FOREST PRACTICES CODE

Timber Supply Analysis

February 1996

Province of British Columbia

Province of
British Columbia

Ministry of
Forests

Ministry of Forests
595 Pandora Avenue
Victoria, British Columbia
V8W 3E7
Tel: 387-1296 Fax: 387-6267

February 19, 1996

Dear Sir/Madam:

The attached report, "Forest Practices Code - - Timber Supply Analysis" summarizes the timber supply implications of introducing the Forest Practices Code. Under my direction, assessments were conducted by a team of specialists from the Ministry of Forests and the Ministry of Environment, Lands and Parks. The results reflect best professional judgement about how new management practices under the Code will affect timber supplies when compared to the pre-Code practices as reflected in the Timber Supply Review.

The analytical process involved sampling representative management units and extrapolating those results to other units with similar characteristics. This approach provides a reasonable estimate of province-wide timber supply impacts and indicates how those may be distributed regionally.

It is intended that the Forest Practices Code will be implemented in a full and consistent manner across the province. The Code should not be modified on a regional basis to conform to the estimates in this report. Rather, applying the objectives of the Code as incorporated in the legislation and guidebooks should result in achieving the estimated regional timber supply levels. Where necessary, our agencies will issue additional policy direction regarding, for example, the design and implementation of prescriptions for visual resource management to ensure that impacts remain within the intended level. A monitoring system will be established to provide feedback on actual timber supply impacts being experienced as the Code is implemented.

There may be questions which have not been answered in the Timber Supply Analysis report or where further clarification is required. Therefore, a series of meetings is being planned around the province where senior executive members from the Ministry of Forests and the Ministry of Environment, Lands and Parks can discuss the report with staff, the forest industry and stakeholder groups. The schedule has not yet been set but tentative plans are for meetings in early March in Smithers, Prince George, Williams Lake, Kamloops, Kelowna, Nelson, Vancouver and Nanaimo. Details will be announced by February 23.

Please find attached a new first page (iv) of the Executive Summary which corrects some errors in regional percentages. The new page incorporates the correct percentages as shown on page 5 of the report.

Yours truly,

L. Pedersen

Larry Pedersen
Chief Forester

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Timber Supply Analysis

February 1996

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B.C. Ministry of Forests
B.C. Ministry of Environment, Lands and Parks

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Preface

On June 15, 1995, the Forest Practices Code (FPC) officially came into effect, changing forever the way forestry is conducted in British Columbia. The FPC signals a new era in forest management, and moves B.C. to the forefront of sustainable forest practices.

Under the FPC, good forest practices are a requirement of law. This not only provides protection for our forests and their diverse ecosystems, but will also provide greater certainty for the forest industry, forest workers, local communities and the general public.

The benefits associated with the FPC are obvious. Sustainable forest management will support a viable and thriving forest industry to provide jobs and community stability throughout B.C.; it will help protect all values of the forest, including timber, fish, wildlife, water quality, biodiversity, soils, recreation and culture; and it will inspire an ethic of respect for the land that will allow us to use our forests to meet our present needs without compromising the needs of future generations.

There are, however, some costs associated with the FPC. Meeting the new standards and regulations will require adjustments to many field operations, a higher level of knowledge and skills training, increased needs for accurate forest resource information, and improvements in monitoring and enforcement procedures. But perhaps the most far-reaching impact of the FPC is the effect it may have on the short- and long-term timber supply.

This report contains an approximation of the impact of implementing the FPC on provincial and regional harvest levels. The analysis is limited to the effects of various FPC requirements on the timber supply; the implications of other potential social, economic or biological issues are not considered.

The harvest level estimates provided here are based on the best available current data. Nevertheless, it must be kept in mind that the FPC will be an evolving process, continually being refined with the growth of knowledge, the development of new technologies, and the accumulation of experience. Therefore, the following impact estimates are subject to change over time.

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The harvest level estimates provided here are based on the best available current data. Nevertheless, it must be kept in mind that the FPC will be an evolving process, continually being refined with the growth of knowledge, the development of new technologies, and the accumulation of experience. Therefore, the following impact estimates are subject to change over time.

Executive Summary

To address concerns over the impact the Forest Practices Code (FPC) will have on provincial timber supplies, the Chief Forester has undertaken a review of potential short- and long-term impacts, based on an analysis of six of the province's timber supply areas (TSAs)—Strathcona, Sunshine Coast, Quesnel, Okanagan, Lakes and Cranbrook. The estimated impacts of the FPC presented in this report are incremental to the timber supply impacts already accounted for in the provincial Timber Supply Review (TSR).

The analysis assessed several key FPC requirements and one Forest Renewal Plan (FRBC) initiative for their impact on harvest levels—riparian management areas, biodiversity, watershed assessment, identified wildlife, soil conservation, visual quality objectives and watershed restoration (FRBC). The estimated harvest level impacts of riparian management areas and biodiversity are based on technical analyses using Forest Service Simulation Model (FSSIM) data sets. The effects of watershed assessment, identified wildlife, soil conservation, visual quality objectives and watershed restoration are based on best professional estimates.

FPC requirements for riparian management areas and biodiversity proved to have the largest impacts on the provincial timber supply. Riparian and biodiversity requirements will impact harvest levels by approximately 6% over the short term, and by approximately 10% over the long term. Riparian requirements impact the timber supply as a result of areas excluded from the timber harvesting land base as permanent riparian reserves and the reduced timber volumes available (ranging from 50%–95%) for harvest in the riparian management zones that buffer the reserves. Biodiversity requirements impact the timber supply primarily through timber retained for the maintenance of mature and older forest cover and a reduction in available timber resulting from the establishment of wildlife tree patches.

The estimated impact of watershed assessments on the provincial timber supply is 1%, over both the short and long term. Identified wildlife requirements are also estimated to impact short- and long-term harvest levels by 1%; however, this figure does not account for individual species that may generate greater than a 1% impact (e.g., spotted owl, marbled murrelet, grizzly bear, caribou, northern goshawk).

Visual quality objectives (VQOs) can be very restraining on timber supply, especially in areas with large numbers of visually sensitive sites. However, a number of FPC provisions, such as riparian and biodiversity requirements, increased partial cutting, and smaller cutblocks, along with improvements in blending cutblocks into the landscape and minor shifts in VQO classes, are expected to reduce visual impacts to the extent that harvest level gains of approximately 2% can be achieved over both the short and long term.

On a provincial average, weighted by the proportion of the provincial AAC harvested from the coast and the interior, implementation of the FPC will have a net impact of approximately 6% on the short-term harvest level. This estimate includes anticipated short-term harvest level gains of approximately 2% attributable to visual quality objectives.

Over the long term, it is estimated that FPC requirements will have a net impact of approximately 7% on provincial harvest levels. This estimate includes anticipated long-term harvest level gains attributable to visual quality objectives (2%), FPC soil conservation requirements (2.3%), and FRBC watershed restoration projects (0.3–1.0%). In addition, it may be feasible to further offset harvest impacts over the long term through various silviculture investments and other strategies.

The impact of FPC requirements on short-term AAC in different areas of the province will vary significantly from the provincial average. Forecast first decade declines for each forest region are as follows: Vancouver, 9.2%; Prince Rupert, 6.1%; Prince George, 3.6%; Kamloops, 3.9%; Cariboo, 3.3%; and Nelson, 8.3%. **These percentages include the potential harvest level gains attributable to visual quality objectives.**

There are several reasons why some forest regions are much less affected by FPC requirements than other areas. The percentage of area expected to be excluded for riparian reserves in dry, flat forests is, on average, only about one quarter of the percentage excluded in wet, mountainous forests. This is due simply to the lower densities of streams and gullies, and lower stream class ratings in many areas of the interior. In addition, the biodiversity requirements that apply to much of the dry forests are less constraining on the rate of harvest than the requirements for wet areas. This is due primarily to

much less constraining requirements for older forest due to the frequent disturbances that occur naturally in the dry forests.

A major factor that will play a large role in the impact that FPC requirements have on provincial timber supplies is the operational interpretation of the guidebooks. Many FPC guidebooks allow considerable flexibility in their application to site-specific activities. This flexibility will, by design, result in some variation in guidebook application in different areas of the province, and will therefore also result in varying impacts to harvest levels.

The analysis presented in this report is based on the minimum requirements stated in the FPC guidebooks, and therefore represents a conservative estimate of impacts. If more stringent requirements are implemented, the effect on the timber supply forecast can be expected to increase.

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Introduction

Prior to the release of the Forest Practices Code (FPC), there was a great deal of discussion concerning potential impacts on the provincial timber supply. To address these concerns, the Chief Forester formed the Forest Practices Code Harvest Level Impact Working Group, a small team of experts with broad technical backgrounds from the Ministry of Forests and the Ministry of Environment, Lands and Parks. The Working Group was directed to undertake a review of the short- and long-term impacts (and any potential benefits) of implementing the FPC, incremental to the timber supply impacts already accounted for in the provincial Timber Supply Review (TSR) launched in 1992.

The Working Group's impact assessment is based on an analysis of six of the province's timber supply areas (TSAs) – Strathcona, Sunshine Coast, Quesnel, Okanagan, Lakes and Cranbrook. The Strathcona and Sunshine Coast TSAs are used as benchmarks to represent coastal areas, the Quesnel and Lakes TSAs are considered representative of the central/northern interior, and the Okanagan and Cranbrook TSAs represent the southern interior.

Several key FPC requirements and one Forest Renewal Plan (FRBC) initiative are assessed for their impact on harvest levels – riparian management areas, biodiversity, watershed assessment, identified wildlife, soil conservation, visual quality objectives and watershed restoration (FRBC). The estimated harvest level impacts of riparian management areas and biodiversity are based on technical analyses of the TSR data sets from the representative TSAs. The effects of watershed assessment, identified wildlife, soil conservation, visual quality objectives and watershed restoration are based on best professional estimates.

In several of the TSAs studied in this assessment, the estimated short-term timber supply impacts do not relate well with the percent land base reductions or reduced harvest volumes that will be brought about by Forest Practices Code requirements. This is primarily to do with how timber supplies are projected to decline over time and how sensitive a given projection is to changes affecting the inventory.

Some of the TSAs studied have fairly robust timber supplies and show little or no immediate timber supply impact if a proportion of the timber harvesting land base is excluded to meet FPC requirements. In other TSAs a smaller proportion of the timber harvesting land base remains as mature timber and exclusion or deferral of harvesting from these areas has a disproportionately large short-term timber supply impact. In the longer term, the relationship between land base/harvested volume reductions and timber supply impacts is more direct.

A major factor that will play a large role in the impact that FPC requirements have on the provincial timber supply is the operational interpretation of guidebooks. Many FPC guidebooks allow considerable flexibility in their application to site-specific activities. This flexibility will, by design, result in some variation in guidebook application in different areas of the province, and will therefore also result in varying impacts to harvest levels. To address the uncertainty associated with the interpretation of the guidebooks, this analysis is based on the expected specified requirements.

The results presented in this report are judgements made by the Working Group concerning future analysis and information that the Chief Forester may reflect in his allowable cut determinations. The Chief Forester retains sole authority under the *Forest Act* for allowable cut determinations, and he may choose different harvest schedules than those presented here in order to accommodate social or economic consequences to changes in timber supply, or due to his views on technical matters or anticipated timing of projected changes. It is therefore important to note that the base case timber supply forecast is but one of many different information sources that the Chief Forester reviews prior to making an AAC determination under Section 7 of the *Forest Act*.

Given the potential differences between AAC determinations and timber supply forecasts, this report does not attempt to document any potential job impacts associated with implementation of the Forest Practices Code. This is a complex matter that would require reconciliation of additional labour inputs associated with delivering the new code against any potential job loss associated with changes in timber supply.

Finally, it should be recognized that the specific analysis work undertaken for this report did not attempt to project any possible benefits that might accrue from more strategic forest management plans targetted specifically at growing more timber. Potentially increased silviculture activity could result in more fibre being produced in the future also having a positive employment benefit.

1 Analysis Methods

Several key FPC requirements and one FRBC initiative were assessed for their impact on harvest levels. These include:

- riparian management areas – areas adjacent to streams, lakes and wetlands
- biodiversity – stand- and landscape-level requirements for maintaining the diversity of plants, animals and other living organisms in all their forms and levels of organization
- watershed assessment – evaluation of the cumulative impact of proposed activities and developments on stream flows, sediments, landslides and stream channel stability
- identified wildlife – species at risk to be managed through higher-level plans, wildlife habitat areas or general wildlife measures
- soil conservation – requirements to reduce detrimental soil disturbance and restore productivity to temporary access structures
- visual quality objectives – resource management objectives that reflect the desired level of visual quality based on physical characteristics and social concerns
- watershed restoration – road and landslide rehabilitation work carried out under FRBC.

Riparian management area and biodiversity guidebook recommendations were modelled using the following methods:

1. Riparian reserves along streams and lake shores were adjusted to meet FPC specifications for each stream class. Note that riparian reserves are **exclusions** from the timber harvesting land base, as opposed to riparian management zones in which limited portions of the timber volume may be harvested (see point 2 below).
2. The timber volume harvested from each block was reduced by the amount retained in riparian management zones for buffering riparian reserves and to buffer streams without reserves (S4, S5 and S6 streams).
3. Seral stage requirements specifying minimum percentages of the forest landscape to be maintained in older age forests and maximum percentages allowed in younger age forests were applied.*
4. Requirements for wildlife tree patches to be left unharvested within cutblocks were applied.*

Provincial timber supply impact estimates for watershed assessment, identified wildlife, soil conservation, visual quality objectives and watershed restoration were based on the following assumptions:

- watershed assessments – The estimated short- and long-term impact of watershed assessments on the provincial timber supply is 1%, based on landscape-level biodiversity being in place and an estimated 15% reduction in the impact of watershed assessments due to watershed restoration projects being implemented under FRBC.
- identified wildlife – FPC guidebooks for identified wildlife were not complete at the time of this analysis. Nevertheless, the impact of wildlife requirements on the provincial timber supply is estimated to be 1% over both the short and long term. This figure does not include impacts for species that may generate greater than a 1% impact (e.g., spotted owl, marbled murrelet, grizzly bear, caribou, northern goshawk).
- soil conservation – Over the short term, it is assumed that soil conservation measures will have little or no impact on the timber supply. However, over the long term, reducing detrimental soil disturbance and rehabilitating temporary access structures and bladed skid-roads could result in a gain in the provincial timber supply of approximately 2.3%.
- visual quality objectives – Visual quality objectives can be very restraining on timber supply, especially in areas with large numbers of visually sensitive sites. However, a number of FPC provisions, such as riparian and biodiversity requirements, increased partial cutting and smaller cutblocks, along with improvements in blending cutblocks into the landscape and minor shifts in VQO classes, are expected to reduce visual impacts to the extent that harvest level gains of approximately 2% can be achieved over both the short and long term.
- watershed restoration – As discussed above, watershed restoration can help offset the impact of watershed assessment over the short term. Over the long term, watershed restoration could result in harvest level gains of 0.3% to 1.0%, due primarily to road and landslide rehabilitation.

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* As specified in the *Biodiversity Guidebook.*

1 Analysis Methods

Based on the analysis work undertaken, three short-term timber supply impact categories were developed (0–7%, 4% average; 7–12%, 10% average; and 12+%, 14% average).

The provincial AAC was then apportioned to the three impact categories based on a broad estimate of what proportion of the province was likely to meet the average impact groupings; based on broad biophysical considerations such as wet versus dry and so on.

Short-term (first decade) regional timber supply impacts were calculated by summing the weighted reductions for all three impact groupings within each region.

VQO gains were estimated for each forest region, based on the provincial target of approximately 2%. Although the gains were determined analytically (by relaxing timber supply modelling constraints for visuals by 5%), it is recognized that field techniques (discussed earlier in this section) to realize these savings will vary among timber supply areas. This matter is discussed further in Section 2 "Results."

2 Results

The Province

The impact of implementing the FPC on the total provincial timber supply (incremental to the TSR) was estimated based on technical analyses of the representative TSAs for riparian and biodiversity requirements, and best professional estimates for the effects of watershed assessment, identified wildlife, soil conservation, visual quality objectives and watershed restoration. The results are presented in Table 1.

On a provincial average, weighted by the proportion of the provincial AAC harvested from the coast and the interior, implementation of the FPC will have a net impact of approximately 6% on the short-term harvest level. This estimate includes anticipated short-term harvest level gains of approximately 2% attributable to visual quality objectives.

Over the long term, it is estimated that FPC requirements will have a net impact of approximately 7% on provincial harvest levels. This estimate includes anticipated long-term harvest level gains attributable to visual quality objectives (2%), FPC soil conservation requirements (2.3%), and FRBC watershed restoration projects (0.3%–1.0%). In addition, it may be feasible to further reduce harvest impacts over the long term through various silviculture investments and other strategies.

TABLE 1. Provincial harvest forecast showing the impact of several key FPC requirements and one FRBC initiative

	Provincial harvest impacts and (benefits) (%)	
	Short term	**Long term**
Riparian	2.1	6.0
Biodiversity		
– stand	1.8*	
– landscape	2.3	
– stand and landscape	4.1	4.3
Watershed assessments	1.0**	1.0
Identified wildlife	1.0	1.0
Soil conservation	0	(2.3)
Visual quality objectives	(2.2)	(2.0)
Watershed restoration		(0.3–1.0)
Total impact	**6.0**	**7.0–7.7*** **

* Increases by 1% in absence of landscape unit biodiversity objectives.

** Increases by 1.5% in absence of landscape unit biodiversity objectives.

*** Does not include further reductions due to silviculture investments and other strategies.

2 Results

Regions

As mentioned in Section 1, "Analysis Methods," six timber supply areas were analysed in this review. The results of those analyses were extrapolated to the entire province. Table 2 below shows the expected regional variations that occur by extrapolating the results to the regional level. The weightings used for regions were based on estimates of similarities in biophysical features and, while approximate in nature, do reflect broad regional differences in moisture regimes, age class structure for the forest, harvesting history and other diverse differences.

Visual quality objectives (VQOs) have been prescribed as a means of managing important scenic resources in many areas of the province. The Forest Practices Code will change the way forests are managed and those changes are expected to be reflected visually on the landscape. For example, standing timber will be left to meet riparian and biodiversity requirements. In addition, important viewsheds may have alternatives to clearcut harvesting applied where applicable. It is expected that the new operating environment combined with advanced landscape management techniques will reduce the level of impacts previously projected for managing VQOs. Table 3 shows the results of cursory analysis of this matter. The table reflects regional variations that result from differing levels of VQO application and management options in the various regions.

TABLE 2. Short-term AAC impacts per region

Region	AAC (m^3)	Reduction (m^3)	% reduction	VQO gain (%)	Total (%)	Net reduction (m^3)
Vancouver	21 143 210	2 937 089	13.9	4.7	9.2	1 937 089
Prince Rupert	9 195 000	633 600	6.9	0.8	6.1	563 600
Prince George	19 060 955	798 438	4.2	0.6	3.6	688 438
Kamloops	7 760 530	519 191	6.7	2.8	3.9	304 191
Cariboo	8 203 952	328 158	4.0	0.7	3.3	268 158
Nelson	6 009 000	597 912	10.0	1.7	8.3	497 912
Province	71 372 647	5 814 388	8.2	2.2	6.0	4 259 388

TABLE 3. VQO gains by region

Region	AAC (m^3)	Volume gain (m^3)	VQO gain (%)
Vancouver	21 143 210	1 000 000	4.7
Prince Rupert	9 195 000	70 000	0.8
Prince George	19 060 955	110 000	0.6
Kamloops	7 760 530	215 000	2.8
Cariboo	8 203 952	60 000	0.7
Nelson	6 009 000	100 000	1.7

3 Conclusions

FPC requirements for riparian management areas and biodiversity proved to have the largest impacts on the provincial timber supply. Riparian and biodiversity requirements will impact harvest levels by approximately 6% over the short term, and by approximately 10% over the long term. Riparian requirements impact the timber supply as a result of areas excluded from the timber harvesting land base as permanent riparian reserves and the reduced timber volumes available (ranging from 50–95%) for harvest in the riparian management zones that buffer the reserves. Biodiversity requirements impact the timber supply primarily through timber retained for the maintenance of mature and older forest cover and a reduction in available timber resulting from the establishment of wildlife tree patches.

The estimated impact of watershed assessments on the provincial timber supply is 1%, over both the short and long term. Identified wildlife requirements are also estimated to impact short- and long-term harvest levels by 1%; however, this figure does not account for individual species that may generate greater than a 1% impact (e.g, spotted owl, marbled murrelet, grizzly bear, caribou, northern goshawk).

Visual quality objectives can be very restraining on timber supply, especially in areas with large numbers of visually sensitive sites. However, a number of FPC provisions, such as riparian and biodiversity requirements, increased partial cutting and smaller cutblocks, along with improvements in blending cutblocks into the landscape, are expected to reduce visual impacts to the extent that harvest level gains of approximately 2% can be achieved over both the short and long term.

On a provincial average, weighted by the proportion of the provincial AAC harvested from the coast and the interior, implementation of the FPC will have a net impact of approximately 6% on the short-term harvest level. This estimate includes anticipated short-term harvest level gains of approximately 2% attributable to visual quality objectives.

Over the long term, it is estimated that FPC requirements will have a net impact of approximately 7% on provincial harvest levels. This estimate includes anticipated long-term harvest level gains attributable to visual quality objectives (2%), FPC soil conservation measures to reduce detrimental soil disturbance and rehabilitate temporary access structures and bladed skidroads (2.3%), and road and landslide rehabilitation conducted under FRBC watershed restoration projects (0.3%–1.0%). In addition, it may be feasible to further reduce harvest impacts over the long term through various silviculture investments and other strategies.

The impact of FPC requirements on timber supplies will not be felt equally across the province. Forest regions that are dominated by wet, mountainous forests will incur higher impacts than dry, flatter regions. There are several reasons for this. The percentage of area expected to be excluded for riparian reserves in dry, flat areas is, on average, only about one quarter of the percentage excluded in wet, mountainous forests. This is due simply to the lower densities of streams and gullies, and lower stream class ratings. In addition, the biodiversity requirements that apply to much of the dry forests are less constraining on the rate of harvest than the requirements for wet areas. This is due primarily to much less constraining requirements for older forests due to the frequent disturbances that occur naturally in dry forests.

Operational interpretation of the guidebooks will affect to a large degree, the impacts that FPC requirements have on provincial timber supplies. The assumptions used in this analysis are outlined in Appendix G. Implementation of the FPC consistent with these assumptions should result in AAC impacts outlined in this report. If more stringent requirements are implemented, the effect on the timber supply forecast can be expected to increase.

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5 Glossary

Allowable annual cut (AAC)	The allowable rate of timber harvest from a specified area of land. The Chief Forester sets AACs for timber supply areas (TSAs) and tree farm licences (TFLs) in accordance with Section 7 of the *Forest Act*.
Biodiversity (biological diversity)	The diversity of plants, animals and other living organisms in all their forms and levels of organization, including genes, species, ecosystems and the evolutionary and functional processes that link them.
Coarse woody debris	Sound and rotting logs and stumps that provide habitat for plants, animals and insects, and a source of nutrients for soil development. Material generally greater than 8–10 cm diameter.
Cutblock	A specific area of land identified on a forest development plan, or in a licence to cut, road permit or Christmas tree permit, within which timber is to be or has been harvested.
Cutblock adjacency	The desired spatial relationship among cutblocks as specified in integrated resource management guidelines. They can be approximated by specifying the maximum allowable proportion of a forested landscape that does not meet green-up requirements.
Forest cover requirements	Specify desired distributions of areas by age or size class groupings. These objectives can be used to reflect desired conditions for wildlife, watershed protection, visual quality and other integrated resource management objectives.
Forest ecosystem network	An area that maintains or restores the natural connectivity within an area.
Forest inventory	Assessment of British Columbia's timber resources. It includes computerized maps, a database describing the location and nature of forest cover, including size, age, timber volume and species composition, and a description of additional forest values such as recreation and visual quality.
Forest renewal plan	A major long-term plan to renew British Columbia's forests by improving reforestation and silviculture, cleaning up environmental damage, and enhancing community stability and employment within the forest sector.
Harvest forecast	The flow of potential timber harvests over time. A harvest forecast is usually a measure of the maximum timber supply that can be realized, over time, for a specified land base and set of management assumptions. It is a result of forest planning models and is affected by the size and productivity of the land base, the current growing stock, and management objectives, constraints and assumptions.
Identified wildlife	Those species at risk that the Deputy Minister of Environment, Lands and Parks or a person authorized by that deputy minister, and the chief forester, agree will be managed through a higher-level plan, wildlife habitat area or general wildlife measure.

5 Glossary

Inoperable areas

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

Landscape unit

A planning area, up to 100 000 ha in size, based on topographic or geographic features such as a watershed or series of watersheds. They are established by the district manager.

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 includes objectives and guidelines for non-timber values) and estimates of timber growth and yield.

Mature forest

Forests composed primarily of co-dominant trees greater than 45 cm dbh, with canopies that vary vertically, horizontally or both. Generally refers to trees 80 to 120 years old or greater, depending on species and site conditions.

Mean annual increment (MAI)

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

Natural disturbance type (NDT)

A term used to to characterize areas with different natural disturbance regimes. Five natural disturbance types are recognized as occurring in B.C.

NDT1. Ecosystems with rare stand initiating events

NDT2. Ecosystems with infrequent stand initiating events

NDT3. Ecosystems with frequent stand initiating events

NDT4. Ecosystems with frequent stand maintaining fires

NDT5. Alpine Tundra and Sub-Alpine Parkland ecosystems

Netdown

The process of identifying the net land base, which is the total number of hectares of forest land contributing to the annual allowable cut. Areas such as private ownership, non-forest, non-productive, environmentally sensitive, unmerchantable or inaccessible are deleted from the gross land base.

Riparian area

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

Riparian management zone

That portion of the riparian management area that is outside of any riparian reserve zone or if there is no riparian reserve zone, that area located adjacent to a stream, wetland or lake of a width determined in accordance with Part 10 of the *Forest Practices Code of British Columbia Act*, Operational Planning Regulation.

Riparian reserve zone

That portion, if any, of the riparian management area or lakeshore management area located adjacent to a stream, wetland or lake of a width determined in accordance with Part 10 of the *Forest Practices Code of British Columbia Act*, Operational Planning Regulation.

5 Glossary

Seral stages	The stages of ecological succession of a plant community (e.g., from young stage to old stage). The characteristic sequence of biotic communities that successively occupy and replace each other by which some components of the physical environment becomes altered over time.
Stand initiating event	Such events occur when natural disturbances such as wildfire, wind, landslides and avalanches significantly alter an ecosystem. In most cases, there will be considerable mortality of plant species, some degree of site disturbance, and the initiation of successional processes that will form a new plant community with a different structure and likely a different composition than its predecessor.
Stand level	The level of forest management at which a relatively homogeneous land unit can be managed under a single prescription, or set of treatments, to meet well-defined objectives.
Stream	A watercourse, having an alluvial sediment bed, formed when water flows on a perennial or intermittent basis between continuous definable banks.
Timber harvesting land base	The portion of the total land area of a management unit considered to contribute to, and be available for, long-term timber supply. The harvesting land base is defined by deducting non-contributing areas from the total land base according to specified management assumptions.
Timber supply area (TSA)	An integrated resource management unit established in accordance with Section 6 of the *Forest Act*.
Visual quality objective (VQO)	A resource management objective established by the district manager or contained in a higher-level plan that reflects the desired level of visual quality based on the physical characteristics and social concern for the area.
Watershed assessment	An evaluation of the cumulative impact that proposed activities and developments would have on stream flows, suspended sediment, landslide and stream channel stability within the watershed.
Wildlife habitat area	A mapped area of land that the Deputy Minister of Environment, Lands and Parks, or a person authorized by that deputy minister, and the chief forester, have determined is necessary to meet the habitat requirements of one or more species of identified wildlife.
Wildlife tree	A tree or group of trees that are identified in an operational plan to provide present or future wildlife habitat.
Wildlife tree patch	A wildlife tree patch (WTP) is an area specifically identified for the retention and recruitment of suitable wildlife trees. A wildlife tree patch can contain a single wildlife tree to many wildlife trees.

APPENDICES

Results, Data and Assumptions

Introduction

The following results, tables and commentary (Appendices A–F) outline the methods and inputs used to derive the timber harvesting land base and construct the timber supply model data set for the analyses done to assess the impact of riparian and biodiversity FPC requirements on the timber supply forecasts of the Strathcona, Sunshine Coast, Quesnel, Okanagan, Lakes and Cranbrook TSAs. Due to time constraints, more in-depth analyses were carried out on the Strathcona (representative of coastal areas) and Quesnel TSAs (representative of interior areas), and this information was extrapolated to the analyses of the other TSAs in determining the provincial impacts. This extrapolation also accounted for the difference in the analyses from assessing different drafts of guidebooks that were in preparation at the time the six individual units were assessed.

Appendix G is a summary of the assumptions used in the timber supply analysis of the FPC.

Appendix A. Strathcona TSA

Results

The Strathcona TSA Timber Supply Review (TSR) was completed in April 1994. The base harvest forecast for the Strathcona TSR starts at an initial rate of harvest of 1.45 million m^3/year (12% below the AAC – September 1995), then declines by 12% per decade to 938 000 m^3/year. The rate of harvest remains at this reduced level for 70 years before increasing by 16% to a long-term harvest level of about 1.1 million m^3/year.

The harvest forecast for the Strathcona TSA with FPC requirements for riparian management areas and biodiversity is illustrated in Figure A-1. For comparison, the harvest forecast from the Strathcona TSR is represented by the dotted line. The thin solid line shows a harvest forecast using a harvest flow policy similar to the TSR base case. The initial rate of harvest using this flow policy is about 18% below the initial rate of harvest in the TSR base case, or about 30% below the current AAC.

An alternative harvest flow policy that allows a much faster rate of decline in decades two and three (up to 23% per decade) is represented by the thick solid line. The initial rate of harvest with this harvest flow policy is only 11% below the initial rate of harvest in the TSR base case, or about 23% below the current AAC.

For the purpose of the provincial impact analysis, the Working Group chose the "11% below the initial rate of harvest of the TSR" option (thick solid line).

The reduced timber supply forecast due to implementing riparian and biodiversity FPC requirements is a result of a reduced timber harvesting land base and decreased timber yields from each hectare of forest land harvested. The reduced size of the timber harvesting land base is due to an increase in riparian reserves. The decrease in timber yields is due to unharvested timber volume left in riparian management zones along streams and lake shores, unharvested timber retained in wildlife tree patches, and the proportion of the forest that must always be maintained in older age stands. This is expected to significantly reduce timber yields over both the short and long term.

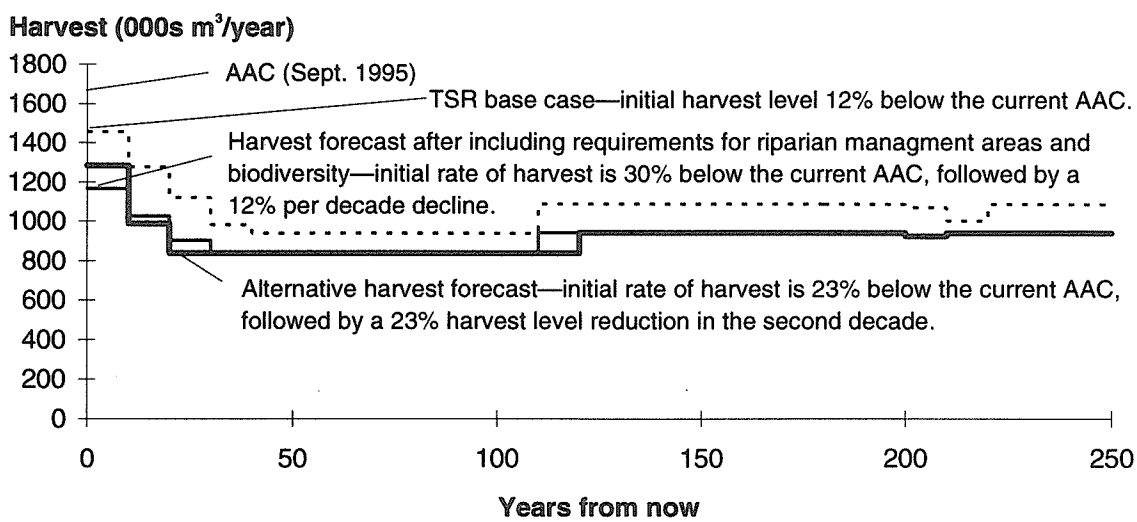

FIGURE A-1. Harvest forecast showing the impact of FPC requirements for riparian management areas and biodiversity on the timber supply of the Strathcona TSA.

Appendix A. Strathcona TSA

Technical Assumptions

After making adjustments to account for riparian and biodiversity guidebook recommendations, the Forest Service Simulation Model (FSSIM) data set from the Strathcona TSA Timber Supply Review was used to analyze the impacts on timber supply. The changes made to the TSR data set in order to model the FPC requirements, as well as the assumptions behind each of the changes, are documented below.

Riparian Reserves

The Strathcona TSR used a 10-metre reserve zone on each side of Class A and major Class B streams, and a 30-metre reserve on all Class A lake shores. For this analysis, the reserve areas were recalculated using the following assumptions.

A 1994 report by Wild Stone Resources provides average figures for stream length by stream class per cutblock, based on a statistically significant sample of coastal cutblocks. These stream length figures were used together with the reserve widths prescribed for each stream class in the FPC to arrive at an average area per cutblock expected to be excluded for riparian reserves. The required reserves for each stream class are as follows:

- S1 – 50-metre reserve, each side
- S2 – 30-metre reserve, each side
- S3 – 20-metre reserve, each side
- S4, 5 or 6 – no reserve required

The measured lake shore perimeter from the Strathcona TSR (Class A lakes only) is assumed to account for all lakes larger than five hectares in size (referred to as L1 lakes in the FPC regulations). The area excluded as reserves on these lake shores was recalculated assuming a 10-metre reserve width along the entire perimeter (as per the Forest Practices Code Operational Planning Regulation), a reduction from the 30-metre reserve width assumed for the TSR.

The above requirements for riparian reserves result in the exclusion of almost 11 000 hectares or about 4.8% of the timber harvesting land base.

Riparian Management Zones

Under FPC standards, riparian management zones will be maintained along all streams and lake shores. Only a portion of the timber volume will be removed from these zones during harvesting, which is modelled by applying a reduction factor to both the existing and regenerated stand yield curves in the timber supply model. The area assumed to fall into riparian management zones is calculated using the following assumptions.

All streams that require forested reserves along their length (S1, S2 and S3) are also assumed to have an additional 20-metre management zone on each side. An average of 50% of the timber volume is assumed to be available for harvest from these management zones.

All streams that do not require forested reserves (S4, S5 and S6 streams) will require a 20-metre (S6 only) or 30-metre management zone. An average of 75% of the volume is assumed to be available for harvest from management zones along S4 and S5 streams, and 95% of the volume is assumed to be available from management zones along S6 streams.

(There were no lakes in the data base for the Strathcona TSA.)

In total, approximately 15% of the timber harvesting land base is assumed to fall within riparian management zones, most of which is alongside S6 streams (due to the frequency of these small streams). The reduction factor applied to the volume-over-age curves in the timber supply model to account for the timber volume left unharvested in riparian management zones is 4.2%.

Landscape-level Biodiversity Guidebook Recommendations

The forest cover requirements used to model landscape biodiversity are drawn from the *Biodiversity Guidebook* (February 25, 1995), using the following assumptions.

Based on inventory summaries of area by biogeoclimatic classification, the Kyuquot supply block is assumed to be natural disturbance type 1 (NDT1) (rare stand initiating events) and the Sayward and Loughborough are assumed to be 40% NDT1 and 60% NDT2 (infrequent stand initiating events). Only the "old forest" cover requirements are applied in the impact analysis. The forest cover requirements for early and mature seral stages are assumed to have considerable flexibility in application and are adequately addressed by existing forest cover requirements for cutblock adjacency and management of visually sensitive areas. The old forest cover requirements used to model landscape biodiversity in the impact analysis are calculated as shown in Table A-1. Table A-1 only shows the calculation done for natural disturbance type 1 (NDT1) forests. The same method of calculation was used to calculate the forest cover requirements over time for other NDTs.

Since the impact that the biodiversity guidebook recommendations have on the timber supply forecast is sensitive to the amount of area that is designated to each biodiversity emphasis class, two different breakdowns of area by biodiversity emphasis class were modelled. Table A-1 assumes a 20%, 70%, 10% breakdown between low, intermediate and high emphasis, respectively. An additional model run was completed that assumes a 50%, 40%, 10% breakdown between the three emphasis categories, respectively. Increasing the amount of area in the low emphasis category reduces the percentage of older forest required in the short term, but does not change the percentage of old growth required in the long term.

The proportion of the required area of old growth that is already present in excluded areas is not fully accounted for in Table A-1. Inventory summaries indicate that the amount of each forest type excluded from the timber harvesting land base for reasons such as inoperability, timber quality, sensitive soils or riparian reserves already exceeds the total amount of old growth that is required by the biodiversity guidebook recommendations. However, the assumption that only half of the required old growth is provided by excluded areas is based on the premise that the excluded areas are not likely to be geographically distributed in such a way that a forest ecosystem network (FEN) could be created without including some of the remaining timber harvesting land base.

Appendix A. Strathcona TSA

TABLE A-1. Calculated landscape-level biodiversity requirements for old forest over time, for natural disturbance type 1 (NDT1)

Initial old growth requirements (Year 0) for NDT1

	Biodiversity emphasis proportions	Percent old growth required	Proportion of old growth in excluded areas	Percent old growth required
Stand/landscape				
Low emphasis*	0.2	0*	0.5	0.0
Intermediate emphasis	0.7	13	0.5	4.5
High emphasis	0.1	19	0.5	1.0
			Total	5.5

Eventual old growth requirements (Year 210) for NDT1

	Biodiversity emphasis proportions	Percent old growth required	Proportion of old growth in excluded areas	Percent old growth required
Stand/landscape				
Low emphasis	0.2	13	0.5	1.3
Intermediate emphasis	0.7	13	0.5	4.5
High emphasis	0.1	19	0.5	1.0
			Total	6.8

		Percent old growth required
Proposed schedule	Year 0	5.5
	Year 70	5.9
	Year 140	6.4
	Year 210	6.8

* the percent old growth requirement in "low emphasis" areas does not have to be met for up to three rotations (approximately 210 years).

Note: Old growth is assumed to be areas with stands older than 240 years.

Stand-level Biodiversity Guidebook Recommendations

The only stand-level biodiversity guidebook recommendation that is modelled is the practice of leaving wildlife tree patches (WTPs). WTPs are modelled by reducing the average volume of timber yielded from each hectare of forest that is harvested. The amount of volume reduction is calculated using figures contained in the Strathcona TSR and from Table 21 in the *Biodiversity Guidebook,* as shown in Table A-2.

Stand-level biodiversity guidebook recommendations regarding retention of coarse woody debris are assumed to have no effect on timber supply forecasts. The recommendations state that no timber meeting current utilization standards is to be left as coarse woody debris.

TABLE A-2. Calculated reductions to volume-over-age curves to account for wildlife tree patches (WTPs)

	(1) Percent of total area	(2) Required % of each cutblock in WTPs[1]	(3) Proportion of required WTPs not already in excluded areas[2]	Proportion of each cutblock to be excluded explicitly for WTPs (1) × (2) × (3)
Low emphasis	20	14	.25	.7
Intermediate emphasis	70	11	.25	1.93
High emphasis	10	8	.25	.2
Weighted total				**2.83**[3]

1 Based on approximately 61% of the Crown forest area in the Strathcona TSA being available for harvest (from Table 1 in the TSR) and about 50% (overall) of the area already being harvested without regard for WTP recommendations (derived from the current Strathcona TSA age class distribution).

2 Because a large proportion of each potential cutblock will already be excluded for reasons other than WTPs (i.e., riparian reserves, riparian management zones, unmerchantable stands, sensitive soils, etc.), the percent reductions in timber yields applied to model the effect of WTPs are assumed to be only 1/4 of the percent area that must be maintained in WTPs.

3 This figure is decreased over time to 1.8% because eventually all areas with WTP requirements will have been harvested, which reduces the required percent area in WTPs per cutblock (column 2 of Table A-2) to 10%, 7% and 4% for high, medium and low emphasis areas, respectively.

Note: Recent revisions to the biodiversity guidebook recommendations require only the low emphasis recommendations to be applied anywhere that landscape-level recommendations are being applied. This change was not analyzed, but was felt to reduce the impact on the short-term timber supply by approximately 1%, which has been accounted for in the impact analysis summary.

Appendix B. Sunshine Coast TSA

Results

The timber supply analysis report for the Sunshine Coast TSA Timber Supply Review has not been publicly released, but the analysis work was completed in early 1995. The base harvest forecast for the Sunshine Coast TSR starts at an initial rate of harvest of 1.1 million m^3/year (the current AAC), then declines by 10% per decade to 876 000 m^3/year. The rate of harvest remains at this reduced level for 10 decades before increasing by 12% to a long-term harvest level of about 986 000 m^3/year.

Note: The analysis on the Sunshine Coast TSA is based on the FPC requirements for riparian management areas and on the November 1994 draft FPC requirements for biodiversity. The analysis was not redone using the February 1995 revised requirements, as was done for the Strathcona and Quesnel TSAs. Using the revised biodiversity requirements, the impact on the harvest forecast is likely to be similar to that shown for the Strathcona TSA.

The harvest forecast for the Sunshine Coast TSA with FPC requirements for riparian management areas and the November 1994 draft FPC requirements for biodiversity is represented by the solid line in Figure B-1. For comparison, the harvest forecast from the Sunshine Coast TSR is represented by the dotted line. The initial rate of harvest is about 20% below the initial rate of harvest (equal to the current AAC) in the TSR base case. From this reduced initial rate, the harvest level declines by about 10% per decade to a long-term level that is about 14% below the long-term level shown in the TSR base case.

The timber supply forecast for the Sunshine Coast TSA is affected by riparian and biodiversity FPC requirements for the same reasons stated for the Strathcona TSA; both the timber harvesting land base and the expected timber yield from each hectare of forest land harvested are reduced.

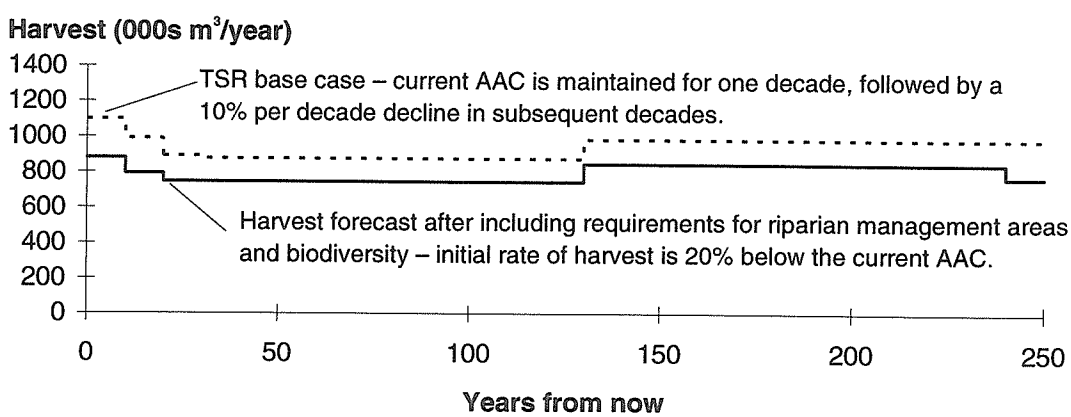

FIGURE B-1. Harvest forecast showing the impact of FPC requirements for riparian management areas and the November 1994 draft FPC requirements for biodiversity on the timber supply of the Sunshine Coast TSA.

Appendix B. Sunshine Coast TSA

Technical Assumptions

The Sunshine Coast TSA analysis was based on riparian guidebook recommendations and the November 1994 draft biodiversity guidebook recommendations; it was not re-analyzed following revision of the biodiversity guidebook recommendations. However, the same assumptions and methods of calculation as in the Strathcona TSA were used here, and therefore the following sections only discuss the figures used in the model without the method of calculation used to derive the figures.

Riparian Reserves

Five percent of the timber harvesting land base is excluded to account for riparian reserves (based on information from the Strathcona analysis).

Riparian Management Zones

All volume-over-age curves are reduced by 4.2% to account for riparian management zones in which a portion of the timber volume will remain unharvested.

Landscape-level Biodiversity Guidebook Recommendations

Landscape-level biodiversity guidebook recommendations are modelled by requiring a minimum of 5% of the timber harvesting land base to be in stands older than 240 years at all times. This forest cover requirement assumes that the entire Sunshine Coast TSA falls into NDT2 (infrequent stand initiating events), and that half of the required proportion of old growth in each landscape unit is provided by areas already excluded from the timber harvesting land base.

Stand-level Biodiversity Guidebook Recommendations

Stand-level biodiversity guidebook recommendations are modelled by reducing all volume-over-age estimates for existing (natural) and regenerated stands by 5% and 2%, respectively. These figures assume that only 50% of the required area of wildlife tree patches will be provided by areas already excluded from the timber harvesting land base.

Appendix C. Quesnel TSA

Results

The timber supply analysis for the Quesnel TSA Timber Supply Review was completed in December 1994. The base harvest forecast for the Quesnel TSR starts at an initial rate of harvest of 2.26 million m^3/year (the current AAC), which can be maintained for seven decades before declining to a long-term level of 1.95 million m^3/year.

The harvest forecast for the Quesnel TSA with FPC requirements for riparian management areas and biodiversity is illustrated in Figure C-1. For comparison, the harvest forecast from the Quesnel TSR is represented by the dotted line. The thin solid line shows the harvest forecast if almost all the old and mature forest required by the *Biodiversity Guidebook* can be found in areas already excluded from the timber harvesting land base as inoperable, poor quality timber or environmental concerns. Given this assumption, the only effect that the FPC requirements have on the timber supply forecast is a slightly reduced long-term harvest level.

The thick solid line shows the harvest forecast if the proportion of mature and older forest required by the *Biodiversity Guidebook* must come out of the existing timber harvesting land base. This assumption is reasonable if the timber harvesting land base is generally made up of large contiguous areas that are not well dispersed with excluded areas. Using this assumption, the initial rate of harvest is still unchanged from the TSR base case, but can only be maintained for five decades before declining by 10% per decade to a long-term level 4% below the long-term harvest level in the TSR base case.

The riparian and biodiversity FPC requirements do not have an effect on the short-term timber supply forecast since the existing inventory of mature timber in the Quesnel TSA is very large. Even with the increased exclusions for riparian reserves and reduced timber availability due to biodiversity requirements, there are enough alternative areas available for harvesting to sustain the current rate of harvest over the short term. However, the initial rate of harvest cannot be maintained as long as in the TSR base case.

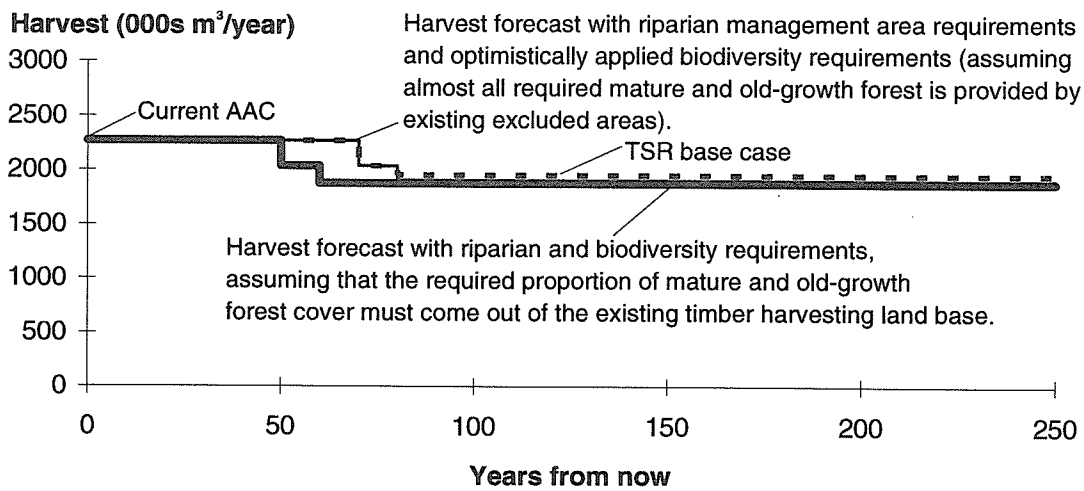

FIGURE C-1. Harvest forecast showing the impact of FPC requirements for riparian management areas and biodiversity on the timber supply of the Quesnel TSA.

Appendix C. Quesnel TSA

Technical Assumptions

After making adjustments to account for riparian and biodiversity guidebook recommendations, the Forest Service Simulation Model (FSSIM) data set from the Quesnel TSA Timber Supply Review was used to analyze the impacts on timber supply. The changes made to the TSR data set in order to model the FPC requirements, as well as the assumptions behind each of the changes, are documented below.

Riparian Reserves

The Quesnel TSR used a 30-metre reserve zone along all streams (each side) and lake shores. For this analysis, the reserve areas were recalculated using the following assumptions.

A total of 3241 kilometres of streams and 500 kilometres of lake shore were measured on 22 sample map sheets. Streams and lake shores are assumed to occur equally in all areas of the TSA. Therefore, the average percent area of each map sheet that falls under riparian reserves is excluded from the timber harvesting land base. The proportion of stream length assumed to fall into each of the "S" designations and the required reserve widths on each side of the stream/lake are as follows:

- S1 – 9% of all measured stream lengths – 50-metre reserve
- S2 – 7% of all measured stream lengths – 30-metre reserve
- S3 – 28% of all measured stream lengths – 20-metre reserve
- S4 – 34% of all measured stream lengths – no reserve
- S5 – 22% of all measured stream lengths – no reserve
- S6 – not measured (not likely to be shown on inventory maps)
- Lake shores – 20-metre reserve*

(proportions derived from Riparian Impact Assessment – Wild Stone Resources; reserve widths are from FPC riparian guidebook recommendations)

* the 20-metre reserve on all lake shores was inadvertently applied and is in excess of the 10-metre reserve required in the riparian guidebook recommendations. However, this overestimate did not affect the results of the analysis.

The above requirements for riparian reserves result in the exclusion of about 20 000 hectares from the timber harvesting land base.

Riparian Management Zones

Under FPC standards, riparian management zones will be maintained along all streams and lake shores. Only a portion of the timber volume will be removed from these zones during harvesting. The area assumed to fall into riparian management zones is calculated using the following methods.

All streams that require forested reserves along their length (S1, S2 and S3) will also have an additional 20-metre management zone on each side. An average of 50% of the timber volume is assumed to be available for harvest from these areas.

All streams that do not require forested reserves (S4 and S5 streams) will require a 30-metre management zone in which only 75% of the timber volume will be removed during harvesting.

All lakes with reserves will require an additional 40-metre management zone outside of the forested reserve. An average of 50% of the timber volume in the management zone will be available for harvest.

The percent area excluded for streams and the volume-over-age curve adjustments made to account for the area of ripararian management zones that will be only partially harvested are shown in Table C-1.

Appendix C. Quesnel TSA

TABLE C-1. Riparian reserve netdown and volume-over-age curve adjustment to account for riparian management zones

Stream class	Length (m)	Reserve (m)	Management zone (m)	Reserve zone area (ha)	Management zone Area (ha)	Management zone Vol. ret. (%)
S1	301 635.7	50	20	3016.357	1206.543	50
S2	233 767.7	30	20	1402.606	935.0706	50
S3	902 418.6	20	20	3609.674	3609.674	50
S4	1 088 377.0		30	0	6530.262	25
S5	714 801.2		30	0	4288.807	25
S6	0.0		20	0	0	5

a	Total area in reserves	8 028.637	sum from above table
b	Total area sampled	330 000	(22 mapsheets)
c	Reserve area netdown (%)	2.4	
d	Reserve netdown using TSR lengths (%)	0.00	
e	Reserve adjustment factor required	0.00	c divided by d
	Additional reserve required	0.00	c minus d
f	Ratio of S4 and S5 to S1,2,3	1.25	from above table
g	Ratio of S6 to S1,2,3	0.00	from above table
h	Ratio of L2 lakes to L1 lakes	1	(estimated) metres
i	Average reserve width on streams with reserves	27.9	
j	Average reserve width on lakes with reserves	20	
k	RMZ width on S1,2, and 3 streams	20	latest specs
l	RMZ width on S4 and 5 streams	30	latest specs
m	RMZ width on S6 streams	20	latest specs
n	RMZ width on lakes with reserves	40	
o	RMZ width on lakes with no reserves	30	hectares
p	Adjusted area removed as stream reserves	20 000	from new netdown (approx.)
q	Area removed as lakeshore reserve	1 600	from new netdown (approx.)
r	Area of RMZ on S1,2, and 3 streams	14 336	k over i times p
s	Area of RMZ on S4 and 5 streams	26 969	l over i times p times f
t	Area of RMZ on S6 streams	0	m over i times p times g
u	Area of RMZ on L1 lakes	3 200	n over j times q
v	Area of RMZ on L2 lakes	2 400	o over j times q times h
w	Timber harvesting land base	950 000	percent
	Reduction to yield curves due to S1,2,3 RMZs	0.8	r over w times 50%
	Reduction to yield curves due to S4,5 RMZs	0.7	s over w times 25%
	Reduction to yield curves due to S6 RMZs	0.0	t over w times 5%
	Reduction to yield curves due to L1 RMZs	0.2	u over w times 50%
	Reduction to yield curves due to L2 RMZs	0.1	v over w times 50%
	Volume over age curve reduction (%)	1.8	

Landscape-level Biodiversity Guidebook Recommendations

A summary of the timber harvesting land base by biogeoclimatic classification indicates that all but 8000 hectares (less than 1%) of the timber harvesting land base is in natural disturbance type 3 (NDT3) (frequent stand initiating events). Biodiversity guidebook recommendations are modelled on the assumption that the entire Quesnel TSA falls into NDT3. The forest cover requirements for this natural disturbance type are drawn from Tables 11 and 12 of the *Biodiversity Guidebook* (February 25, 1995).

Only the mature and old forest cover requirements are applied in the impact analysis. The forest cover requirements for the early seral stage are assumed to be non-constraining and are adequately addressed by existing forest cover requirements for cutblock adjacency and management of visually sensitive areas. The mature and old forest cover requirements for landscape biodiversity in the impact analysis are modelled by first determining how much of each forest type is already excluded by other netdowns (e.g., riparian buffers, sensitive soils, inoperability). The area already excluded is subtracted from the area that must be maintained at the older ages in the timber harvesting land base (i.e., if 13% old growth is required and 9% is already in excluded areas, then only another 4% of old growth is required to be maintained on the timber harvesting land base). Sufficient forest area is already excluded in the Quesnel TSA, such that, assuming the excluded area is well distributed between landscape units, the minimal forest cover requirements for mature forest shown in Table C-2 are all that is required on the timber harvesting land base.

TABLE C-2. Forest cover requirements for biodiversity if all excluded forest area is well distributed and contributes to landscape-level biodiversity

Model zone	Mature age	Minimum percent to be older than mature age
Western caribou	n/a	n/a
Special sale area	n/a	n/a
LRUP/Visual quality	100	3
Kluskus supply block	n/a	n/a
IRM	100	8
Problem forest types	100	10

A second model run was set up using the assumption that the inoperable areas are not well distributed among operable areas, and that the required proportion of mature and old-growth forest would have to be maintained entirely from operable areas. The forest cover requirements for mature forest are calculated for this run as shown in Table C-3.

TABLE C-3. Mature forest cover requirements over time, if the requirements must be met exclusively from the timber harvesting land base

Initial old growth requirements (Year 0) for NDT3	Biodiversity emphasis proportions	Percent mature/old forest required	Proportion of mature/old in excluded areas	Additional percent mature/old required
Stand/landscape				
Low emphasis	0.5	0	0	0.0
Intermediate emphasis	0.4	23	0	9.2
High emphasis	0.1	34	0	3.4
Total				12.6

Eventual old growth requirements (Year 210) for NDT3	Biodiversity emphasis proportions	Percent mature/old forest required	Proportion of mature/old in excluded areas	Additional percent mature/old required
Stand/landscape				
Low emphasis	0.5	11	0	5.5
Intermediate emphasis	0.4	23	0	9.2
High emphasis	0.1	34	0	3.4
Total				18.1

Proposed schedule for phasing of mature/old forest:

Year 0 – 12.6%
Year 70 – 14.4%
Year 140 – 16.3%
Year 210 – 18.1%

Note: Mature/old forest is greater than 80 years.

Stand-level Biodiversity Guidebook Recommendations

Wildlife tree patch (WTP) recommendations are the only stand-level biodiversity guidebook recommendations modelled for the Quesnel TSA. WTPs are modelled by reducing the average volume of timber yielded from each hectare of forest that is harvested. The appropriate volume reduction is estimated using figures contained in the Quesnel TSR and the *Biodiversity Guidebook* (February 25, 1995).

Approximately 70% of the forest area in the Quesnel TSA is available for harvest (from Table 1 in the Quesnel TSR). If about 20% (overall) of the area has already been harvested without regard for WTP guidelines (which appears reasonable given the age class distribution on page 17 of the Quesnel TSR), Table 21 in the February 1995 draft *Biodiversity Guidebook* indicates that 9% of the area of cutblocks to be harvested in the near future will have to be left in WTPs. In the future, as more areas have been harvested using WTP guidelines, the percent area that will have to be left as a WTP in each block will be reduced to 8% (also from Table 21 in the February 1995 draft *Biodiversity Guidebook*). The percent reductions in timber yields applied to model the effect of WTPs are assumed to be one half of the percent area that must be maintained in WTPs. The reasoning behind this assumption is that at least half of the area required for WTPs will be contributed by inoperable stands, unmerchantable stands and areas excluded for riparian reserves.

Recommendations regarding retention of coarse woody debris are assumed to have no impact on the timber supply forecast and are not included in this analysis. The revised biodiversity guidebook recommendations state that no timber meeting utilization standards will be required to be left on site for biodiversity purposes.

Appendix D. Okanagan TSA

Results

The timber supply analysis report for the Okanagan TSA Timber Supply Review was completed in November 1993. The base harvest forecast for the Okanagan TSR starts at an initial rate of harvest of 2.61 million m^3/year (the current AAC), which can be maintained for two decades before declining by 10% per decade to a long-term level of about 2.0 million m^3/year.

Note: The analysis on the Okanagan TSA is based on the FPC requirements for riparian management areas and on the November 1994 draft FPC requirements for biodiversity—the analysis was not redone using the February 1995 revised requirements, as in the Strathcona and Quesnel TSAs.

The harvest forecast for the Okanagan TSA with FPC requirements for riparian management areas and the November 1994 draft FPC requirements for biodiversity is represented by the solid line in Figure D-1. For comparison, the harvest forecast from the Okanagan TSR is represented by the dotted line. The initial rate of harvest is about 5.5% below the initial rate of harvest in the TSR base case. From this reduced initial rate, the harvest level declines by about 11% per decade to a long-term level that is about 10% below the long-term level shown in the TSR base case.

The timber supply forecast for the Okanagan TSA is affected only slightly by the FPC requirements for riparian reserves and landscape-level biodiversity. The area excluded for riparian reserves is expected to be far less than is removed in wetter areas of the province, and the Okanagan TSA Timber Supply Review already includes requirements for maintenance of old-growth forest that are considered comparable to the FPC requirements for landscape-level biodiversity. Of greater significance are the requirements for stand-level biodiversity (wildlife tree patches) and the partial retention of timber volume when harvesting in riparian management zones. These two factors reduce the expected timber yield from each hectare of forest land harvested by about 4%.

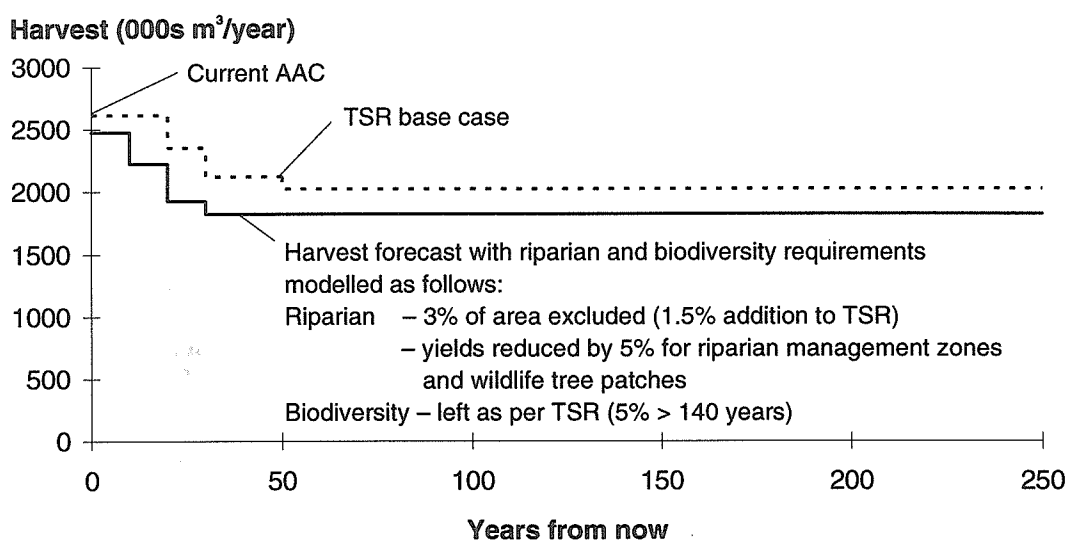

FIGURE D-1. Harvest forecast showing the impact of FPC requirements for riparian management areas and the November 1994 draft FPC requirements for biodiversity on the timber supply of the Okanagan TSA.

Appendix D. Okanagan TSA

Technical Assumptions

The Okanagan TSA analysis was based on riparian guidebook recommendations and the November 1994 draft biodiversity guidebook recommendations, and was not re-analyzed following revision of the biodiversity guidebook recommendations.

Riparian Reserves

The Okanagan TSR modelled riparian and lake shore management by assuming that a 20-metre riparian reserve will be maintained on each side of all streams and lakes, and assumed that 50% of the area in these reserves could be harvested using a selection system. The total area excluded in the TSR using these assumptions was 1.5% of the operable land base. For this analysis, an additional 1.5% of the timber harvesting land base was removed to reflect that no harvesting is likely to occur in the riparian reserves.

Riparian Management Zones

All volume-over-age curves are reduced by 1.5% to account for riparian management zones in which a portion of the timber volume will remain unharvested. This figure was derived from average interior stream length and class information contained in the Riparian Impact Assessment completed by Wild Stone Resources.

Landscape-level Biodiversity Guidebook Recommendations

The Okanagan TSR includes forest cover requirements of a minimum of 5% of the timber harvesting land base to be comprised of stands older than 140 years at all times. This requirement, which provides for older forest in addition to that already maintained in excluded and visually sensitive areas, is felt to adequately reflect the FPC requirements for maintaining older forest.

Stand-level Biodiversity Guidebook Recommendations

Wildlife tree patch (WTP) recommendations are the only stand-level biodiversity guidebook recommendations modelled for the Okanagan TSA. WTPs are modelled by reducing the average volume of timber yielded from each hectare of forest that is harvested. The appropriate volume reduction is estimated using figures contained in the Okanagan TSR and the February 1995 draft *Biodiversity Guidebook.*

Approximately 70% of the productive forest area in the Okanagan TSA is available for harvest (from Table 1 in the Okanagan TSR). If about 20% (overall) of the area has already been harvested without regard for WTP recommendations (which appears reasonable given the age class distribution on page 16 of the Okanagan TSR), Table 21 in the February 1995 draft *Biodiversity Guidebook* indicates that 9% of the area of cutblocks to be harvested in the near future will have to be left in WTPs. In the future, as more areas have been harvested using WTP recommendations, the percent area that will have to be left as WTPs in each block will be reduced to 8% (also from Table 21 in the February 1995 draft *Biodiversity Guidebook*). The percent reductions in timber yields applied to model the effect of WTPs are assumed to be one quarter of the percent area that must be maintained in WTPs. The reasoning behind this assumption is that three quarters of the area required for WTPs will be contributed by inoperable stands, unmerchantable stands and areas excluded for riparian reserves.

Recommendations regarding retention of coarse woody debris are assumed to have no impact on the timber supply forecast and are not included in this analysis. The revised biodiversity guidebook recommendations state that no timber meeting utilization standards will be required to be left on site for biodiversity purposes.

Appendix E. Lakes TSA

Results

The timber supply analysis report for the Lakes TSA Timber Supply Review was completed in June 1995. The base harvest forecast for the Lakes TSR starts at an initial rate of harvest of 1.5 million m^3/year (the current AAC), which can be maintained for seven decades before declining to a steady long-term harvest level of about 1.45 million m^3/year.

Note: The analysis on the Lakes TSA is based on the FPC requirements for riparian management areas and on the November 1994 draft FPC requirements for biodiversity—the analysis was not redone using the February 1995 revised requirements, as in the Strathcona and Quesnel TSAs.

The harvest forecast for the Lakes TSA with FPC requirements for riparian management areas and the November 1994 draft FPC requirements for biodiversity is represented by the solid line in Figure E-1. For comparison, the harvest forecast from the Lakes TSR is represented by the dotted line. The initial rate of harvest is unchanged from the TSR base case; however, it can only be maintained for three decades before declining to a steady long-term level of about 1.22 million m^3/year. Although the short-term harvest level is unchanged, the area between the solid and dotted lines from year 30 to the end of the 250-year period represents a significant reduction in the projected medium- and long-term timber supplies.

The timber supply forecast for the Lakes TSA is affected by the riparian and biodiversity FPC requirements for the same reasons stated for the Strathcona and Sunshine Coast TSAs; both the timber harvesting land base and the expected timber yield from each hectare of forest land harvested are reduced.

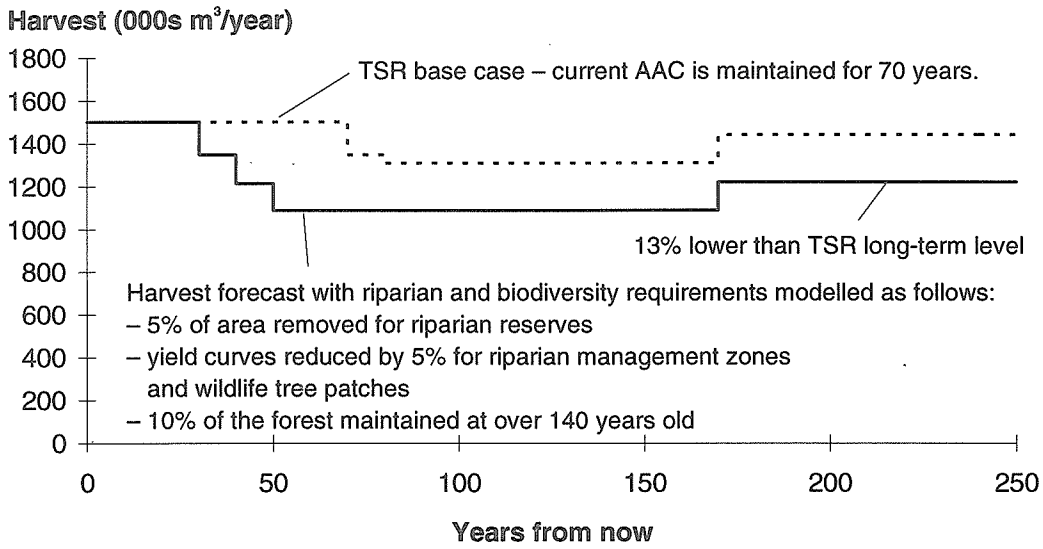

FIGURE E-1. Harvest forecast showing the impact of FPC requirements for riparian management areas and the November 1994 draft FPC requirements for biodiversity on the timber supply of the Lakes TSA.

Appendix E. Lakes TSA

Technical Assumptions

The Lakes TSA analysis was based on riparian guidebook recommendations and the November 1994 draft biodiversity guidebook recommendations, and was not re-analyzed following revision of the biodiversity guidebook recommendations.

Riparian Reserves

Five percent of the timber harvesting land base is excluded to account for an increased area of riparian reserves that may be required by the FPC. To address concerns that average interior stream length figures (from the Riparian Impact Assessment) would underestimate the actual area of riparian reserves for this TSA because of the large number of lakes and wetlands, a separate estimate of the area of lake shore and wetland reserves was calculated. This calculation was based on the total area of lake and wetland showing on the forest cover inventory, the average area of each lake and wetland area, and a final assumption that all lakes and wetlands are circular (for ease of calculating a perimeter length from an area). The estimated area of lake and wetland reserve was then added to the average interior stream length figures to come up with a total area of riparian reserve equal to 5% of the timber harvesting land base.

Riparian Management Zones

All volume-over-age curves are reduced by 2% to account for riparian management zones in which a portion of the timber volume will remain unharvested. This figure is not based on data, but is simply a best professional estimate based on the figures derived for other interior TSAs (Okanagan, Quesnel).

Landscape-level Biodiversity Guidebook Recommendations

Landscape-level biodiversity guidebook recommendations are modelled by requiring a minimum of 10% of the timber harvesting land base to be in stands older than 140 years at all times. This forest cover requirement assumes that the entire Lakes TSA falls into NDT3 (frequent stand initiating events), and that very little of the required proportion of old growth in each landscape unit is provided by areas already excluded from the timber harvesting land base.

Stand-level Biodiversity Guidebook Recommendations

Stand-level biodiversity guidebook recommendations are modelled by reducing all volume-over-age estimates for existing (natural) and regenerated stands by 3%. This figure assumes that about 75% of the required area of wildlife tree patches will be provided by areas already excluded from the timber harvesting land base.

Appendix F. Cranbrook TSA

Results

The timber supply analysis report for the Cranbrook TSA Timber Supply Review was completed in March 1995. The base harvest forecast for the Cranbrook TSR starts at an initial rate of harvest of 806 522 m^3/year (10% below the current AAC), then declines by 10% per decade for the next three decades to about 603 000 m^3/year (this interim level is about 9% below the steady long-term level, and about 25% below the initial level). The rate of harvest remains at this level for eight decades before rising to the steady long-term harvest level of 661 000 m^3/year. Overall, there is about an 18% decline from the initial harvest level to the long-term level attained in decade 13—this also represents a 26% decrease from the current AAC.

The Cranbrook TSR harvest forecast reflects the extensive history of fires in the Cranbrook TSA which has led to a short supply of mature timber. This shortage in mature timber has resulted in harvesting being allowed at younger ages and lower volumes than would normally be permitted. As a result, the long-term timber supply projection of the TSR is lower than the theoretical maximum sustainable level.

Note: FPC requirements for riparian management areas were not included in the Cranbrook analysis.

The harvest forecasts for the Cranbrook TSA with FPC requirements for biodiversity only are represented by the solid lines in Figure F-1. For comparison, the harvest forecast from the Cranbrook TSR is represented by the dotted line. The initial rate of harvest either starts at a level 14% below (thin solid line) or 8% below (thick solid line) the initial rate of harvest in the TSR base case. The only difference between the lines is the timing of harvests (harvest flow). As per the *Biodiversity Guidebook*, 60% of the TSA was treated as low biodiversity emphasis, 30% moderate and 10% high.

For the purpose of the provincial impact analysis, the Working Group chose the "8% below the initial rate of harvest of the TSR" option (thick solid line).

Biodiversity requirements specify that a certain proportion of the landscape must be retained in mature and older forest cover. Over time, these retained areas will produce much older trees with higher volumes. As other areas over the landscape mature and grow older, the biodiversity cover requirements can be shifted to these areas, freeing previously retained areas to be harvested. The older harvest ages in the previously retained areas will, for the most part, come closer to the culmination point (as compared to the TSR long-term forecast), and will therefore yield higher volumes per hectare. As a result, the long-term harvest level is about 20% higher than that of the TSR base case beginning in decade 13. This level approaches the theoretical maximum sustainable level of 832 000 m^3/year, which is based on maximum mean annual increment.

It is assumed that both the short- and long-term timber supply will be further impacted with the inclusion of other FPC requirements.

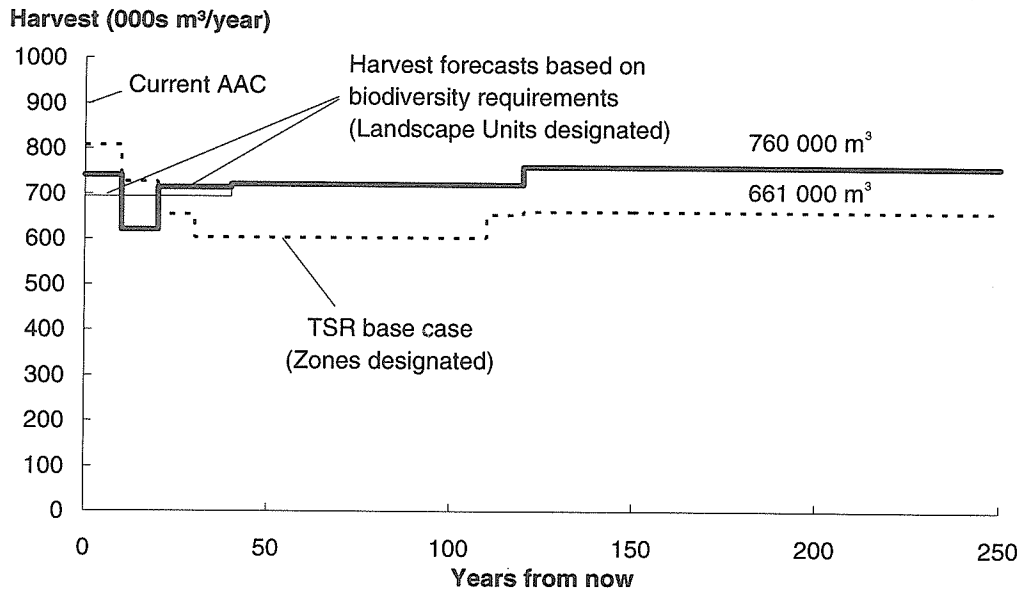

FIGURE F-1. Harvest forecast showing the impact of FPC requirements for biodiversity (riparian management areas not included) on the timber supply of the Cranbrook TSA.

Technical Assumptions

The Cranbrook TSA analysis was based on biodiversity guidebook recommendations only.

Biodiversity Guidebook Recommendations

The biodiversity analysis undertaken for the Cranbrook TSA involved designating landscape units and applying seral stage requirements as outlined in the 'risk/emphasis' section of the *Biodiversity Guidebook* (February 1995).

Other resource values were not analyzed, and as such, the impacts shown overestimate the effect of applying the biodiversity guidebook recommendations on a managed forest. For example, riparian areas, visual quality, identified wildlife and watershed assessments all have certain forest cover requirements that can account for meeting seral stage requirements for maintenance of biodiversity. The results, however, do portray estimated harvest levels given the minimum requirements for biodiversity with the following breakdown; 60% low, 30% intermediate and 10% high emphasis.

Seral stage requirements for mature and old forest were essentially the only parameters modelled. The forest cover requirements for early seral stage were included; however, they were unconstraining. The mature and old forest cover requirements for landscape biodiversity were modelled by first determining how much of each biogeoclimatic type (natural disturbance type) is already excluded by other netdowns (e.g., inoperable areas, environmentally sensitive areas). The area already excluded was subtracted from the amount of area that must be maintained at older ages in the timber harvesting land base.

Appendix G. Assumptions Used in the Timber Supply Analysis of the Forest Practices Code

Riparian Management Areas

Maximum levels of basal area retention within the riparian management zone for each riparian class of stream, wetland and lake were as follows:

Riparian class	Maximum overall retention (%)
Stream	
S1	50
S2	50
S3	50
S4	25
S5	25
S6	5
Wetlands and Lakes	
All classes combined	25

Landscape-level Biodiversity (based on the Strathcona and Quesnel analyses)

- Application of landscape-level biodiversity was assumed to be province-wide.
- Emphasis options were arrayed in the following proportions based on two runs: low emphasis 20%, intermediate emphasis 70%, high emphasis 10%; and low emphasis 50%, intermediate emphasis 40%, high emphasis 10%.
- In coastal areas, forest cover requirements for early and mature seral stages were assumed to be non-constraining.
- In coastal areas, 50% of old seral requirement will be met by excluded areas.
- In interior areas, requirements for early seral stages were assumed to be non-constraining.

Stand-level Biodiversity (based on the Strathcona and Quesnel analyses)

- Application of stand-level biodiversity was assumed to be province-wide.
- Recommendations regarding coarse woody debris were assumed to have no effect on timber supply forecasts.
- In coastal areas, 75% of the area requirements for wildlife trees will be met by excluded areas.
- In the interior, 50% of the area requirements for wildlife trees will be met by excluded areas.

Identified Wildlife

- Short- and long-term AAC impact for identified wildlife assumed to be 1%.
- Assumed that identified wildlife species generating more than 1% AAC impact will be managed through higher-level plans.

Watershed Assessments

- Short- and long-term AAC impact estimated to be 1% based on the following assumptions:
  - province-wide application of landscape-level biodiversity recommendations; and
  - 15% reduction in the impacts of watershed assessments due to FRBC watershed restoration projects.

Appendix G. Assumptions Used in the Timber Supply Analysis of the Forest Practices Code

Soil Conservation

- No short-term AAC benefits were assumed to accrue from FPC soil conservation measures.
- Long-term benefits, due to reducing soil disturbances and rehabilitating temporary access structures and bladed skidroads were assumed to be 3.2% and 0.3% for the interior and coast, respectively.

Visual Quality Objectives

- Modifying visual quality management practices will result in AAC gains of approximately 2% over both the short and long term.