it provides to increase mid-term timber supply (starting 20 years from now), results in a mid-term harvest level of 870 000 cubic metres per year. However, this mid-term level of 870 000 cubic metres per year must be maintained until 145 years from now when the base case long-term harvest level can be reached.

The base case ranks stands for harvest based on the numbers a years a stand has grown beyond the time it reached 95% of its maximum growth. A second sensitivity analysis was performed using only the minimum volume thresholds to define merchantability and ranking stands for harvest based on highest volume stands being harvested first. The short-dashed line in Figure 15 shows the timber supply implications for the TSA. The current AAC could be maintained for another decade before declining at about 12% per decade to the same mid-term harvest level as projected in the base case. However, defining merchantability only through minimum volume thresholds and ranking stands for harvest based on the basis of highest volume stands being harvested first, reduced the long-term harvest level to 900 000 cubic metres per year, 7% below the base case harvest forecast. This reduction in the long-term harvest level is a function of cutting high volume stands that are still growing before lower volume stands that have stopped growing. Stands are harvested almost 20 years earlier on average in this sensitivity analysis and the area harvested is about 13% higher on average.

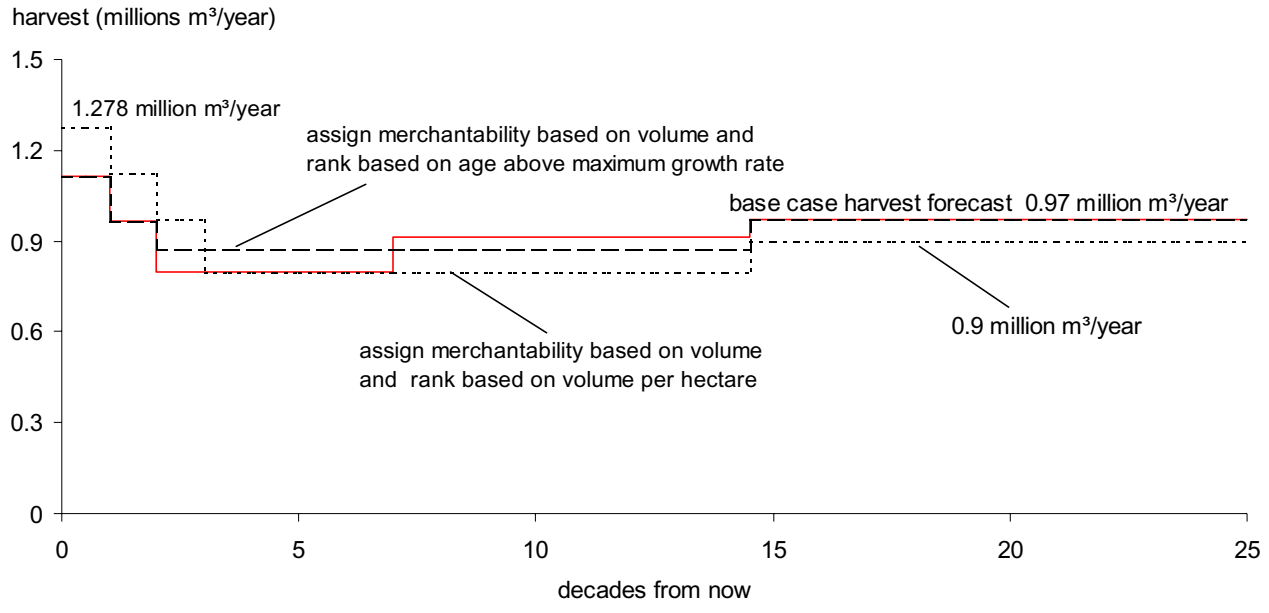


Figure 15. Harvest forecast if stands are merchantable based on volume per hectare — Strathcona TSA, 2004.

5.4 Implications of using the maximum perspective alteration in visual quality areas

Rates of alteration in visually sensitive landscapes were modelled at the highest end of the disturbance range based upon historic advantageous visual design within cutblocks*. For this sensitivity, stand heights and maximum disturbance rates in the visual areas have been localized using new plan-to-perspective (P2P) information by slope class developed by Ministry of Forests, Forest Practices Branch (*Bulletin — Modelling Visuals in TSRIII*). The disturbance levels listed in Table A-18. in parentheses are the result of area-weighting the P2P by slope class to create a single number for each visual quality class. The area-weighted visually effective green-up heights were derived using *Procedures for Factoring Visual Resources into Timber Supply Analyses* (Table 6, "Tree height required to meet VEG by per cent slope for well-stocked stands"). By using the top of the perspective range of disturbance, the mid-term timber supply could increase by about 20 000 cubic metres per year, as shown in Figure 16.

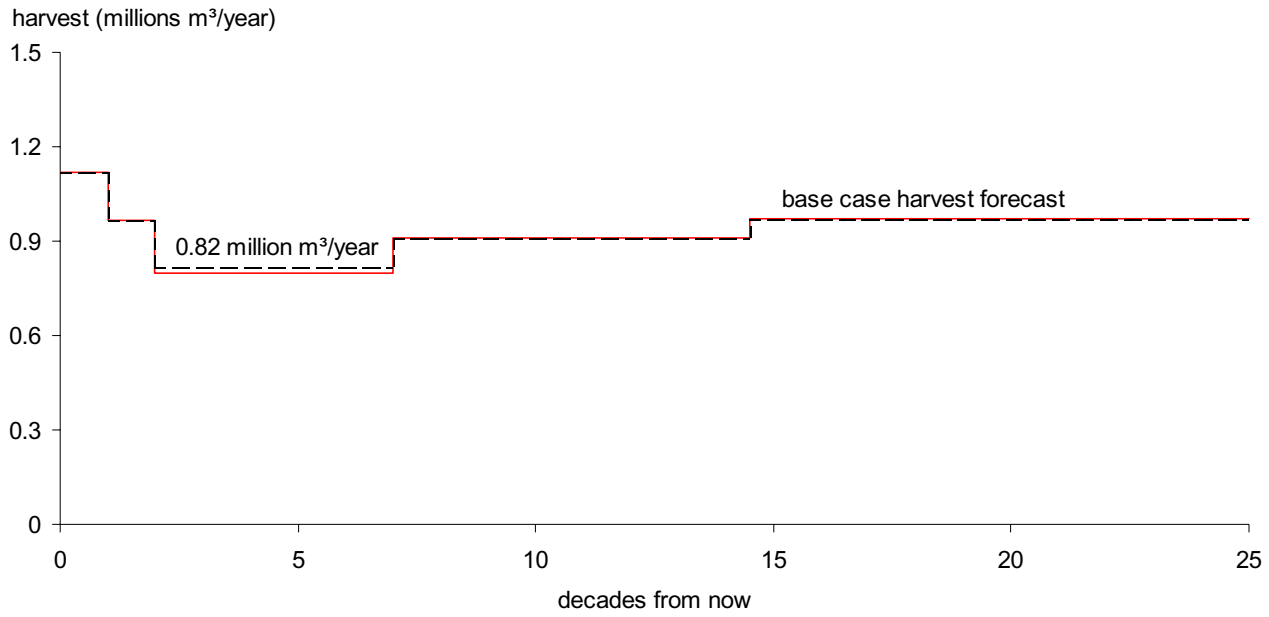


Figure 16. Harvest forecast using the maximum perspective alteration in visual areas — Strathcona TSA, 2004.

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

5.5 Uncertainty with the minimum volume required for harvest

Figure 17 portrays the timber supply implications of raising the minimum volume requirements by 100 cubic metres per hectare to 450 cubic metres per hectare. The forecast shows that the base case is sensitive to a significant increase (about 33%) in stand volume required for a stand to be considered harvestable. Maintaining the base case harvest forecast would create a deficit of eligible stands to harvest starting 35 years from now in the order of 2.7 million cubic metres. To eliminate this deficit, the initial harvest level was reduced by about 5% and the mid-term harvest level declined by about 40 000 cubic metres per year. About 6300 hectares of timber harvesting land base that is harvested in the base case is not harvested by the end of the planning horizon because they never obtain 450 cubic metres per hectare. Campbell River Forest District staff are confident that old-growth stands at the minimum volume threshold of 350 cubic metres per hectare are being harvested consistently enough in operational practice to be included in the base case.

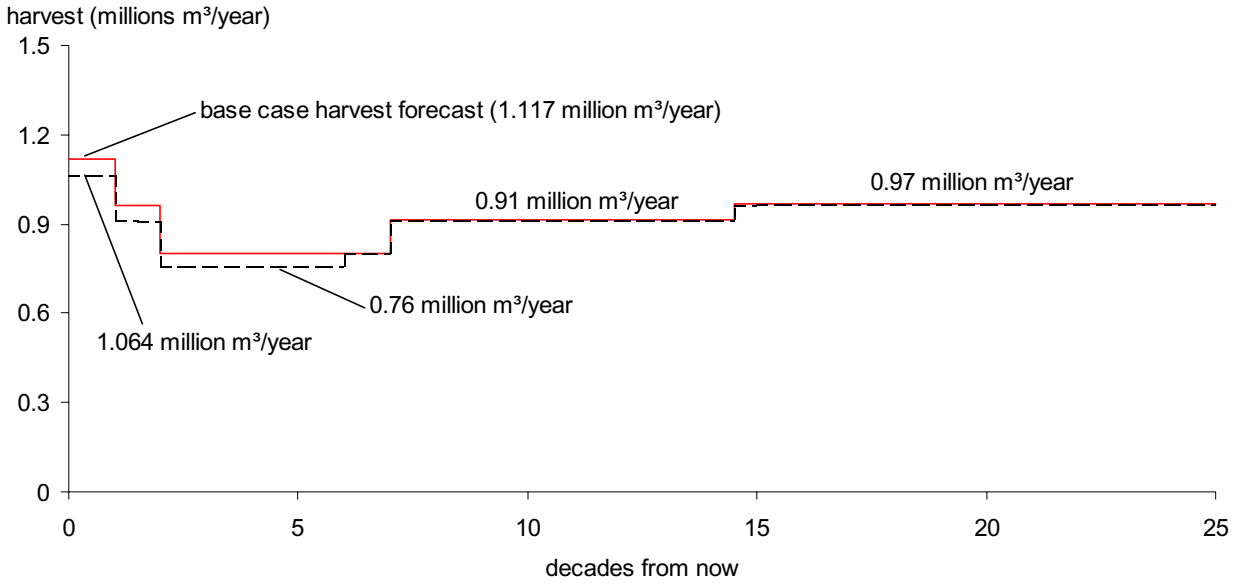


Figure 17. Harvest forecast if the minimum volume requirement is increased by 100 cubic metres per hectare — Strathcona TSA, 2004.

5.6 Uncertainty in the feasibility of harvesting operations in potentially unstable terrain

A large amount of the forest in the Strathcona TSA is in potentially unstable terrain. The previous timber supply analysis (TSR 2) assumed that a percentage of this area would be available for harvest based upon professional geotechnical advice. This percentage reflected an average feasibility to harvest within unstable terrain and did not take into account other factors that might influence the harvesting opportunity on a stand by stand basis. In this analysis the percentage of unstable terrain assumed to be eligible for harvest was the same but a maximum slope threshold of 30 degrees was also used to provide more spatial resolution to where unstable terrain would be more likely to occur. Stands above 30 degrees were assumed to be unharvestable while stands under 30 degrees were assumed to be generally harvestable (95% of them). This tended to capture a large portion of current operations in the TSA (i.e., 75% of harvesting in potentially unstable terrain has been below 35 degrees in slope).

In this sensitivity, stands possessing at least 500 cubic metres per hectare and between 30 and 40 degrees of slope were assumed to be harvestable. This increased the timber harvesting land base by approximately 20 000 hectares of land, or 13%. Figure 18 shows that the initial harvest level could increase to 1.155 million cubic metres per year before declining in the same number of steps as the base case to the mid-term harvest level of 930 000 cubic metres per year before rising to a long-term harvest level of 1.07 million cubic metres per year after 145 years. There are small amounts of harvest occurring in stands of 30 to 40 degrees in slope in this category of land. The degree to which harvesting can be consistently predicted could have significant mid-term timber supply implications.

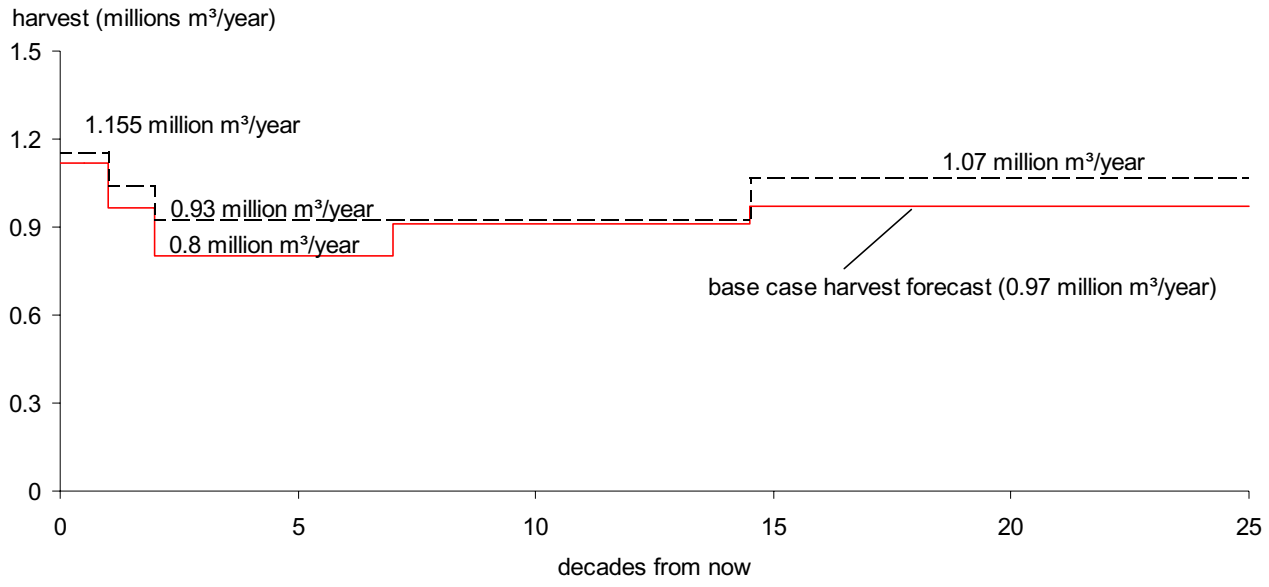


Figure 18. Harvest forecast if stands possessing at least 500 cubic metres per hectare on potentially unstable terrain between 30 and 40 degrees slope are assumed to be harvestable — Strathcona TSA, 2004.

5 Timber Supply Sensitivity Analyses

5.7 Uncertainty with IRM forest cover requirements

In the base case, the maximum allowable area below green-up requirements in the integrated resource management or enhanced resource management zone within each landscape unit was 25%. This means that for every one hectare of recent harvest in areas where only cutblock adjacency is considered in a given landscape unit, three hectares of timber harvesting land base must be at or above green-up height before more harvesting can occur. Figure 19 shows that timber supply does become limited in 45 years time if the allowable disturbance level is reduced to 20%, indicating that further reductions to the maximum allowable disturbance would significantly reduce mid-term timber supply. In the base case and sensitivity forecasts it is assumed that it is possible to harvest in all landscape units at any time, so that when the disturbance limit is reached in one area, harvesting can shift to another. If operationally it is difficult to move operations quickly between landscape units, mid-term timber supply could be impacted.

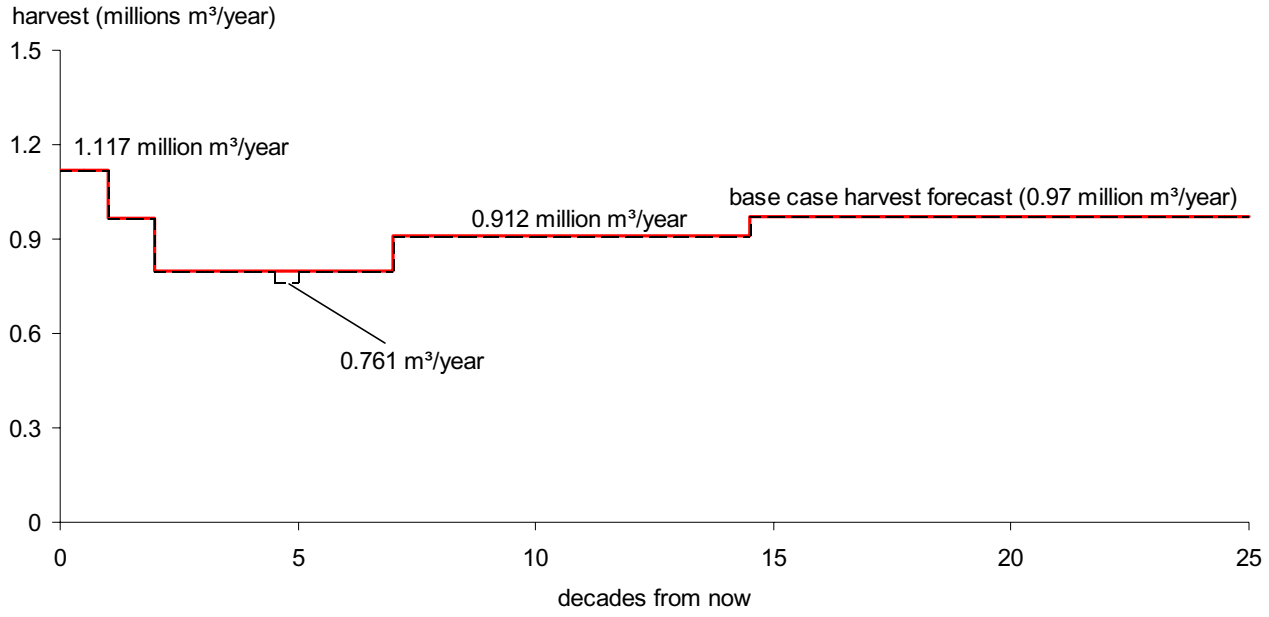


Figure 19. Uncertainty in expressing cutblock adjacency objectives — Strathcona TSA, 2004.

5.8 Uncertainty with the effects of spatial adjacency

In the base case forecast, adjacency was modelled aspatially. The timber supply modelling platform used in this analysis can represent cutblocks and model adjacency spatially. To examine the impact of using a spatial modelling approach a sensitivity analysis was carried out. Cutblocks were allowed to range in size from 2 to 40 hectares with 200 metre buffers on forest adjacent to the cutblocks. Area within the cutblock must reach 1.3 metres in height in enhanced resource management zones and 3 metres in height everywhere else before these buffers can be harvested.

Figure 20 shows that the short-term timber supply can be maintained using a spatial modelling approach but a deficit of about 1.4 million cubic metres is created in 45 years time. At the start of the sensitivity analysis, available volume and area declines from the base case level of 31 million cubic metres on about 48 000 hectares to 28 million cubic metres on 44 000 hectares, indicating that about 3 million cubic metres on 4000 hectares are tied up in adjacency buffers. This 4000 hectares was not restricted from harvest in the base case.

Second-growth harvesting occurred sooner in the spatial sensitivity providing about half of the harvest in 10 years time. This indicates that spatial patterns reduced the availability of old forest harvest as adjacency requirements needed to be met before adjacent old-growth stands could be harvested. Second-growth harvest was substituted as a result.

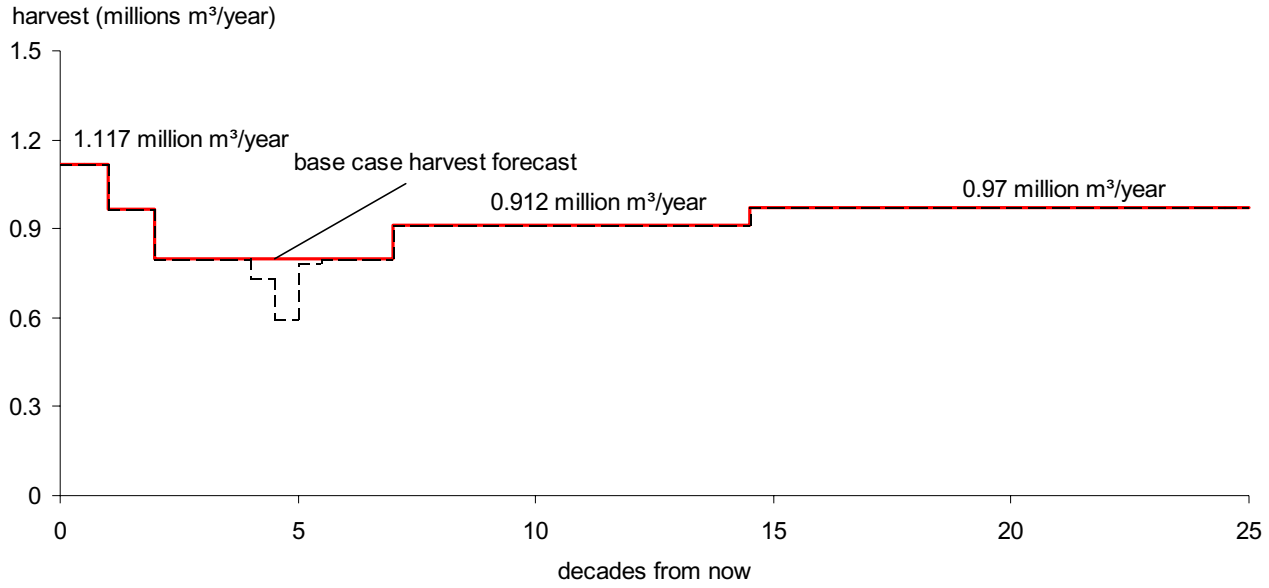


Figure 20. Influence of spatial blocking on timber supply — Strathcona TSA, 2004.

5.9 Implications of removing or projecting genetic worth

The *Forest Practices Code* requires the use of the best genetic quality seed and vegetation material source available for regeneration. The base case management assumptions use the genetic gain information available up until 2002, the date all stands have been projected to. Only fir, cedar and some hemlock stands are currently planted with genetic gain. Once the simulation starts, the 2002 information based on seed use and genetic gain are assumed to remain static and affects only stand volume (does not impact adjacency or green-up).

To examine the implications of the genetic program currently in use in the Strathcona TSA, genetic gain was removed in the derivation of standing volume and the long-dashed line in Figure 21 shows the long-term timber supply would decline by about 6% or 60 000 cubic metres per year.

Conversely if the current understanding of seed use and seedlot gains that will be available over the next 5 years is projected for use in the analysis, the long-term timber supply would increase by an additional 3% over the base case as shown by the short-dashed line in Figure 21. This sensitivity was made possible by creating genetic gain assignments based on appropriate seed zones and the seed use and the seedlot genetic gain available in a particular year. The timber supply realized through genetic gain is associated with fir, cedar and some hemlock stands. If silviculture operations shifted to planting all hemlock sites long-term timber supply would be further increased. Currently only about 59% of the timber harvesting land base has the potential for genetic gain under the seed-use guidelines and the planting regimes shown in Table A-27., "Regeneration assumptions by analysis unit."

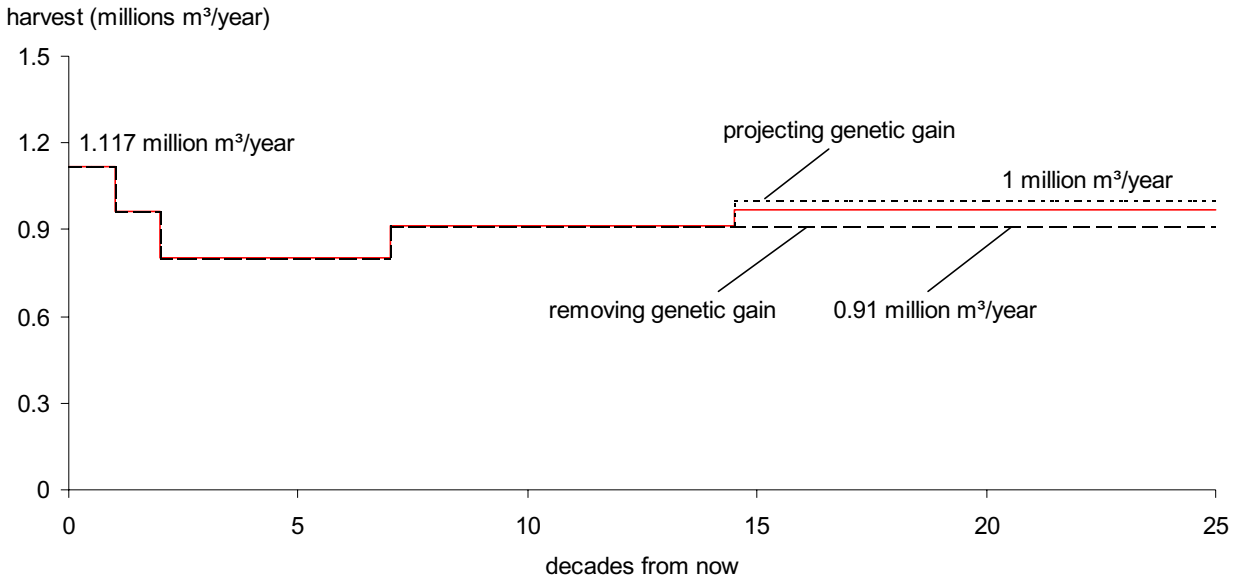


Figure 21. Sensitivity of the harvest forecast to genetic worth considerations — Strathcona TSA, 2004.

5.10 Uncertainty in the area required to meet riparian management considerations

One of the key changes in data from the last timber supply analysis is the area assumed to be required to meet riparian management. The data used in the base case was riparian mapping available through the detailed TRIM2 project. This mapping was buffered by riparian widths in a geographic information system (GIS) by classifying the riparian feature by slope class. Campbell River Forest District staff have been concerned that the mapping and buffering exercise overestimates the riparian requirements. One of the issues with the detailed TRIM2 linework is the lack of distinction between continuously flowing and intermittent streams.

If the TRIM1 linework, an earlier stream source that contained additional stream information but was less detailed (contains fewer small streams), were used, the riparian reduction required in Table 5 would drop from 26 350 hectares to 9838 hectares but, wildlife tree* retention would need to almost double in area to about 4031 hectares as portions of stands that were assumed to be retained as part of a riparian reserve in the base case are now available for harvest. The TRIM1 figure is comparable to the area figure used in TSR 2. The timber harvesting land base would increase by roughly 15 000 hectares, a 9% land base increase. Figure 22 shows the forecast if the riparian requirements have been overestimated in the base case, the initial harvest level could increase by at least 30 000 cubic metres per year with a mid-term harvest level increase of 100 000 cubic metres. This forecast is based on a similar land base to TSR 2 and produces a similar timber supply forecast.

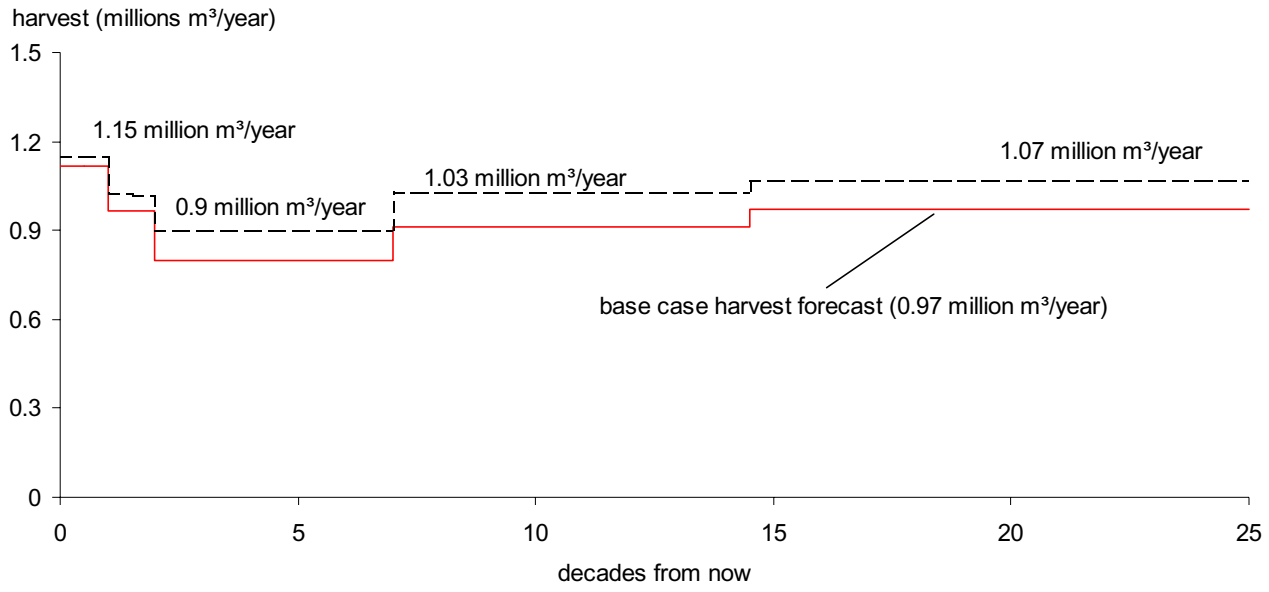


Figure 22. Sensitivity of the harvest forecast to a reduction in the area required to meet riparian management — Strathcona TSA, 2004.

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

5.11 Uncertainty in the volumes in existing natural stands

At the time of the previous AAC determination, additional information concerning existing natural stand yields was provided. This information has been assessed and the statistical information placed in two tables in the appendix, Table A-21. and Table A-22. The information was provided by the Ministry of Sustainable Resource Management. Stands on the east side (Sayward and Loughborough supply blocks) above 140 years of age were the only stands where the ground estimates were statistically different from the inventory heights and volumes. The heights in these stands were overestimated by about 8.5 metres while the volume was overestimated by an average of 30%.

A sensitivity analysis was performed which applied a volume adjustment of 30% on stand volume estimates for these stands, reduced the total initial inventory on the timber harvesting land base by 1.4 million cubic metres, or about 3%. This translated into an average timber supply reduction of just over 28 000 cubic metres per year and this can be seen by the dashed line in Figure 23. An additional sensitivity analysis was performed whereby yields were assumed to be 5% higher than the base case. The initial harvest level in this sensitivity could increase by 5% with a slightly higher mid-term harvest level than the base case as shown by the dotted line in Figure 23.

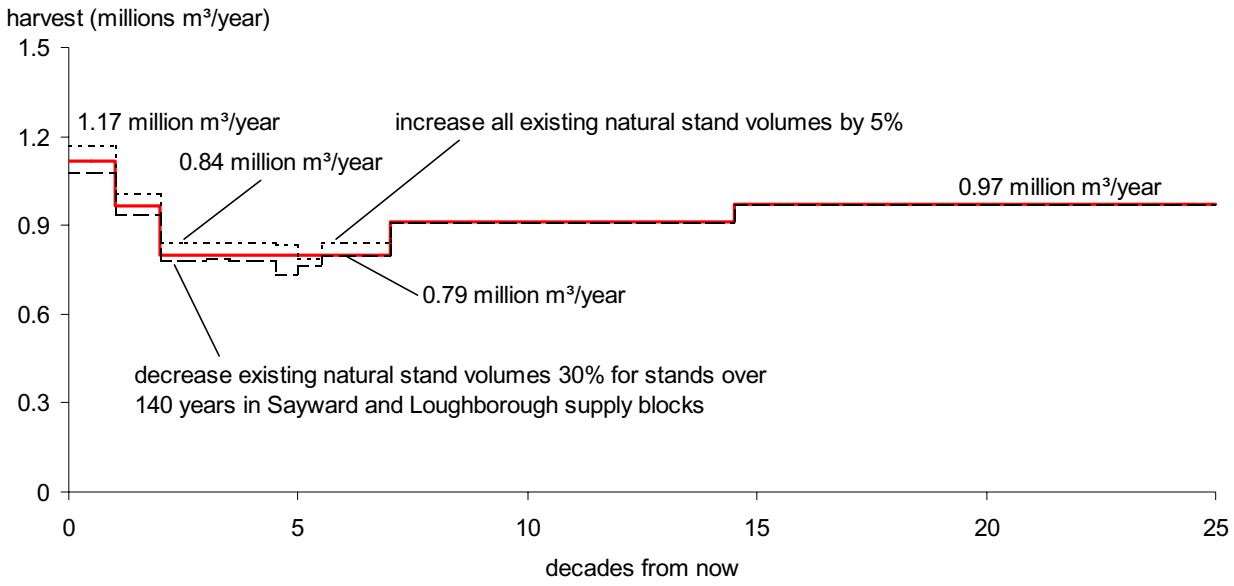


Figure 23. Sensitivity of the harvest forecast to changes in existing natural stand volume — Strathcona TSA, 2004.

5.12 Implications of natural disturbance based succession using the *Biodiversity Guidebook* return intervals

The base case forecast assumes no disturbance in forests outside of the timber harvesting land base. The *Biodiversity Guidebook* defines natural disturbance types (NDT)* based on the return interval of stand replacing events. For the sensitivity analysis shown in Figure 24, the return intervals have been used to create an expected rate of stand replacing events to be applied to forests outside the timber harvesting land base within each BEC variant. Because most of the Strathcona TSA is in natural disturbance type (NDT) 1 and 2 which have stand types that are long lived, stands within 100 years of the old forest age or older were assumed to be eligible to experience a stand replacing event. The forecast shows a deficit of just under one million cubic metres and indicates that the base case is not highly sensitive to the level of natural disturbances suggested by the *Biodiversity Guidebook*.

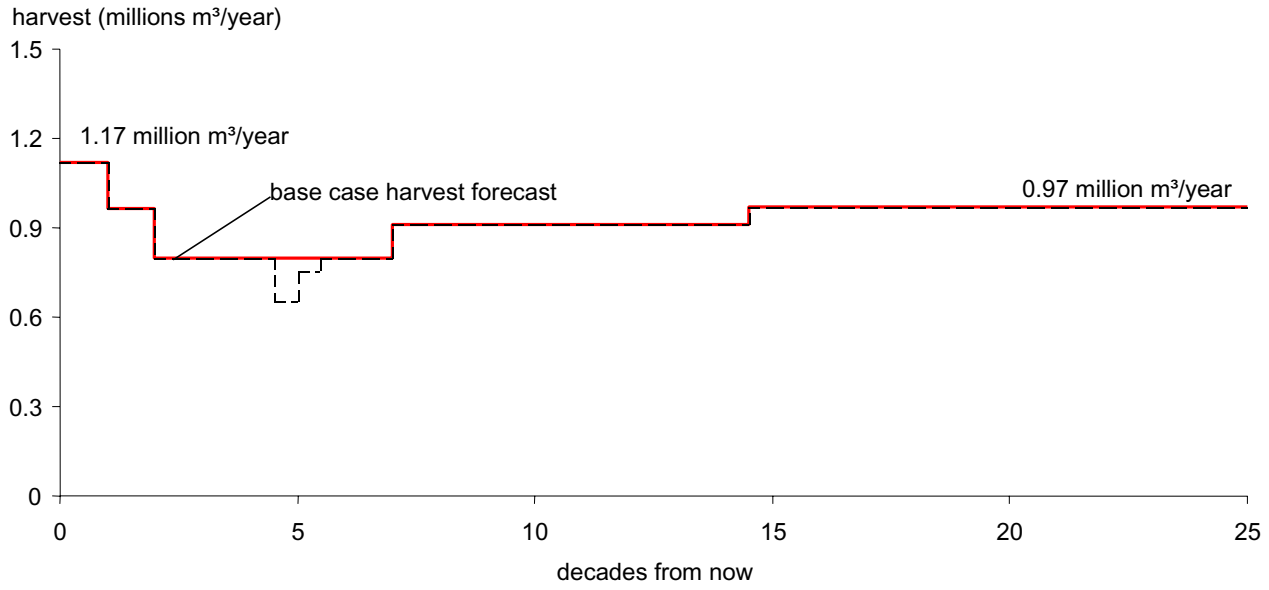


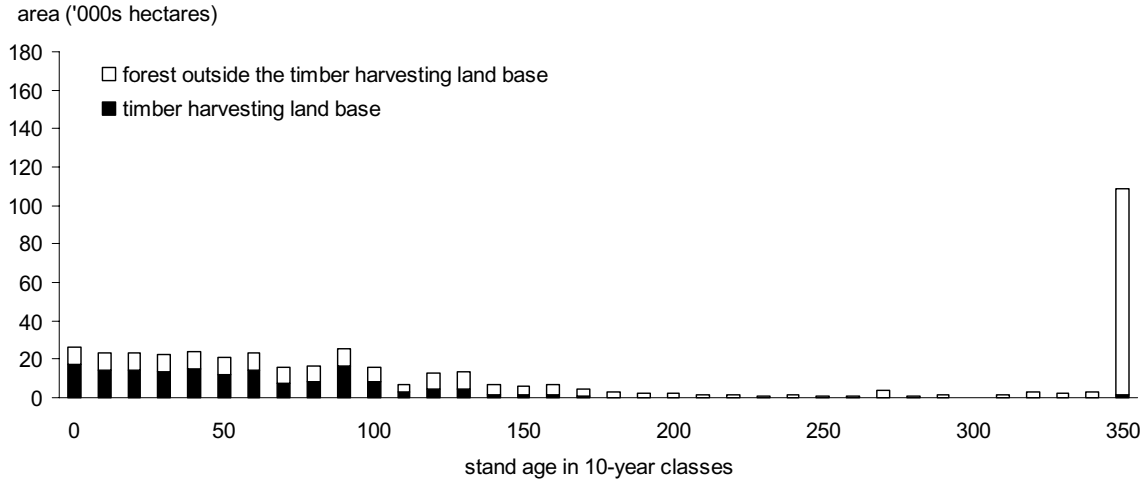
Figure 24. Sensitivity of the harvest forecast to natural disturbance outside of the timber harvesting land base — Strathcona TSA, 2004.

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.

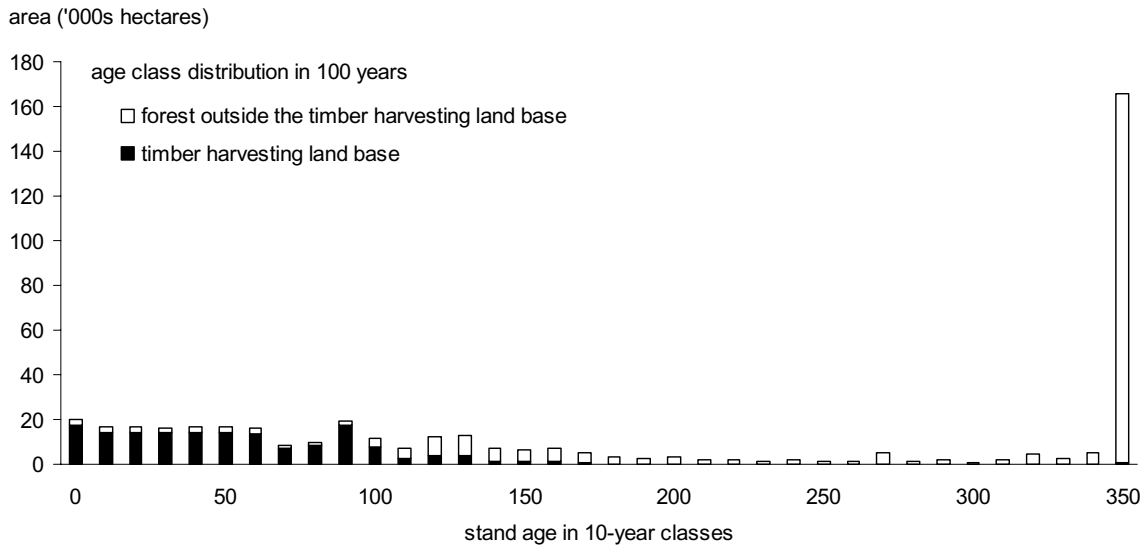
5 Timber Supply Sensitivity Analyses

Figure 25 compares the age class distributions 100 years from now, for the natural disturbance sensitivity analysis and the base case. The modelled natural disturbance resulted in a uniform distribution of area in younger ages outside of the timber harvesting land base (Figure 25a) relative to the base case (Figure 25b). Using the *Biodiversity Guidebook* return intervals, about 900 hectares could be expected to be affected annually by natural disturbance outside of the timber harvesting land base. The equivalent of about 860 hectares per year was in stands under 50 years of age are in the current age class distribution (Figure 4), which is a similar area meaning that the approach used in the sensitivity analysis is likely a reasonable estimation of future losses.

While the amount of natural disturbance outside of the timber harvesting land base is uncertain, the disturbance rate can affect timber supply and other management objectives. For example, if stands cannot be expected to remain on the landscape indefinitely, definition of old-growth management areas and assignment of visual management regimes could be affected.



(a) Age class composition at 100 years assuming natural disturbance outside the timber harvesting land base.



(b) Base case age class composition at 100 years assuming no natural disturbance.

Figure 25. Age class composition at 100 years assuming natural disturbance — Strathcona TSA, 2004.

5.13 Implications of simultaneously changing riparian requirements, site productivity, existing stand yields and natural disturbance

During preparation of the analysis report, several data elements which introduce particular uncertainty to the AAC decision were deemed to be important enough to combine to produce a composite sensitivity analysis. These are:

- riparian requirements based on TRIM 1 mapping;
- SIBEC site productivity estimates and further extrapolations where TEM is unavailable;
- reductions to old-growth volumes in the eastern portion of the Strathcona TSA;
- natural disturbance in stands outside of the timber harvesting land base.

Figure 26 shows the timber supply implications of this combination. While both site productivity and reduced riparian requirements have been shown in previous sensitivity analyses to have a positive impact in the mid-term, the other two data elements; reductions in old-growth volume in the eastern portion of the TSA and natural disturbance have been shown to reduce the mid-term harvest. The net result is a mid-term harvest about 70 000 cubic metres per year higher than the base case. Long-term timber supply is increased by 34% in this sensitivity as the land base is larger and more productive than was assumed in the base case. The additional volume in the mid-term can be accessed earlier in time but the mid-term would need to decline as the small disruption in supply in fifty years would increase and limit the mid-term harvest level.

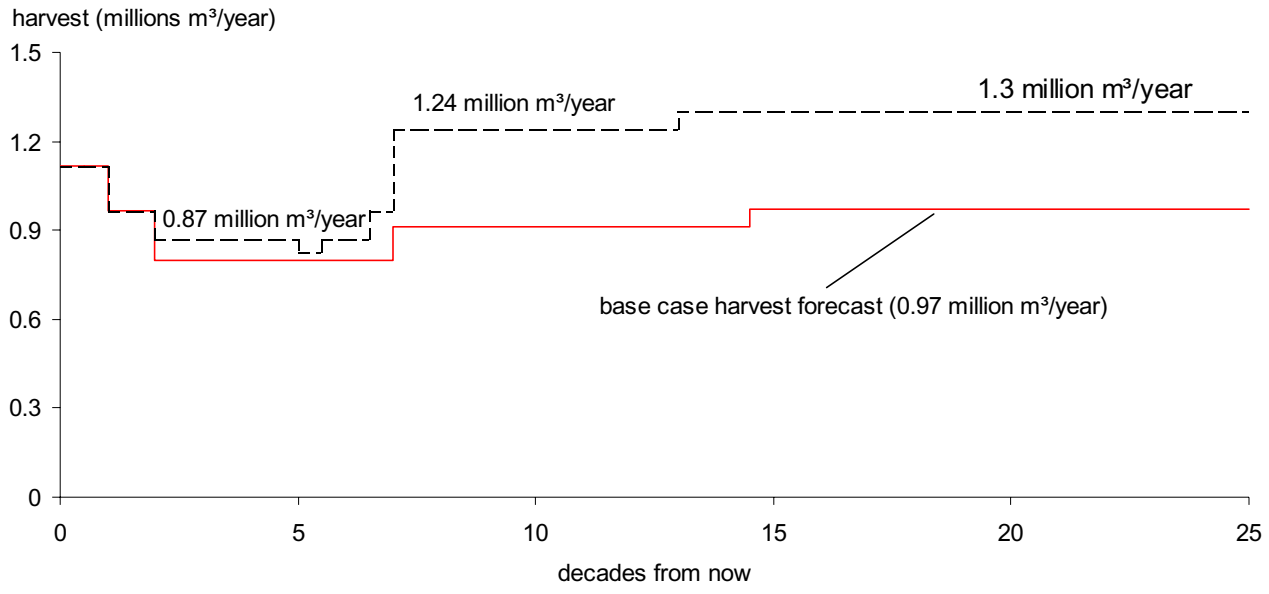


Figure 26. Sensitivity of the harvest forecast to simultaneously changing riparian requirements, site productivity, existing stand old-growth yields on the east side of the TSA and introducing natural disturbance to stands outside of the timber harvesting land base — Strathcona TSA, 2004.

6 Summary and Conclusions of the Timber Supply Analysis

The results of the timber supply analysis suggest that under current management assumptions, the current AAC cannot be maintained without impacting the mid-term significantly and, some downward adjustment to the current AAC may be necessary as a result. The analysis also highlights the significant transition points that can be expected between old forest and second growth and then the onset of the harvest of managed stands.

To facilitate a summary of the sensitivity analyses, Table 6 was prepared to describe the short-, mid- and long-term harvest levels. In some cases, the mid- or long-term are the average harvest when the forecast was shown without flowing the timber supply disruptions.

The table highlights that the issues and uncertainties most important to defining short- and mid-term timber supply are: the amount of area that needs to be set aside to protect riparian areas or potentially unstable terrain; the productivity of managed stands; the criteria that define when a stand is merchantable and which stands are chosen for harvesting first.

Issues and uncertainties most important to defining long-term timber supply are: the productivity estimates of managed stands; the harvest of high volume rather then older stands first, and the amount of area that needs to be set aside to protect riparian and potentially unstable terrain.

6 Summary and Conclusions of the Timber Supply Analysis

Table 6. Summary information from the timber supply sensitivity analyses — Strathcona TSA, 2004.

Report section	Harvest forecast description	Harvest level (millions cubic metres per year)		
		Short term 0-10 years	**Mid term 21-70 years**	**Long term > 70 years**
4.1	Base case harvest forecast	1.12	0.8	0.91
5.1	Alternative harvest flow	1.278	0.73	0.91
		0.87	0.87	0.87
5.2	Implications of using site index assignment for managed stands based on TEM/SIBEC			
	Stands after first harvest	1.12	0.80	1.12
	Stands after first harvest and stands currently less than 20 years	1.12	0.83	1.12
5.3	Implications of volume per hectare based merchantability			
	Stands ordered similar to the base case	1.12	0.87	0.87
	Stands ordered by volume per hectare	1.278	0.8	0.90
5.4	Implications of using the maximum perspective alteration in visual quality areas	1.12	0.82	0.91
5.5	Uncertainty with the minimum volume required for harvest	1.064	0.76	0.91
5.6	Uncertainty in the feasibility of harvesting operations in potentially unstable terrain	1.155	0.927	0.927
5.7	Uncertainty with IRM forest cover requirements	1.12	0.80	0.91
5.8	Uncertainty with the effects of spatial adjacency	1.12	0.77	0.91
5.9	Removing genetic gain from timber supply	1.12	0.8	0.91
	Projecting future gains and seed use	1.12	0.8	0.91
5.10	Uncertainty with the area required to meet riparian management considerations	1.15	0.9	1.03
5.11	Existing natural stand yields reduced to reflect the results of the inventory audit	1.08	0.79	0.91
	Existing natural stand yields increased by 5%	1.17	0.83	0.91
5.12	Implications of natural disturbance based succession using the *Biodiversity Guidebook* return intervals	1.12	0.78	0.91
5.13	Simultaneously changing the riparian requirements, site productivity, reducing existing stand old-growth yields on the east side of the TSA and including natural disturbance in stands outside of the timber harvesting land base	1.12	0.87	1.24

7 Socio-Economic Analysis

The potential impact of timber supply adjustments on local communities and the provincial economy is an important consideration in the timber supply review. This section examines the socio-economic implications of the "base case" harvest flow in the Strathcona TSA. Base case harvest levels are those that can be sustained over time given the current forest management regime.[1] The analysis compares the level of forestry activity currently supported by the TSA timber harvest to the level of activity that could be supported as the Strathcona timber supply approaches its long-term harvest level.

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.

7.1 Socio-economic setting

7.1.1 Current population and demographic trends

The Strathcona TSA is part of the Campbell River Forest District and in 2001 had a population of 92,052 — a decline of 1.7% since 1996 (see Table 7). Most of this population decline occurred in the more resource dependent towns of Gold River, Tahsis and Sayward. Even the communities of Comox and Courtney, which had significant increases between 1991 and 1996 had only modest increases in population.

Forecasts for the Comox-Strathcona Regional District, which includes the Strathcona TSA, indicate a population increase of about 0.7%[2] by 2004.

Table 7. Population statistics, Strathcona TSA

Communities	Population 1996 census	Population 2001 census	% change 1996-2001
Campbell River	28,851	28,456	-1.4
Courtenay	17,404	18,304	5.2
Comox	11,069	11,172	0.9
Cumberland	2,548	2,618	2.7
Gold River	2,041	1,359	-33.4
Tahsis	940	600	-36.2
Sayward	440	379	-13.9
Zeballos	232	224	-3.4
Electoral Area G[a]	205	156	-23.9
Total — Campbell River Forest District	93,620	92,052	-1.7

(a) Electoral Area G includes Kyuquot, Esperanza, Ceepeecee and other rural areas.

Source: BC STATS, with 1996 and 2001 Census data. Using 2001 Census geography.

(1) The timber supply review and the socio-economic analysis do not consider the implications of changes in the resource management regime and land use.

(2) BC STATS, Population Section.

7.1.2 Economic profile

Current Economic Structure

Labour force data[3] indicate that from 1995-2000 the labour force in the Campbell River Forest District has declined by about 5%. Direct employment in forestry has declined by over 16% during the same period.

Economic dependency estimates developed by BC STATS provide the best indication of the "basic" sectors* making up the structure of, and drive local economies.[4] The most notable changes between 1996 and 2000 in the district's economic dependency reflected forestry's decline in employment, and the increasing dependence on the public sector.

In 2001, as Figure 27 illustrates, the key sources of basic employment in the Strathcona TSA are the public sector (including education, health, and other federal, provincial and local public services) forestry, and travel and tourism[5].

Forestry accounts for about 21% and the public sector about 34% of total employment in the district. Travel and tourism-related employment, including accommodation, and parts of food, retail trade and other sectors, accounts for about 15% of total employment.

Employment income is also a good indicator of a sector's contribution to the economy. For example, forestry employs 21% of total employment and contributes 20% of income. The public sector while employing 34% of total employment contributes 26% of income, and the tourism sector, which employs 15% of total employment, provides 7% of basic income.

Non-employment related dependency refers to the jobs that rely on spending related to pension and investment income, employment insurance, and other transfer payments. This type of non—employment related income accounts for over 33% of the total income flowing within the Campbell River Forest District and supports an estimated 8.3% of the total employment. This reflects the large retirement population and illustrates the spending power associated with this growing sector.

Basic sector
Sectors of the economy, such as forestry, tourism and mining, that create flows of income into the region and are assumed to be drivers of the local economy. Non-basic sectors, such as retail outlets, are supported by basic sectors.

(3) Horne, Garry. 1999. The 1996 Forest District Tables. BC Stats, Ministry of Finance and Corporate Relations. Horne, Garry. 2004. "2001 Economic Dependency Tables for Forest Districts", B.C. Ministry of Management Services.

(4) Basic sector employment is derived from, but is defined differently than labour force data. For example, basic employment excludes unemployed and includes both direct and indirect employment generated by basic sector companies purchasing inputs and other goods and services. The public sector is treated as a basic sector because the level of activity is largely determined by factors external to the local economy. Total employment attributable to each basic sector is used in this report. See Horne, Garry. 2004. *British Columbia's Heartland At the Dawn of the 21st Century: 2001 Economic Dependencies and Impact Ratios for 63 Local Areas*. B.C. Ministry of Management Services.

(5) Travel and tourism reflects business and spending activity catering to both business travellers and tourists.

7 Socio-Economic Analysis

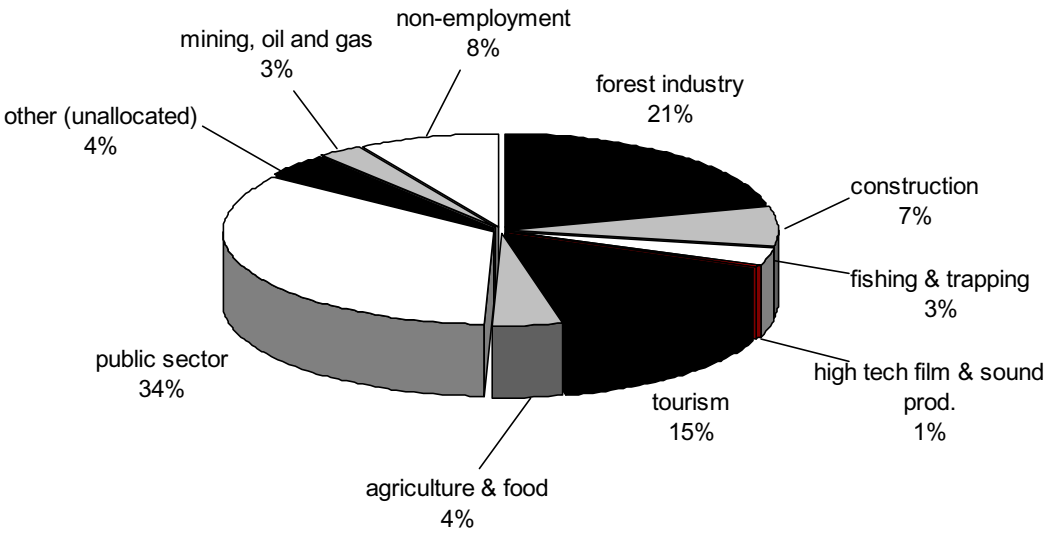


Figure 27. Total employment by sector, Campbell River Forest District, 2001.

7 Socio-Economic Analysis

7.2 Strathcona TSA forest industry

7.2.1 Current allowable annual cut and apportionment

The current allowable annual cut (AAC) for the Strathcona TSA is 1 278 000 cubic metres, effective January 1, 2000. From 1996 to the end of 1999 the AAC was set at 1 420 000 cubic metres. The current AAC is apportioned to various licence types, as summarized in Table 8.

Table 8. Allowable annual cut by licence type, Strathcona TSA

Type of licence	Current AAC	% of total
Forest Licences (replaceable)	915 748	71.7
Forest Licences (non-replaceable)	92 331	7.2
BC Timber Sales (BCTS)	208 397	16.3
TSL replaceable	17 845	1.4
Forest Service Reserve	29 639	2.3
Woodlot Licence* (unapportioned)	14 040	1.1
Total allowable annual cut	1 278 000	100.0

Source: Ministry of Forests, Resource Tenures and Engineering Branch.
Report effective date: 2004-06-16.

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.*

7.2.2 Strathcona TSA harvest history

Table 9 summarizes the volume of timber harvested in the Strathcona TSA from 1999 to 2002.

While the AAC sets the maximum permissible harvest level, the actual volume of timber harvested in a particular year determines the level of economic activity. If actual annual harvest levels are consistently lower than the AAC, then forestry activity is below its full potential. The harvest statistics indicate that recent actual annual harvests in the TSA have been very close to the apportioned volume.

Table 9. Volume billed, by licence type, 1999 – 2002 (cubic metres), Strathcona TSA[a]

Type of licence	1999	2000	2001	2002	1999 – 2002 average
Forest licences	937,535	1,222,665	925,347	899,344	996,223
BC Timber Sales (BCTS)	313,000	386,141	293,662	293,662	321,616
TSL replaceable	8,888	70,948	7,750	5,551	23,284
Other[b]	175	206	338	323	261
Total harvest	1,259,598	1,679,960	1,253,892	1,198,880	1,348,083
Total allowable annual cut	1,420,000	1,278,000	1,278,000	1,287,000	1,287,000

Source: Ministry of Forests, Revenue Branch.

(a) The table provides volumes of timber volumes billed from the Strathcona TSA only. Timber harvested from tree farm licences, woodlots, and private land is not included.

(b) "Other" consists of cutting authorities such as rights-of-way, road permits and other small temporary permits.

7.2.3 Strathcona TSA major licensees and processing facilities

There are seven replaceable forest licences in the Strathcona TSA and three non-replaceable forest licences. Table 10 provides AAC and recent harvest data for these licences.

Table 10. Volumes billed by forest licence holders, 2000 – 2002, in cubic metres

	AAC	2000	2001	2002	Average
Weyerhaeuser Co. Ltd. (2 licences)	87,325 8,000	118,238	82,293	115,670	105,400
Doman-Western Lumber Ltd.	355,814	351,836	216,693	155,326	241,285
International Forest Products	242,979	313,089	282,416	436,478	343,994
Canadian Forest Prod. Ltd.	107,282	182,224	140,727	69,269	130,740
Hecate Logging Ltd.	58,609	73,735	33,389	31,806	46,310
TFL Forest Ltd. (2 licences)	25,376 38,363	120,790	125,305	49,479	98,525
Nootka First Nations Forest	17,883	0	16,267	0	5,422
Nootka Sound Development	35,766	53,549	28,257	41,317	41,041
Total	915,748	1,213,461	925,347	899,344	1,012,717

Source: Ministry of Forests, Revenue Branch.

In 2003, 11 lumber mills operated in the Campbell River Forest District. TimberWest Forest Ltd. operates a lumber mill north of Campbell River and International Forest Products Ltd. (Interfor) operates a mill in Courtenay. Both are medium sized facilities with annual capacities of over 100 million board feet.

The NorskeCanada Ltd. pulp and paper mill is also located just north of Campbell River and has an annual capacity to produce close to 900 metric tonnes of pulp and over 600 metric tonnes of paper.

The Campbell River Forest District is also home to six shake and shingle mills, a post mill, and a chip mill.

From 2001-2003, the solid wood mills consumed on average about 1.5 million cubic metres of timber per year. In 2003, the total number of employees supported at these mills was about 1,600 people. From 2001 to 2003, these mills employed on average about 1,625 people, both full- and part-time. This level of employment is about 900 less than the number employed in 1996. Given that logs flow to this area from various management units, not all of this employment can be attributed to the Strathcona TSA timber supply.

7.2.4 Forestry sector employment and employment coefficients

Employment coefficients* developed for the previous timber supply review analysis, expressed as full-time jobs or person-years of employment per 1000 cubic metres of harvest, are summarized in Table 11. TSA coefficients include residents of the Strathcona TSA who are supported by timber harvesting and processing in the TSA. Provincial coefficients include all residents of the province that rely on the Strathcona TSA timber supply, including those within the TSA.

Employment is divided into direct, indirect and induced components, the sum of which is the total impact. TSA level indirect and induced employment estimates were updated based on multipliers developed by BC STATS. See Appendix B for more information regarding employment coefficients and multipliers.

Table 11. Direct, indirect and induced employment and employment coefficients, Strathcona TSA[a]

Forest industry activity	TSA employment (person-years)	TSA coefficients (person-years/ '000s m^3)	Provincial employment (person-years)	Provincial coefficients (person-years/ '000s m^3)
Harvesting	372	0.27	634	0.46
Silviculture	41	0.03	96	0.07
Processing	303	0.22	1,075	0.78
Total direct	716	0.52	1,805	1.31
Indirect + induced[b]	455	0.33	2,259	1.64
Total employment	1,171	0.85	4,064	2.95

(a) Employment estimates are reported in person-years. Coefficients are based on results of industry survey undertaken for the *Strathcona TSR Analysis Report* (December, 1998). Employment estimates are based on an average 2000-2002 harvest of 1 377 577 cubic metres.

(b) Indirect and induced impacts for the TSA were updated based on Horne, G. 2004. "2001 Economic Dependency Table for Forest Districts". The TSA indirect and induced coefficients reflect the mid-point of migration and no-migration TSA level multipliers for timber harvesting and processing. Provincial coefficients have not been updated and reflect data use in the *Strathcona TSR Analysis Report* (December 1998).

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.

7.2.5 Strathcona TSA forestry employment income and government revenues

In 2001, the average after-tax annual income for direct forestry employees is about $40,657 and indirect and induced average annual incomes, $22,000.[6] The Strathcona TSA's timber harvest generates approximately $73.4 million in direct after-tax employment income and an additional $49.7 million of indirect and induced after-tax income.

Provincial government revenues from the forest industry related to harvest levels come from two main sources:

- stumpage, royalties and rent payments; and
- income taxes paid by those who are employed in the industry.

As shown in Table 12, between 2000 to 2002, the timber harvest in the Strathcona TSA contributed an estimated $27.5 million in stumpage and related payments annually to the provincial government. In addition, the provincial government received approximately one-third of the $12.9 million in income taxes paid by forestry sector and related employees.

Table 12. Estimate of provincial revenues, Strathcona TSA, 1998-2002

	Estimated provincial revenues ($ million)	Provincial revenue ($ per '000 cubic metres)
Stumpage and related revenues[a]	27.5	19,977
Employment income taxes[b]	4.4	3,194
Total	31.9	23,171

(a) Ministry of Forests, Revenue Branch. Includes stumpage, royalties and rents.

(b) 2001 Economic Dependency Tables for Forest Districts.

(6) Horne, Garry. 2004. "2001 Economic Dependency Tables for Forest Districts", B.C. Ministry of Management Services.

7.3 Socio-economic implications of the base case harvest forecast

The base case harvest flow projection indicates that the current AAC of 1.278 million cubic metres cannot be maintained. In the first decade, the timber supply is projected to decline to 1.117 million cubic metres, in the second decade to 965 000 cubic metres and in the third to 800 000 cubic metres. This socio-economic analysis will focus on the initial 20-year period.

7.3.1 Employment, income and government revenue implications of base case harvest levels

The socio-economic analysis considers average levels of forest industry related activity that the base case forecast could support. Impacts associated with future projected harvest levels are calculated using employment, income and revenue coefficients (per 1000 cubic metres). This method assumes that the current role of the forest industry in the provincial economy and labour productivity will not change. For example, employment levels in the future can be predicted based on today's relationship between employment and the volume of timber harvested and processed. The analysis also assumes that the proportions of harvesting, silviculture and timber processing employment will remain constant and that the types and proportions of wood products manufactured will remain the same.

While this method is reasonably accurate for short-term forecasts (within the next five years), employment coefficients 20 years from now may differ as a result of changes in market conditions, timber-processing technologies, etc. The analysis indicates the magnitude of impacts to employment, employment income and provincial government revenues, within a constantly changing socio-economic environment.

Strathcona TSA socio-economic assessment

Since 1993, the Strathcona TSA AAC has been declining and the timber supply analysis indicates this trend will continue. Employment in the logging and forestry services sector associated with Strathcona TSA harvesting has also declined, although in the Campbell River forest district the reduction between the 1996 and 2001 Census was marginal. These forest district loggers may be working in various areas along the coast, however. Processing employment has also declined since 1996 by roughly 900 jobs.

Over the next two decades the timber supply from the Strathcona TSA will support 160 fewer person-years of employment within the TSA. See Table 13.

Provincial socio-economic assessment

Provincial employment includes all forestry sector employment supported by the timber harvested from the Strathcona TSA, including those who live and work within the TSA and those who reside outside the TSA. Similar to the TSA level impacts, employment associated with the Strathcona TSA should be expected to decline. Direct provincial employment associated with the Strathcona TSA timber supply could decline by as much as 400 person-years over the next two decades. See Table 13.

7 Socio-Economic Analysis

Table 13. Strathcona TSA socio-economic impacts of base case harvest forecast

	Economic impact of current AAC	Potential economic impact of projected timber supply[a]	
		Decade 1	Decade 2
Current AAC / future timber supply	1,278,000	1,118,000	965,000
Current harvest level (2000-02 average)	1,377,577		
Difference from current AAC	99,577	(160,000)	(313,000)
Strathcona TSA			
Employment		**(person-years)**	
Direct	652	570	492
Indirect + induced	491	429	371
Total	1,143	1,000	863
Potential direct employment gain (loss) in each decade		(82)	(78)
Employment income		**($2001 million per year)**	
Direct	26.5	23.2	20.0
Indirect + induced	10.8	9.4	8.2
Total	37.3	32.6	28.2
Province[b]			
Employment		**(person-years)**	
Direct	1,674	1,465	1,264
Indirect + induced	2,096	1,834	1,583
Total	3,770	3,298	2,847
Potential direct employment gain (loss) in each decade		(210)	(200)
Employment income		**($2001 million per year)**	
Direct	68.1	59.5	51.4
Indirect + induced	46.1	40.3	34.8
Total	114.2	99.8	86.2
Provincial government revenues		**($2001 million per year)**	
Stumpage & related payments	25.5	22.3	19.3
Employee income taxes	4.1	3.5	3.1
Total	29.6	25.8	22.4

(a) Assumes market, technology and other factors will permit harvest and use of currently unutilized timber (i.e., the difference between the AAC and the average harvest.

(b) Provincial employment and income estimates include TSA employment and income.
All estimates based on data in Section 7.2.4 and 7.2.5.

7.3.2 Implications for processing facilities in the Strathcona TSA

Strathcona TSA mills process approximately 1.5 million cubic metres of timber annually. The TSA harvest represents about 90% of this volume processed; however, because of the large movement of timber on the coast not all of the TSA harvest supports local mills. Additional sources include adjacent TSAs and TFLs.

Throughout the coast companies will be seeking greater efficiencies in production. This trend combined with timber supply reductions will continue to contribute to a restructuring of the coastal forest industry.

7.3.3 Community impacts

The Strathcona TSA relies on the forest industry for a substantial portion of its economic activity. The base case timber supply projection indicates that the forestry sector will continue to decline in both absolute and relative terms. These changes will affect the communities within the TSA differently with more remote communities with greater ties to forestry potentially being more adversely affected. Communities along the east coast of Vancouver Island will continue to do the best, relying on more easy access to transportation routes and other sectors such as retirement and tourism.

7.4 Summary

The forest industry is the largest private sector source of basic income in the Strathcona TSA economy.

Within the Strathcona TSA, the current AAC supports an estimated 1,143 person-years of employment annually (includes direct, indirect and induced jobs*) and $37.3 million in employment income. Provincially, it supports 3,770 full-time jobs, $114.2 million in employment income and $29.6 million in gross provincial revenues.

The base case harvest forecast for the Strathcona TSA indicates that within the first two decades the timber supply will decline. In the first decade that could mean a reduction of over 200 person-years of direct employment across the province, about 40% of this reduction may occur within the 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.

8 References

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Horne, Garry. 2004. British Columbia's Heartland At the Dawn of the 21st Century: 2001 Economic Dependencies and Impact Ratios for 63 Local Areas. B.C. Ministry of Management Services.

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.

Basic sector — Sectors of the economy, such as forestry, tourism and mining, that create flows of income into the region and are assumed to be drivers of the local economy. Non-basic sectors, such as retail outlets, are supported by basic sectors.

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

Commercial thinning — A silviculture treatment that 'thins' out an overstocked stand by removing trees that are large enough to be sold as products such as poles or fence posts (see also, **Juvenile spacing**). It is carried out to improve the health and growth rate of the remaining crop trees.

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.

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.

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.

9 Glossary

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.
Forest type	The classification or label given to a forest stand, usually based on its tree species composition. Pure spruce stands and spruce-balsam mixed stands are two examples.
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.
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.
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. 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.

9 Glossary

Karst features	Karst is a distinctive topography that develops as a result of the dissolving action of water on carbonate bedrock (usually limestone, dolomite or marble). Karst features include fluted rock surfaces, vertical shafts, sinkholes, sinking streams, springs, complex sub-surface drainage systems and caves.
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.
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.
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.
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.

9 Glossary

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.
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.
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.
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.
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.
Ungulate	A hoofed herbivore, such as deer.

9 Glossary

Unsalvaged losses	The volume of timber killed or damaged annually by natural causes (e.g., fire, wind, insects and disease) that is not harvested.
Variable Density Yield Prediction model	An empirical yield prediction system supported by the Ministry of Sustainable Resource Management, 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 species composition.
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

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 Strathcona 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

The following data sources will be consulted during this timber supply review.

Table A-1. Inventory information

Data	Unit	Source	Vintage	Update	Scale
Forest cover	Kyuquot TSB	Ministry of Sustainable Resource Management	1987	2001	1:20 000
	Sayward TSB	Ministry of Sustainable Resource Management	1991	2001	1:20 000
	Loughborough TSB	Ministry of Sustainable Resource Management	1991	2001	1:20 000
Operability mapping	Strathcona TSA	Ministry of Forests	1997	None	1:20 000
BEC variant	Strathcona TSA	Ministry of Sustainable Resource Management	1987	1994	1:250 000
Visual landscape inventory	Kyuquot TSB	Ministry of Forests	2001	2001	1:50 000
	Sayward TSB	Ministry of Forests	2001	2001	1:50 000
	Loughborough TSB	Ministry of Forests	2001	2001	1:50 000
Terrain stability mapping	Kyuquot TSB	Ministry of Forests	1992	1998	1:20 000
	Sayward TSB	Ministry of Forests	1993	1998	1:20 000
	Loughborough TSB	Ministry of Forests	1993	1998	1:20 000
ESA mapping	Kyuquot TSB	Ministry of Sustainable Resource Management	1992	None	1:20 000
	Sayward TSB	Ministry of Sustainable Resource Management	1977	None	1:20 000
	Loughborough TSB	Ministry of Sustainable Resource Management	1977	None	1:20 000

(continued)

A.1 Inventory Information

Table A-1. Inventory information (concluded)

Data	Unit	Source	Vintage	Update	Scale
Recreation features inventory	Kyuquot TSB	Ministry of Forests	1991	None	1:50 000
	Sayward LU	Ministry of Forests	2001	None	1:50 000
	Remainder of Sayward TSB	Ministry of Forests	1993	None	1:50 000
	Loughborough TSB	Ministry of Forests	1995	None	1:50 000
Karst features inventory	Strathcona TSA	Ministry of Forests	1995	None	1:50 000
Draft landscape units	Strathcona TSA	Ministry for Sustainable Resource Management	1997	2002	1:50 000
Resource management zones	Vancouver Island	Ministry of Sustainable Resource Management	2000	None	1:250 000
Community watersheds	Strathcona TSA	Ministry of Sustainable Resource Management	1995	None	1:50 000
Ungulate winter range	Sayward LU	Ministry of Sustainable Resource Management	2001	None	1:20 000
Wildlife habitat areas	Patterson Lake	Ministry of Sustainable Resource Management	2002	None	1:20 000
Archaeological data		Ministry of Sustainable Resource Management			
Seed planning units version 2		Ministry of Forests	2003		1:250 000

Data source and comments:

The forest inventory to be used in this timber supply analysis was assembled in two projects. The data for the Kyuquot supply block was completed in 1987 while the data collected for the Sayward and Loughborough supply blocks was completed in 1991. Using satellite imagery, the data was updated to reflect depletions that have occurred since the last inventory update.

A.1 Inventory Information

Operability mapping has been updated by the forest district staff using information supplied by a consortium of licensees and an internal review of harvest performance in area previously deemed inoperable.

Reconnaissance level terrain stability mapping was completed for the entire TSA over a period between 1992 and 1998. This mapping delineates areas of unstable and potentially unstable terrain.

Wildlife habitat mapping, including ungulate winter range and bald eagle shoreline nesting area, was initially completed in the 1970's and last updated in 1992.

Recreation and visual landscape inventories were completed over the period of 1991 to 1995. In 1998, the visual landscape inventory was updated to correct digitization errors. Areas having karst features are identified on the recreation features inventory.

Landscape unit boundaries were delineated in 1997 as part of the Vancouver Region Landscape Unit Planning Strategy. In November 2000, resource management zones were created on Vancouver Island as part of the Vancouver Island Land Use Plan (VILUP). Specific resource management objectives and strategies are applied to these zones. In April 2001, the British Columbia Government endorsed Phase 1 of the Central Coast LRMP, termed a Framework Agreement. The agreement included a negotiated map delineating new proposed protection areas (PPAs), option areas, First Nations lead areas and special management zones.

A.2 Zone and Analysis Unit Definitions

A.2.1 Management zones (groups)

The concept of management zones is used to differentiate areas with different management objectives. For example, a zone may be defined as an area which has a common harvesting system, silviculture system, or visual quality objective. The computer simulation model enables the tracking of multiple objectives on the forested land base. In addition, the non-contributing forest (land considered unavailable for timber harvesting) may be included for consideration in attaining forest cover objectives. Grouping enables forest management constraints to apply to different combinations of variables or zones. Groups may be thought of as layers of different objectives, which must be tracked over time. Further information on the forest cover requirements to be applied to these areas can be found in Section A.4.9.

Table A-2. Objectives to be tracked

Objectives	Inventory definition
All areas	Cutblock adjacency only
Known scenic areas	RVQC code = P
	RVQC code = R
	RVQC code = PR
	RVQC code = M
Timber supply block	Kyuquot (Timber Supply Block A)
	Sayward (Timber Supply Block B)
	Loughborough (Timber Supply Block D)
Draft landscape units, biogeoclimatic variant and biodiversity emphasis	Draft landscape unit number as indicated on mapping
Community watersheds	Community watershed areas
VILUP	Vancouver Island Land Use Plan, resource management zones
Ungulate habitat	Elk visual coverage
	Deer spring forage
Operability	Conventional
	Helicopter
Patterson Lake WHA	General foraging area

A.2 Zone and Analysis Unit Definitions

A.2.2 Analysis unit characteristics

An analysis unit represents a combination of stands dominated by specific tree species or silvicultural regime as indicated in the forest inventory file. Each analysis unit is assigned its own timber volume projections (yield tables) for existing and future stands. In the Strathcona TSA, cedar (*Thuja plicata + Chamaecyparis nootkatensis*) , Sitka spruce (*Picea sitchensis*), hemlock (*Tsuga heterophylla and Tsuga mertensiana*), balsam (A*bies spp*.) and red alder (*Alnus rubra)* stands are grouped into managed analysis units on the basis of leading species and site index. The 53 managed analysis units defined for use in the analysis are listed in Table A-3.

Yield tables for existing natural stands are derived using the variable density yield projection (VDYP model) and no aggregation of different stand types has been used. Yield tables for recent plantations and future stands are derived using the table interpolation program for stand yields (TIPSY).

Table A-3. General definition of analysis units

Analysis unit	Inventory type groups	Description
Fir – SI less than 17.4	1 – 8	<= 17.4
Fir – SI 17.5 to 34.4	1 – 8	1 metre increments
Fir – SI 35+	1 – 8	>= 34.5
Cedar – SI less than 13.4	9 – 11	<= 13.4
Cedar – SI 13.5 to 22.4	9 – 11	1 metre increments
Cedar – 23+	9 – 11	>= 22.5
Hemlock/balsam – SI less than 10.4	12 – 20	<= 10.4
Hemlock/balsam – SI 10 to 29	12 – 20	1 metre increments
Hemlock/balsam – SI 30+	12 – 20	>= 29.5
Spruce	21 – 26	All sites
Alder	37 – 38	All sites

A.3 Definition of the Timber Harvesting Land Base

This section outlines the steps used to identify the timber harvesting land base (i.e., the productive forest expected to support timber harvesting) within the Strathcona timber supply area. Land may be unavailable for timber harvesting for three principle reasons:

- it is not administered by the B.C. Forest Service for timber supply purposes (e.g., private land, parks, etc.);
- it is not suitable for timber production purposes (e.g. non-forested areas); or
- it is unavailable for timber harvesting (e.g. recreation areas, wildlife areas).

Land may also be added to the timber harvesting land base:

- by management activities which improve productivity or operability (e.g., the stocking of land currently classified as non-commercial brush); or
- by the acquisition of productive forest land (e.g., timber license reversions).

A.3.1 Land not administered by the British Columbia Forest Service for timber supply

Ownership codes included in the forest inventory file are used to identify whether or not land contributes to the timber supply for the TSA. Ownership codes 62C, 69C and 77-C denote Crown land in a forest management unit, miscellaneous reserves and unassigned woodlot licence area respectively. Areas covered by timber licences (i.e., ownership code 70N) are not administered by the government until they have been harvested and reverted to the crown. Areas with other ownership codes will be removed from the timber harvesting land base. These include parks, ecological reserves, the Beaver Lodge lands and woodlot licences. Ownership codes which are expected to contribute to biodiversity are 61-N, 63-N, 67-N and 69-M.

A.3.2 Land classified as non-forest, non-productive forest and non-commercial brush

Lands without any non-productive descriptor, or labeled as either inventory type identity 6 (e.g., non-forest alpine forest, lakes, rocks, etc.) or inventory type identity 8 (e.g., not classified) were excluded from the timber harvesting land base. In addition non-productive codes 1 through 10, 15, 16, 18, 25, 26 35, 42, 50, 54, 60, 62, 63 and 64 were removed as non-forest while non-productive codes 11 through 13 or stands with no information under the BC land classification system. Stands with type identity 5 (non-commercial brush) were removed from the timber harvesting land base. Exceptions to the last two reductions are young stands with logging history which are considered to be productive forest too young to provide an adequate forest description.

A.3 Definition of the Timber Harvesting Land Base

A.3.3 Inoperable areas

Operability codes are generally based on the presence of absence of physical barriers or limitations to harvesting, the appropriate logging methods (e.g., cable, helicopter) and the merchantability of the stands. Stands with operability codes (I, N) were removed from the timber harvesting land base. Table A-4. summarizes the tree species of inoperable areas.

Table A-4. Description of inoperable area by leading species

Leading species	Area removed (hectares)
Aspen	2
Cedar	39 103
Alder	169
Fir	2 941
Hemlock/balsam	41 445
Pine	2 116
Spruce	286
No species listed	202
Total	86 265

A.3.4 Currently unmerchantable stand types

Unmerchantable forest types are stands which are physically operable and exceed low site criteria yet are not currently utilized or have marginal merchantability. These types are wholly or partially excluded from the timber harvesting land base. Examples of these types of stands are, deciduous types, balsam, cedar and hemlock stands that contain a high proportion of decadent wood or pine stands with a very high stand density. In the Campbell River Forest District, currently unmerchantable stands in the Kyuquot supply block are inventory type groups 27 through 42, while in the rest of the TSA stands in the inventory type group 37 and 38 (alder dominated) are harvestable before 80 years of age when the stand volume quickly becomes unmerchantable. Alder stands aging beyond 80 years during the simulation are made unharvestable in the timber supply model.

A.3 Definition of the Timber Harvesting Land Base

Table A-5. Description of unmerchantable stand types

Leading species	Area removed (hectares)
Aspen	73
Cedar	21
Alder	561
Fir	45
Hemlock/balsam	351
Maple	124
Pine	738
Total	1 913

A.3.5 Stands exhibiting low site productivity

Sites may have low productivity either because of inherent site factors (e.g., poor nutrient availability, exposure, excessive moisture, etc.), or because they are not fully occupied by commercial tree species. Typically, these stands are inter-mixed with other stands within the forested land base. As these stands are not considered to be harvestable, they need to be identified and removed from the timber harvesting land base. This will be done as outlined in Table A-6. Stands possessing both low volume and below the minimum site index were removed from the timber harvesting land base. Stands with logging history were not removed during the assessment of low site.

Table A-6. Description of sites with low timber growing potential

Leading species	Net merchantable volume / minimum site index	Reduced area (hectares)
Fir	350 m³/ha / 13.6	1 814
Cedar	350 m³/ha / 12.4	4 215
Hemlock/balsam	350 m³/ha / 11.3	2 991
Spruce	350 m³/ha / 9.7	6
Alder	350 m³/ha / 14	0
Total		9 404

A.3 Definition of the Timber Harvesting Land Base

A.3.6 Unstable and potentially unstable terrain

For areas with sensitive soils, reconnaissance level mapping of terrain stability was completed by a qualified registered professional for the whole TSA between 1992 and 1998. District staff have accepted the accuracy of the mapping.

Harvesting operations are carried out in compliance with the *Forest Practices Code* on some areas with sensitive soil; thus their complete removal from the timber harvesting land base would be inappropriate. The percentage reduction to be applied for a particular class of sensitive soil is outlined in Table A-7. These percentages were developed on the basis of professional geotechnical advice received during the last timber supply review and are considered to accurately reflect current management.

In spatially representing the harvesting opportunity in potentially unstable terrain, the amount of area assumed to be harvestable was held constant. It was first assumed that any potentially unstable terrain that was above 30 degrees in slope would not be eligible for harvest. Secondly, in order to obtain the same area as aspatial approximation, 95% of stands on slopes less than 30 degrees where a component of the stand was in the timber harvesting land base were then assumed to be completely harvestable. This method tends to slightly reduce the amount of timber harvesting land base in the Kyuquot supply block and increase the timber harvesting land base in the rest of the TSA due to the pitch of the respective terrain types. However, at the TSA level, the introduction of slope was not allowed to change the overall timber harvesting land base. The choice of the maximum slope was chosen after reviewing harvesting activity in potentially unstable terrain.

Table A-7. Description of soil stability categories and reduction factors

Description (stability category)	Location	Reduction per cent (%)	Reduced area (hectares)	Timber harvesting land base (hectares)
Unstable (S001)	Entire TSA	95	10 075	487
Potentially unstable(S002)	Kyuquot supply block	40	15 536	21 080
Potentially unstable(S002)	Sayward and Loughborough supply blocks	50	10 242	8 333

A.3 Definition of the Timber Harvesting Land Base

A.3.7 Sensitive wildlife areas

Wildlife inventory information has been captured using two different variables added to the inventory file. The EW variable represents the value applied to a given polygon while the EW_MGMT variable identifies the applicable management regime. A EW_MGMT label of 50% is given to stands that should receive a maximum area reduction of 50% while a CC label represents stands to which a forest cover requirement are applied. These cover requirements ensure specific forest conditions are maintained within the area.

Table A-8. Description of areas with high wildlife values

EW rating	EW_MGMT	Reduction per cent (%)
1	—	100
2	CC	0
2	50%	50

A.3.8 Sensitive recreation areas

Recreation areas such as campgrounds, trails and lookout sites are identified in the inventory file by specific feature and management class codes. Recreation management codes are more current and are used instead of ESA designations for the purpose of excluding areas with high recreation value. Areas with a recreation management class code of 0 are those areas such as established campsites that have very high, recreation values. Areas requiring special management for recreation will receive a 50% reduction.

Karst is a distinctive topography that develops from the dissolving action of water on carbonate bedrock, usually limestone, dolomite or marble. This geological process, occurring over thousands of years, results in features that include fluted rock surfaces, vertical shafts, sinkholes, sinking streams, springs complex sub-surface drainage systems and caves. In areas dominated by karst environments, timber harvesting must be managed with additional care or, in some areas, avoided altogether. Many of the karst features in the TSA lie in areas that are inoperable or that are excluded from the timber harvesting land base for other objectives. Areas identified as having potential karst values will receive an 8% exclusion from the timber harvesting land base.

Table A-9. Description of areas with high recreation values

Recreation management class code	Recreation feature significance code	Recreation value description	Reduction (%)
0	A, B, C	Managed exclusively for recreation	100
1	A, B	Special management required	50
L5	N/A	Karst feature not already reduced for special management (management class 1)	8

A.3 Definition of the Timber Harvesting Land Base

A.3.9 Cultural heritage resource values

Archaeological resource values primarily relate to First Nations historic village sites and shell middens as well as culturally modified trees (CMTs). Historic village sites and shell middens are most frequently identified close to marine shorelines whereas CMTs are generally found within remaining old-growth forest types, and most often red- or yellow-cedar leading forests. Remaining old-growth forest types are primarily located in the Kyuquot Supply Block, and to a lesser extent, in the Loughborough Supply Block of the TSA. Identified CMTs have followed a similar pattern of distribution.

Archeological sites have been discovered and catalogued during the archaeological impact assessments. These sites are retained under the *Heritage Conservation Act*. For large areas that can mapped as polygons, the entire polygon was removed from eligibility to the timber harvesting land base, otherwise, one hectare per site occurrence was removed the timber harvesting land base in the location of the site.

A.3.10 Areas considered for old-growth management

Currently, only the Sayward landscape unit has old-growth management areas which have been endorsed by the Ministries of Forests, Sustainable Resource Management, and Water, Land and Air Protection, through landscape unit planning. Of a total productive forest of about 1057 hectares, a total of about 470 hectares is removed from the timber harvesting land base to account for these areas.

A.3.11 Areas considered for riparian reserve and management zones

Initial TRIM2 water course linework was provided to a consultant by Coast Forest Region staff. The lake coverage was overlaid with the biogeoclimatic subzone/variant map. Lakes were classified into L1 – L4 categories based on area and biogeoclimatic zone as outlined in the *Riparian Management Guidebook*. The same process was used to classify marshes into categories W1 – W4. The set of rules for stream classification was based on the slope breaks listed in Table A-10. The buffer widths assigned to each riparian feature class found in Table A-11. capture both the riparian reserve zone and management zone and represents the portion of these areas assumed to be unavailable for harvest. Double line streams are considered to be S1 streams.

Table A-10. Stream class assumptions by slope class

Stream class	Single line water type	Slope class
S2/S3	Definite & indefinite	< 20%
S4	Intermittent	< 20%
S5	Definite & indefinite	>= 20%

A.3 Definition of the Timber Harvesting Land Base

Table A-11. Riparian management area buffer widths by feature class

Riparian feature class	Reserve zone width (m)	Management zone width (m)	Management zone retention (%)	Calculated RMA width	Implemented (modelled) RMA width
Lakes					
L1	10	0	0.25	10.0	**10**
L2	10	20	0.25	15.0	**15**
L3	0	30	0.25	7.5	**7.5**
L4	0	30	0.25	7.5	**7.5**
Wetlands					
L1	10	40	0.25	20.0	**20**
L2	10	20	0.25	15.0	**15**
L3	0	30	0.25	7.5	**7.5**
L4	0	30	0.25	7.5	**7.5**
L5	10	40	0.25	20.0	**20**
Streams					
S1	50	20	0.32	56.4	**56.5**
S2	30	20	0.79	45.8	**46.0**
S3	20	20	0.65	33.0	**33.0**
S4	0	30	0.63	18.9	**19.0**
S5	0	30	0.25	7.5	**7.5**
S6	0	20	0.08	1.6	**2.0**
S1-S4 (Sayward)					**43.0**
S2-S4					**43.0**
S5-S6					**3.0**

A.3 Definition of the Timber Harvesting Land Base

Table A-12. shows the area removed from eligibility to the timber harvesting land base by virtue of being in a riparian buffer. While the productive forest area is over 42 000 hectares in total, only 26 350 hectares is removed specifically for riparian management as a portion of the area is already classified as unavailable for harvest for some other reason. Most of the riparian area is in the CWHvm1 and CWHxm2.

Table A-12. Riparian area by biogeoclimatic variant

Biogeoclimatic variant	Reduced area (hectares)	Productive forest area (hectares)
CWHdm	563.84	681.28
CWHmm1	1 720.37	2 476 .22
CWHmm2	427.96	979.33
CWHvh1	3 138.46	6 336.37
CWHvm1	10 788.93	16 198.6
CWHvm2	1 116.22	3 371.07
CWHxm1	1617.84	2 132.8
CWHxm2	6 802.48	8 993.87
MHmm1	174.2	1 096.03
Total	26 350.3	42 265.57

A.3 Definition of the Timber Harvesting Land Base

A.3.12 Existing and future unclassified roads

A TRIM road coverage for the Campbell River forest district is available through the corporate data warehouse. The line work from this coverage was buffered to create a total road width of 15 metres. This resulted in a reduction of 8252 hectares from a total productive area of 10 060 hectares.

Future roads were assumed to be needed for stands further than 200 metres from an existing road and older than 86 years of age. The road reduction was applied at a rate of 5% in conventionally harvested areas and one per cent in helicopter harvested areas. The increase in road requirements from 0.5% in the data package to one per cent for helicopter harvested areas was done to simplify modelling and does not constitute a change in the expected operational road requirement in these areas. The future reduction for roads is about 776 hectares.

A.3.13 Wildlife tree patches requirements

Wildlife tree retention values for each landscape unit and BEC variant have been developed by district staff.

A spatial exercise was used to reduce the area of the timber harvesting land base where WTR must occur. This exercise delineated a 200-metre buffer around forested stands that are not considered part of the timber harvesting land base. It is assumed that conditions in this buffer meet all of the requirements for WTR and herefore additional contributions are not needed in those areas. According to this exercise, only about 27 685 hectares of timber harvesting land base will require the full WTR requirement while it is assumed that the other 133 315 hectares of timber harvesting land base is sufficiently close to existing stand structure (i.e., in the 200–metre buffers). The spatial riparian coverage provides a significant contribution to meeting WTP requirements.

Figure A-1. shows the spatial location of randomly assigned WTPs in dark grey for one landscape unit. No size requirement was used in the assignment, however the nature of the exercise resulted in various sized reserves in areas that had no stands outside of the timber harvesting land base to provide the stand structure requirements of WTR. The entire 2438 hectares shown in Table 5, “Determination of the timber harvesting land base for the Strathcona TSA” is located in the type of area represented in light grey (THLB requiring WTP representation).

A.3 Definition of the Timber Harvesting Land Base

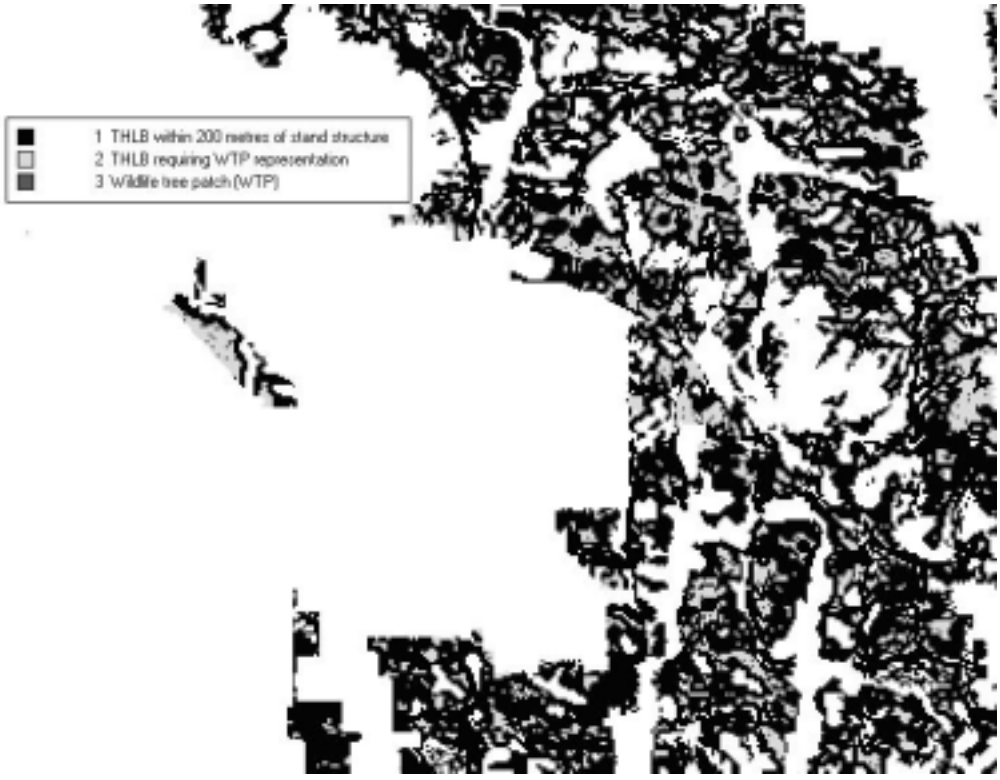

Figure A-1. Spatial representation of the timber harvesting land base and wildlife tree patch retention — Strathcona TSA, 2004.

A.4 Forest Management Assumptions

A.4.1 Utilization levels

Utilization levels define the maximum stump height, minimum top diameter inside bark (dib) and minimum diameter at breast height (dbh) that will be used to calculate merchantable volume.

Table A-13. Utilization levels

Analysis unit	Minimum dbh (cm)	Maximum stump height (cm)	Minimum top dib (cm)
All stand types 140 years and older	17.5	30	10
All stand types less than 140 years	12.5	30	10

Data source and comments:

Table A-13. reflects current regional utilization standards, license requirements and current performance except for the minimum top dib for stands above 140 years of age. Currently, the utilization standards for stands above 140 years of age is a minimum top dib of 15 cm but the variable density yield projection (VDYP) model only compile volumes at 10 cm top dib. The Resources Information Branch of the Ministry of Sustainable Resource Management has indicated that the difference in yield between a 10 cm top dib and a 15 cm top dib is negligible.

A.4.2 Harvest scheduling, targets and priorities

Stands were scheduled based on relative-oldest first as defined by the stand age minus the age when stands reach 95 per cent of maximum average growth.

A.4.3 Timber licences

Timber licenses represent about 17 600 hectares of timber harvesting land base. These are old tenure arrangements that give a licensee exclusive rights to harvest merchantable timber within the licence area and the volume does not contribute to the TSA allowable annual cut. Once these areas have been harvested, regenerated and attain free growing status, the timber license area reverts to Forest Service jurisdiction. Accordingly, these areas are included in the timber harvesting land base after the first harvest where they contribute to the mid- and long-term timber supply.

Currently about 12 600 hectares of forest aged less than or equal to 105 years of age have reverted and are part of the timber harvesting land base. Approximately 5000 hectares of timber licences in the Strathcona TSA are left to revert to Forest Service jurisdiction. In the analysis, these areas were assumed to be harvested and reverted to Crown jurisdiction at a rate of 500 hectares per year and were assigned to regenerated analysis units consistent with the existing forest cover. These stands are expected to be harvested in the next ten years.

A.4.4 Minimum merchantability by analysis unit

The analysis used too many yield tables to explicitly provide the minimum harvestable ages, however the basic TIPSY tables provide some guidance based on the site index derived growth rates. Table A-14. shows the age to reach minimum volume requirements, the age of maximum average growth, the age where 95% of maximum average growth for each of the base analysis units. Stands must attain the minimum volume and reach 95 per cent of maximum average productivity before being eligible for harvest. At lower site index values, stands must be held beyond the age where maximum average growth occurs while in more productive analysis units, harvesting at minimum volume before maximum average growth is reached could significantly reduce long-term timber supply.

A.4 Forest Management Assumptions

Table A-14. Minimum merchantability and growth potential by analysis unit

Analysis unit	Minimum volume required (m^3/ha)	Maximum average growth (m^3/ha/year)	Age of maximum average growth (years)	Age at 95% of maximum average growth (years)	Age to reach minimum volume required (years)	Minimum harvestable age (years)
Ce13	350	1.9	170	130	190	190
Ce14	350	2.7	160	120	140	140
Ce15	350	3.1	150	120	120	120
Ce16	350	3.6	160	120	110	120
Ce17	350	4.4	120	100	90	100
Ce18	350	4.9	130	100	90	100
Ce19	350	5.5	120	90	80	90
Ce20	350	6.1	110	90	70	90
Ce21	350	6.6	110	90	70	90
Ce22	350	7.1	120	90	70	90
Ce23	350	9	100	80	60	80
D_	350	0.1	60	55	60	60
Fd17	350	2.2	100	80	190	190
Fd18	350	2.7	90	70	140	140
Fd19	350	3.1	100	70	120	120
Fd20	350	3.5	100	80	110	110
Fd21	350	3.9	90	80	90	90
Fd22	350	4.4	100	80	90	90
Fd23	350	4.9	90	70	80	80
Fd24	350	5.3	90	70	70	70
Fd25	350	5.8	80	70	70	70
Fd26	350	6.3	80	70	70	70
Fd27	350	6.8	80	70	60	70
Fd28	350	7.3	80	60	60	60
Fd29	350	7.9	80	60	60	60
Fd30	350	8.3	80	60	50	60
Fd31	350	9	80	60	50	60
Fd32	350	9.5	70	60	50	60
Fd33	350	10.1	70	60	50	60
Fd34	350	10.6	70	60	50	60
Fd35	350	12.8	60	50	40	50
HB10	350	1.3	180	140	280	280
HB11	350	1.7	170	130	220	220
HB12	350	2.1	150	120	180	180
HB13	350	2.5	160	110	150	150
HB14	350	2.9	130	110	130	130
HB15	350	3.4	140	110	110	110
HB16	350	3.9	130	110	100	110
HB17	350	4.4	130	100	90	100
HB18	350	4.9	130	100	80	100
HB19	350	5.5	120	100	80	100

(continued)

A.4 Forest Management Assumptions

Table A-14. Minimum merchantability and growth potential by analysis unit (concluded)

Analysis unit	Minimum volume required (m^3/ha)	Maximum average growth (m^3/ha/year)	Age of maximum average growth (years)	Age at 95% of maximum average growth (years)	Age to reach minimum volume required (years)	Minimum harvestable age (years)
HB20	350	6.1	110	90	70	90
HB21	350	6.6	120	90	70	90
HB22	350	7.2	110	90	70	90
HB23	350	7.8	110	90	60	90
HB24	350	8.4	100	80	60	80
HB25	350	9	100	80	60	80
HB26	350	9.6	90	80	50	80
HB27	350	10.2	90	70	50	70
HB28	350	10.8	80	70	50	70
HB29	350	11.5	80	70	50	70
HB30	350	14.2	60	60	40	60
S_	350	6.9	100	90	70	90

A.4.5 Immature plantation history

This section identifies areas of existing immature forest where the density (i.e., stems per hectare) is controlled and therefore should be assigned to a managed stand yield table (MSYT). All NSR and stands harvested in the future will be managed under MSYTs. The stand attributes assumed for each analysis unit are described in Table A-26. of Section A.6. Some of the existing managed stands, about 6600 hectares, are given genetic gain consideration based on the Class A seed use in Table A-16. and Table A-17. respectively.

Table A-15. Immature plantation history

Analysis unit	Stand age at which MSYT will be applied
All Douglas-fir	<= 65 years
All Hemlock/balsam	<= 25 years
All cedar	<= 15 years
All spruce	<= 25 years

A.4.6 Not satisfactorily restocked (NSR) areas

Land classified in the TSA FIP file as type identity 4 or 9 is included in the current timber harvesting land base. These type identities indicate old cutblocks which have not yet reached free-growing status. NSR from the FIP file will be assigned an age based on the regeneration delay for the listed species as found in Table A.26 and logging year. (e.g., current year 2001 – logged year 1996 – 2 years (regeneration delay for Douglas-fir) = stand age 3).

A.4 Forest Management Assumptions

A.4.7 Fertilized areas

Fertilization information was extracted as a spatial coverage to indicate which stands should receive an increase in stand volume due to this treatment. This increase will be applied to these stands in the timber supply model as opposed to the yield tables at a rate of 30 cubic metres per hectare per treatment. The original data package included a table showing 19 000 hectares of fertilized land and indicated that given the gains already captured in site index estimates generated during the last re-inventory, the assumed treatment response would be reduced by 44%. As only about 7300 hectares of forest above 30 years of age were recorded in the inventory; about 4900 hectares with one application and about 2400 hectares with two applications, the full 30 m^3/ha response was assumed and was applied as a 30 cubic metre/ha increase in volume.

The incidence of future fertilization is uncertain and therefore was not modelled.

A.4.8 Genetic gain through tree improvement

Data from the Tree Improvement Branch of the Ministry of Forests indicate that Class A seed has been employed for cedar, fir and some hemlock stands and the gains are listed in the table below. Seed with higher genetic worth is becoming available but seed use cannot be adequately projected for use in the base case timber supply analysis. The relative per cent of Class A seed use by species against all planting activity is also listed below. The use of planted hemlock is only a common practice where Doman-Western operates. Genetic gains in hemlock-dominant stands will only occur within these spatial locations. Using these assumptions and the per cent class A seed use by year, about 6700 hectares was assigned a genetic gain value at the start of the simulation. A total of almost 95 000 hectares of productive forest is within the four seed planning units used in the Strathcona TSA. Stands are randomly assigned a genetic gain value in the future based on the current seed use and the current genetic gain 7value. Not all stands within the seed planning units will be assigned a genetic gain as class A seed use is available 100 per cent of the time. The current and projected seed use and genetic gain values are listed in Appendix A.6.

Table A-16. Historic genetic gain by year

Species	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
CW	2	2	2	2	2	2	2	2	2	4
FD	2	3	2	2	5	4	2	4	4	7
HW	2	2	2	2	2	2	2	2	3	3

Table A-17. Per cent class A seed use by year

Species	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
CW	46	51	31	44	33	57	76	66	69	69
FD	85	81	96	96	95	97	98	86	90	100
HW	53	48	49	69	68	53	83	87	94	100

A.4 Forest Management Assumptions

A.4.9 Forest cover requirements

Forest cover requirements may be examined at a number of different levels. These may be considered as layers in GIS terminology. One possible layer may be landscape units, another may be wildlife areas, while another may be associated with a different resource emphasis. With the requirement to retain different forest characteristics across the landscape, it is important to identify how non-contributing forest (productive forest which does not contribute to the timber harvesting land base) may be considered in the forest cover requirements (i.e., maximum allowable disturbance or minimum area retention). Table A-18. details the groups to be tracked during this timber supply review.

Table A-18. Forest cover requirements

Group	Maximum allowable disturbance (%)	Green-up height or age	Minimum retained area (%)	Minimum age or height for retention	Area of application
ERMZ	**25**	**1.3**			Timber harvesting land base within the enhanced portions of landscape units outside of visual areas
IRM	**25**	**3 m**			Timber harvesting land base within an landscape unit outside of visual areas
RVQC=P Sayward Rest of TSA	**1**	**5 m** (5.1 m) (4.6 m)			Forested area in a visual polygon
RVQC= R Sayward Rest of TSA	**5** (4.6) (4)	**5 m** (4.3 m) (5.0 m)			Forested area in a visual polygon
RVQC=PR Sayward Rest of TSA	**15** (18.3) (15.9)	**5 m** (5.1 m) (5.7 m)			Forested area in a visual polygon
RVQC=M Sayward Rest of TSA	**25** (48) (39)	**5 m** (4.9 m) (5.9 m)			Forested area in a visual polygon
EW	**25**	**3 m**	50	5 m	Forested area within each wildlife polygon
Wildlife habitat area	**15**	**20 years**			Forested area within the wildlife habitat areas
Community watershed	**5**	**5 years**			Productive forest by watershed

Data source and comments:

The IRM objective is a surrogate for cutblock adjacency. Recommended visual quality class (rVQC) have been assigned by Campbell River Forest District manager. Community watershed guidelines are taken from the *Forest Practices Code Community Watershed Guidebook* and are applied to the John Hart Lake (920.049) and the Barton Creek(930.002) community watersheds.

All stand heights shown in Table A-18. refer to top heights (inventory definition), not average stand heights.

A.4 Forest Management Assumptions

The base case maximum allowable disturbance and green-up heights were provided by Campbell River Forest District staff as found in the data package. Stand heights and maximum disturbance rates in the visual areas were localized for the Strathcona TSA based on new plan to perspective information by slope class developed by Forest Practices Branch, Ministry of Forests. The plan to perspective alteration adjustments are calculated from slope-based relationships of plan to perspective information derived by Forest Practices Branch, Ministry of Forests. The area-weighted heights are calculated using Table 6 Tree height required to meet VEG by per cent slope for well-stocked stands found in *Procedures for Factoring Visual Resources into Timber Supply Analyses.* The bracketed values for maximum disturbance and green-up height were used in the sensitivity analysis described in Section 5.4. For green-up heights above 5 metres, the average slope exceeds 25%. The localization of the per cent alteration and VEG heights indicates that visual areas in the Sayward landscape unit are generally on shallower slopes than the rest of the TSA hence the allowable disturbances are slightly higher and the VEG heights by recommended visual quality class are slightly lower than the rest of the TSA.

For the Sayward landscape unit, the old-growth management areas have been specifically identified and advertised. For all other landscape units, the biodiversity guidelines with the draft biodiversity emphasis option will be modelled based on the old-seral requirements found in the *Forest Practices Code Biodiversity Guidebook*. For low biodiversity emphasis option areas, a recruitment strategy will be put into place, if required, to ensure that the old-seral objective are achieved by the end of the third rotation. Forest cover requirements are determined for each BEC variant within each landscape unit.

Table A-19. Landscape unit old-seral and mature-seral forest cover requirements

Disturbance type	BEO	Mature requirement (%)	Old-growth requirement (%)	Starting in year		
				1	70	140
NDT 1	L	25	13	4.3	8.6	13
	I	25	13	13	13	13
	H	25	19	19	19	19
NDT 2	L	25	9	3	6	9
	I	25	9	9	9	9
	H	25	13	13	13	13

Data source and comments:

In natural disturbance types (NDTs) 1, 2 and 4, old-seral forest is defined as stands older than 250 years. Mature age for these disturbance types is 80 years in the CWH and 120 years in the MH.

Under the Vancouver Island Land-Use Plan, objectives for mature-seral forest were defined in special resource management zones as between one-quarter and one-third of the forested area should mature. These mature-seral objectives are only applied in these areas.

A.4 Forest Management Assumptions

A.4.10 Unsalvaged losses

Table A-20. shows the estimated average annual unsalvaged volume loss due to catastrophic events such as insect epidemics, fires, wind damage or other agents. The unsalvaged loss column only reflects those areas in which the volume will not be recovered.

Table A-20. Unsalvaged losses

Cause of loss	Total loss (m^3/year)	Annual unsalvaged loss (m^3/year)
Fire	2 500	1 750
Windthrow	60 000	30 000
Total	62 500	31 750

Data source and comments:

The windthrow and fire estimates are based upon district blowdown ledgers, district experience with salvage and district fire occurrence records. There is currently no other information available.

Ongoing monitoring of insect infestations within this TSA reveals that losses are relatively minor and would be accounted for in existing yield models. Key insect species which are monitored in this district are western black-headed budworm, western hemlock looper, balsam wooly adelgid, and conifer sawflies.

Laminated root rot (*Phellinus weiri*) occurs in the drier regions of the district, primarily in younger Douglas-fir forests in the Sayward area, on Quadra Island, and in minor pockets in the Gold River area. Current estimates of annual unsalvaged losses total 11 400 cubic metres. Because this is a geographic issue rather than a TSA-wide issue, an operational adjustment factor of 7.7% was developed by district staff to be applied to thrifty Douglas-fir stands (between the ages of 10 and 140) in the CWH xm1 and xm2 with a site index greater than 24 metres which were regenerated without consideration for root rot impacts. This resulted in about a 20 000 cubic metre per year impact to short- and mid-term timber supply. Management strategies in these areas are expected to reduce the need for this additional factor in very young Douglas-fir stands and future managed stands.

A.5 Volume Estimates for Existing Stands

Ground sampling within the Strathcona TSA was carried out in 1998. Table A-21. shows the statistical information provided by the Ministry of Sustainable Resource Management. First stands were defined as being in the eastern portion of the TSA (Sayward or Loughborough supply blocks) or in the western portion of the TSA (Kyuquot supply block). This showed that while the 13% difference at the TSA level was statistically different (p-value of 0.036 where anything below 0.05 shows a statistical difference), when the east and west were shown separately, the statistical difference was evident in the east (overestimation of volume of almost 20%) and there was no statistical difference in the west (p-value exceeds 0.05).

Table A-21. Ground sampling review of existing natural stands above 60 years of age Strathcona TSA

Description	Number of samples	Mean audit vol/ha	Mean inventory vol/ha	p-value for difference[a]	Ratio of means
All operable samples	41	581	666	0.036	0.872
West only	21	632	668	0.605	0.946
East only	20	527	663	0.001	0.795

(a) p-values below 0.05 show statistical significance at the 0.05 % significance level

As the main differences appeared to be related to the eastern side of the TSA, these stands were further stratified by age range as shown in Table A-22. By stratifying these stands into two categories, stands above 140 years of age and stands below 140 years of age, it was found that the stands above 140 years of age in the Sayward and Loughborough supply blocks were the only strata where the inventory heights and volumes were statistically different. While there is only a sample size of 11 stands out of the original 41 stands, the 11 stands have such an extremely low p-value (quite different from the other strata), that there is a very low probability that there is not a difference between average ground volume/height and the average inventory volume and inventory height. A sensitivity analysis (Section 5.11) was performed to examine the implications of a volume over-estimation of 30% in stands above 140 years of age in the Sayward or Loughborough supply blocks, however it should be noted that this overestimation is the average value within a range between 20 and 40%.

Table A-22. Ground sampling review of existing natural stands in the eastern side of the TSA by age range Strathcona TSA

Description	Number of samples	Mean audit vol/ha	Mean inventory vol/ha	p-value for difference[a]	Ratio of means
Stands < 140 years	9	554	598	0.372	0.927 (0.763--1.091)
Stands > 140 years	11	505	717	< 0.001	0.704 (0.593--0.815)

(a) p-values below 0.05 show statistical significance at the 0.05 % significance level

The variable density yield projection (VDYP) model, version 6.6 developed and supported by the B.C. Ministry of Sustainable Resource Management, Resource Information Branch, was used to estimate timber volumes for existing natural stands. While it has been common practice to aggregate yield tables to simplify the dataset, no simplifications were made in this analysis other than to direct stands with identical stand attributes (stand age, crown closure, site productivity, forest inventory zone, etc.) to the same yield table. This results in thousands of yield tables, too many to be included in this appendix. Table A-23. shows the area-weighted volume estimates by analysis unit for existing natural stands in various age ranges. Managed stands and current NSR will be projected using managed stand yield tables.

A.5 Volume Estimates for Existing Stands

Table A-23. Current area-weighted volume (m³/hectares) by age range for existing natural stands Strathcona TSA

Analysis unit	Timber harvesting land base (hectares)	Stands under 40 years of age	Stands under 60 years of age	Stands under 100 years of age	Stands under 140 years of age	Stands over 140 years of age
Ce13	4635	0	17	146	262	423
Ce14	2286	0	29	129	274	523
Ce15	3069	1	51	222	305	562
Ce16	2155	0	52	0	286	593
Ce17	1453	0	77	234	405	648
Ce18	1270	0	132	330	462	692
Ce19	841	0	105	345	400	728
Ce20	830	12	145	325	0	823
Ce21	329	0	201	346	516	871
Ce22	1309	20	196	309	517	862
Ce23	4665	29	337	465	629	800
D_	2868	106	288	386	273	0
Fd17	1100	6	111	195	324	400
Fd18	2844	16	105	193	357	430
Fd19	531	1	113	232	409	509
Fd20	767	1	154	255	344	533
Fd21	882	3	169	257	509	576
Fd22	1692	37	146	283	484	607
Fd23	1012	60	149	367	585	677
Fd24	882	0	273	364	532	683
Fd25	1237	4	271	399	646	747
Fd26	890	1	289	403	623	862
Fd27	7640	64	270	429	624	839
Fd28	1717	54	349	426	691	837
Fd29	2252	19	383	481	823	931
Fd30	1273	6	414	511	810	0
Fd31	2063	8	427	537	810	0
Fd32	2614	79	437	572	0	0
Fd33	1152	30	516	582	787	0
Fd34	943	0	536	635	853	0
Fd35	3726	31	637	718	967	0

(continued)

A.5 Volume Estimates for Existing Stands

Table A-23. Current area-weighted volume (m³/hectare) by age range for existing natural stands Strathcona TSA (concluded)

Analysis Unit	Timber harvesting land base (hectares)	Stands under 40 years of age	Stands under 60 years of age	Stands under 100 years of age	Stands under 140 years of age	Stands over 140 years of age
HB10	911	28	0	0	0	422
HB11	1013	4	0	0	0	477
HB12	1563	0	0	0	268	522
HB13	1981	0	45	126	292	576
HB14	9145	1	30	198	363	623
HB15	4321	4	47	238	393	650
HB16	2695	0	119	254	403	702
HB17	3178	1	134	258	455	760
HB18	3016	2	156	288	458	815
HB19	2507	0	143	323	576	849
HB20	2901	0	233	354	584	875
HB21	2958	15	216	378	607	940
HB22	33067	28	181	383	645	918
HB23	5363	21	240	481	656	953
HB24	2826	0	291	472	665	963
HB25	1829	1	270	546	760	974
HB26	2196	6	329	546	754	1067
HB27	4426	31	318	572	800	1000
HB28	6418	70	355	591	831	1011
HB29	1601	45	388	601	878	1120
HB30	5664	55	514	679	959	1017
S_	642	32	364	528	664	1006

A.6 Volume Estimates for Regenerated Stands

WinTIPSY (Windows™ version of the Table Interpolation Program for Stand Yields) version 3.2, supported by the B.C. Ministry of Forests', Research Branch, was used to estimate growth and yield for existing and future managed stands. The area-weighted site index for each analysis unit was used, along with regeneration assumptions, as input to TIPSY. Table A-15. indicates which stands are assumed to be managed in the analysis.

Table A-26. displays the inputs for creating base volume tables for managed stands. The base volumes can then by augmented by genetic gain factors developed by Forest Analysis Branch or fertilization response.

Stand yields were altered to reflect the planting of genetically improved stock. Table A-24. shows the projected genetic gain associated with each seed planning zone and Table A-25. shows the projected stock use. For the base case only the information up to the start of the simulation (2002) was used. A sensitivity analysis was performed to examine the implications if the projections starting in 2006 actually occur. District staff indicate that the planting of hemlock seedlings is only occurring with regularity in the operating areas managed by Doman-Western so these areas will be eligible for the gains listed.

Table A-24. Genetic gain projections by seed planning unit

Seed planning unit	2002	2006
CW Maritime low elevation	1	5
Fd Maritime high elevation	2	9
Fd Maritime low elevation	12	13
Hw Maritime low elevation	10	13

Table A-25. Seed use projections by seed planning unit as a percentage of total seed request

Seed planning unit	2002	2006
CW Maritime low elevation	60	60
Fd Maritime high elevation	92	92
Fd Maritime low elevation	92	92
Hw Maritime low elevation	92	92

A.6 Volume Estimates for Regenerated Stands

Table A-26. Regeneration assumptions by analysis unit

Analysis unit	Timber harvesting land base	Inventory site index	Regeneration delay	Regeneration method	Species composition	Stems per hectare	OAF1	OAF2	Utilization
Ce13	4635	12	3	p	Cw50Hw50	800	15	5	12.5
Ce14	2286	14	3	p	Cw50Hw50	800	15	5	12.5
Ce15	3068	14.9	3	p	Cw50Hw50	800	15	5	12.5
Ce16	2155	15.9	3	p	Cw50Hw50	800	15	5	12.5
Ce17	1452	17	3	p	Cw50Hw50	1200	15	5	12.5
Ce18	1269	17.9	3	p	Cw50Hw50	1200	15	5	12.5
Ce19	841	18.9	3	p	Cw50Hw50	1200	15	5	12.5
Ce20	829	20	3	p	Cw50Hw50	1200	15	5	12.5
Ce21	328	21	3	p	Cw50Hw50	1200	15	5	12.5
Ce22	1309	22	3	p	Cw30Ba70	1200	15	5	12.5
Ce23	4661	25.2	3	p	Cw30Ba70	1200	15	5	12.5
Fd17	1099	10.3	3	p	Fd100	1200	15	5	12.5
Fd18	2843	18	2	p	Fd100	1200	15	5	12.5
Fd19	531	19	2	p	Fd100	1200	15	5	12.5
Fd20	767	19.9	2	p	Fd100	1200	15	5	12.5
Fd21	881	20.9	2	p	Fd100	1200	15	5	12.5
Fd22	1691	22	2	p	Fd100	1200	15	5	12.5
Fd23	1012	23	2	p	Fd100	1200	15	5	12.5
Fd24	881	23.9	2	p	Fd100	1200	15	5	12.5
Fd25	1236	25	2	p	Fd100	1200	15	5	12.5
Fd26	890	26	2	p	Fd100	1200	15	5	12.5
Fd27	7634	27	2	p	Fd100	1200	15	5	12.5
Fd28	1716	28	2	p	Fd100	1200	15	5	12.5
Fd29	2250	29.1	2	p	Fd100	1200	15	5	12.5
Fd30	1272	30	2	p	Fd100	1200	15	5	12.5
Fd31	2062	31.1	2	p	Fd100	1200	15	5	12.5
Fd32	2611	32	2	p	Fd100	1200	15	5	12.5
Fd33	1150	33.1	2	p	Fd100	1200	15	5	12.5
Fd34	942	34	2	p	Fd100	1200	15	5	12.5
Fd35	3724	37.7	2	p	Fd100	1200	15	5	12.5
HB10	910	6.8	2	p	Hw50Cw50	1200	15	5	12.5
HB11	1012	11	3	p	Hw50Cw50	1200	15	5	12.5
HB12	1563	11.9	3	p	Hw50Cw50	1200	15	5	12.5
HB13	1981	12.9	3	p	Hw50Cw50	1200	15	5	12.5
HB14	9140	14	3	p	Hw50Cw50	1200	15	5	12.5
HB15	4320	14.9	3	p	Hw50Cw50	1200	15	5	12.5
HB16	2694	15.9	3	p	Hw50Cw50	1200	15	5	12.5
HB17	3177	16.9	3	p	Hw50Cw50	1200	15	5	12.5
HB18	3015	18	3	p	Hw50Cw50	1200	15	5	12.5
HB19	2507	18.9	3	p	Hw50Cw50	1200	15	5	12.5

(continued)

A.6 Volume Estimates for Regenerated Stands

Table A-26. Regeneration assumptions by analysis unit (concluded)

Analysis unit	Timber harvesting land base	Inventory site index	Regeneration delay	Regeneration method	Species composition	Stems per hectare	OAF1	OAF2	Utilization
HB20	2901	19.9	3	p	Hw50Cw50	1200	15	5	12.5
HB21	2957	20.9	3	p	Hw50Ba50	1200	15	5	12.5
HB22	33040	22	3	p	Hw50Ba50	1200	15	5	12.5
HB23	5357	23	3	p	Hw50Ba50	1200	15	5	12.5
HB24	2824	24	3	p	Hw50Ba50	1200	15	5	12.5
HB25	1828	25	3	p	Hw50Ba50	1200	15	5	12.5
HB26	2195	26	3	p	Hw50Ba50	1200	15	5	12.5
HB27	4424	27	3	p	Hw50Ba50	1200	15	5	12.5
HB28	6411	28	3	p	Hw50Ba50	1200	15	5	12.5
HB29	1601	28.9	3	p	Hw50Ba50	1200	15	5	12.5
HB30	5662	32.8	3	p	Hw50Ba50	1200	15	5	12.5
S_	641	21.1	3	p	Cw80Ss20	1200	15	5	12.5

Appendix B

Socio-Economic Analysis Background Information

B.1 Definition of Forest Industry Activities

The socio-economic analysis identifies employment and income impacts, changes in government revenues and community impacts at various harvest levels and times in the future. Some of the assumptions used in the analysis are as follows:

Employment multipliers — these multipliers are used to estimate indirect and induced employment impacts of a change in direct industry activity. Employment multipliers are calculated based on analytical assumptions and data collected at a specific time. Consequently, the multipliers reflect industry and employment conditions at that time and may not accurately reflect future industry conditions. In any impact analysis, the information should be considered as indicators of magnitude.

Employment coefficients — employment impacts associated with future harvest levels are calculated using employment coefficients (person-years per 1000 cubic metres). This approach assumes that the industry structure will be the same in future as it is today. While reasonably accurate in the short term, employment coefficients may change in future as a result of changing market conditions or production technologies, for example.

Timing of impacts — employment impacts are shown to occur simultaneously with a change in the harvest level. While fairly accurate for the harvesting sub-sector, this may not be the case for the processing and silviculture sub-sectors of the forest industry. Also, indirect and induced impacts will likely occur over a longer period, as business and consumer spending levels adjust to changes in harvest levels and associated spending.

Processing thresholds — processing job impacts are unlikely to occur in direct proportion to harvest changes (i.e., a 10% harvest reduction may not lead to a 10% processing employment reduction). Impacts are more likely to occur stepwise related to processing thresholds. A processing threshold is the level of a mill's timber supply where, when reached, will cause a mill to either lay off a shift or shut down the mill, temporarily or permanently. As a result, the analysis may overestimate processing impacts if mills continue to operate the same number of shifts, but perhaps at lower production levels, or alternatively could underestimate impacts if a mill were to eliminate a shift. Over the mid- to long-term the impact figures should be reasonably accurate, however.

Proportional harvest reductions — harvest reductions are assumed to be spread proportionately among all licensees and forms of tenure.

B.2 Economic Impact 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 during TSR 2. Other general economic data are from BC STATS, the Ministry of Finance and Corporate Relations, Statistics Canada and local communities.

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.

Estimating employment and income impacts involves several steps. First, the current activity in each of the three sub-sectors was assessed. Then, indirect and induced employment and employment income impacts were estimated. Employment coefficients were calculated and 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 transport, log salvage, planning and administration functions. The employment multipliers used in this analysis define road building and maintenance work as indirect rather than direct employment. Including this employment in direct estimates would result in double-counting.

Harvest employment coefficients from the TSR 2 Strathcona SEA were used to estimate current average direct employment rates.

Two estimates of direct employment in harvesting are presented:

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.

Employment — silviculture

Silviculture employment consists of all basic and intensive reforestation activities, including surveys, site preparation, planting, fertilization, pruning and spacing. Most silviculture work is seasonal, consequently silviculture jobs were converted into equivalent full-time person-years of employment. Coefficients used in this report for TSA and provincial level silviculture employment are from TSR 2.

B.2 Economic Impact Methodology

Employment — timber processing

Information about employment, production and sources of timber was gathered from TSA 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 requirement was supplied by the harvest 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: those who lived within the TSA and those who lived outside the TSA. Employment in timber processing which is supported by chip by-products from milling operations was also estimated similarly.

As with the harvesting sub-sector, direct employment coefficients from the TSR 2 Strathcona SEA were used to estimate current average direct processing employment.

Indirect and induced employment estimates

Indirect employees associated with the forestry sector are those who supply goods and services to firms directly engaged in the basic forestry sector; for example, those who provide road maintenance services, fuel and office equipment and products. Induced employment consist of those who supply goods and services purchased by employees who are directly and indirectly engaged in the industry; for example, those who work in retail outlets.

Two sets of employment multipliers were used for this report: migration multipliers and no-migration multipliers. 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 a displaced worker remains 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 induced impacts associated with a change in direct employment. Estimates provided in this report reflect the mid-point of these multipliers.

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

Table B-1. Total employment multipliers

Forest sub-sector	TSA migration multiplier	TSA no-migration multiplier	Provincial coastal migration multiplier	Provincial coastal no-migration multiplier
Harvesting	1.58	1.38	2.02	1.72
Solid wood processing	1.64	1.44	2.31	1.94
Pulp	2.25	1.98	2.54	2.13

Sources: Provincial multipliers: Horne, G., R. Riley, L. Ransom, and S. Kosempel. 1996. A provincial impact estimation procedure for the British Columbia forest sector.

Local area multipliers: Horne, Garry. "British Columbia's Heartland At the Dawn of the 21st Century: 2001 Economic Dependency and Impact Ratios for 63 Local Areas." January 2004. Victoria: Ministry of Management Services. 1999.

Employment estimates of alternative 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 the future. Therefore, the employment estimates should be viewed as indicators of the magnitude of change rather than as precise estimates of changes in employment levels.