

**ECONOMIC EVALUATION OF
SOME RESOURCE MANAGEMENT
GOVERNING THE TIMBER SUPPLY IN TFL 39**

**July 1994
B.M. Gellner**

TABLE OF CONTENTS

	Page #
1.0 INTRODUCTION	1
2.0 ECONOMIC IMPORTANCE OF TFL 39	2
2.1 Overview	2
2.2 Economic Contribution	3
1. Gross Sales Value	4
2. Direct Employment	7
3. Indirect Employment	8
4. Community Dependencies	9
5. Employee Compensation & Benefits	11
6. Government Revenues	11
7. Summary	13
3.0 ECONOMIC EVALUATION	13
3.1 Economic Impact Analysis	14
3.2 Benefit-Cost Analysis	14
1. Foregone Rents	15
2. Increase In Manufacturing Costs	15
3. Increase In Harvesting and Planning Costs	16
4. Training and Adjustment Costs	17
5. Other Costs	17
4.0 RESULTS	18
4.1 Economic Analysis Of Integrated Resource Management Constraints	18
1. Aggregate Impact Except Additional Biodiversity ...	18
2. Visual Quality	19
3. Biodiversity	21
4.2 Summary	22
5.0 WHAT ARE THE BENEFITS?	24
REFERENCES	26

1.0 INTRODUCTION

B.C.'s forests, including those under MB's care, are managed to meet economic, community and other goals, such as biodiversity, wildlife, recreation and fisheries. The challenges facing forest planners involve trying to find a balance between goals that are often conflicting, and managing for views that can be diverging and evolving.

Specific harvest rules and land-base deletions were incorporated in the timber supply analysis in order to examine the sensitivity of the harvest in TFL 39 to various integrated resource management issues. A key reason for doing this is to identify those constraints that have large economic consequences. Forest planners and decision makers can then determine ways in which the costs can be minimized while achieving the various intended objectives.

The objective of this report therefore is to assess the economic costs and impacts of the key issues governing the timber supply analysis in TFL 39. Economic impact and benefit-cost techniques are used to accomplish this objective. While other decision making tools are available, these two combined are believed to produce sufficient information to help identify in which areas industry and government can work cooperatively to develop more beneficial outcomes.

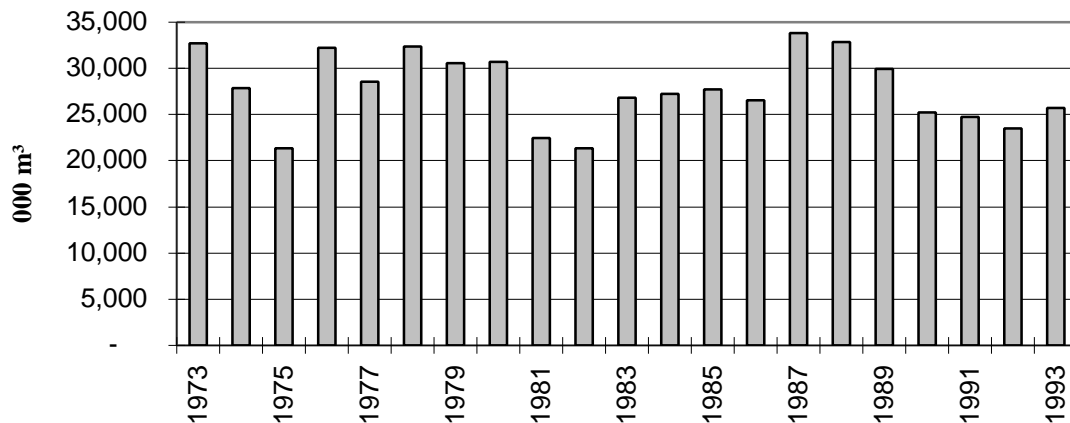
Before examining the impacts, this report describes the importance of TFL 39 to the provincial and national economy. This establishes the benchmark against which the various economic impact scenarios can be compared. Where possible, the report explores TFL 39's importance in local communities since community stability and viability are key objectives of any timber supply decision.¹

2.0 ECONOMIC IMPORTANCE OF TFL 39

2.1 Overview

The Coastal forest region, containing some of the most valuable coniferous timber in the world, provides about 33% of the timber harvested in the province. Supplies from this area have remained relatively stable over the last two decades, averaging almost 28 million m³ per year between 1973 and 1993. (Figure 1) Consequently, despite undergoing restructuring in order to stay competitive, the forest industry continues to provide a solid economic foundation for many Coastal communities.

¹ This report does not examine specific social indicators. For an understanding of how certain resource based communities have adjusted to various changes, refer to ARA Consulting Group Inc. (1993).

Figure 1: Coastal Log Production

Source: Ministry of Forests

Based on 1993 data, TFL 39 represents about 13% of the timber harvested from the Vancouver Forest Region. TFL 39 accounts for 19% of the timber produced from the five districts in which it is located, reaching as high as 47% in the Queen Charlotte Islands. (Table 1) This local activity has significant implications for community stability and viability.

Table 1
Coastal Regions and TFL 39 Harvest - 1993

District	Total (000 m ³)	TFL 39 ¹ (000 m ³)	TFL 39 Share
Sunshine Coast	1,891	384	20%
Campbell River	5,834	1,305	22%
Port McNeill	5,103	308	6%
Mid Coast	1,924	158	8%
Queen Charlotte	2,111	999	47%
Total Vancouver Region	24,659	3,154	13%
Total Coastal Region	25,684	3,154	12%

Source: Ministry of Forests, MB

¹ These numbers exclude small business

All volumes are log scaled volumes (i.e these volumes are 8% lower than those in the timber supply analysis to reflect residue losses).

Most of the logs harvested in TFL 39 flow to processing facilities located in Nanaimo, Chemainus, Powell River and the Lower Mainland. These mills manufacture a wide range of products with emphasis on decorative grades of lumber. Other mills also benefit from the timber harvested in TFL 39 through long term fibre trading relationships with MB.

Following primary processing, 42% of MB's lumber production² is remanufactured in B.C. into value added products such as panelling, bevel siding, window & door stock, finger-joint blanks, finger-joint blocks, cutstock, fencing, appearance beams, shutter components, edge-glued boards, flooring, decking, handrail blanks, clear cutstock and much more. MB is the largest remanufacturer in B.C. and largest supplier of fibre to independent B.C. remanufacturers. In comparison, the remaining Coastal primary producers direct about 23% of their lumber through B.C.-based remanufacturers. In the Interior, only 6% of the lumber produced is further remanufactured in B.C.

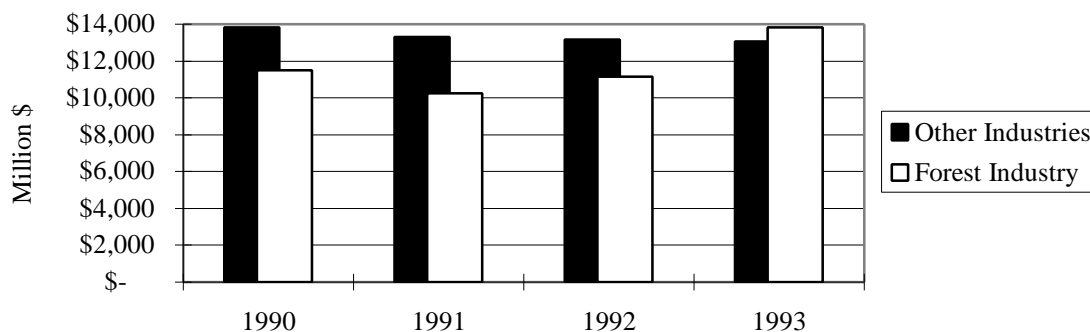
2.2 Economic Contribution

The contribution of the forest sector and TFL 39 to the local, provincial and national economies can be measured using five key indicators. These indicators provide the foundation for the economic impact analysis portion of the study.

1. Gross Value of Sales

Gross value of sales is the total sales value generated by the final products produced from B.C.'s forest industry. In 1993, the provincial forest industry sold \$13.8 billion worth of products³, 85% of which was directed to international markets. This represents over 50% of B.C.'s total manufacturing value (Figure 2).

**Figure 2: B.C. Manufacturing Shipments
(Million \$)**



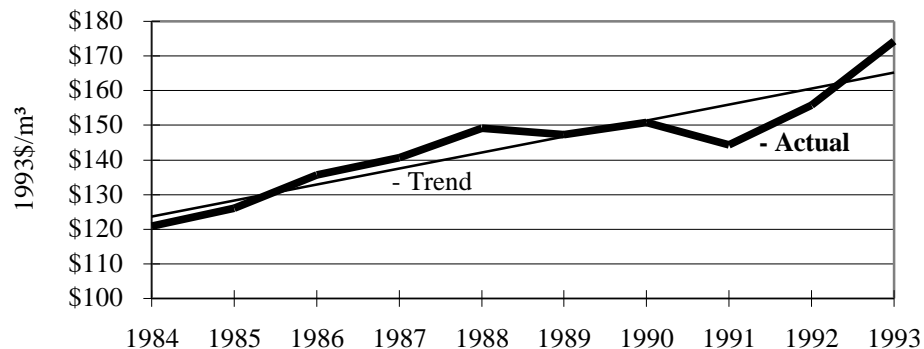
Source: Statistics Canada

On average, sales value per m³ has been increasing at a real rate of 3% per year over the last several years, finishing 1993 at \$175/m³ (Figure 3). This growth has been driven by strengthening wood products markets, significant improvements in value recovery and a depreciating Canadian dollar.

² Includes volume remanured in MB owned facilities, remanured in MB leased facilities and sold by MB to independent remanurers.

³ The higher the value of shipments from B.C. the higher is the economic well-being of B.C. society, all other thing being equal.

Figure 3: Real Gross Sales Value Per m³ Of Harvest

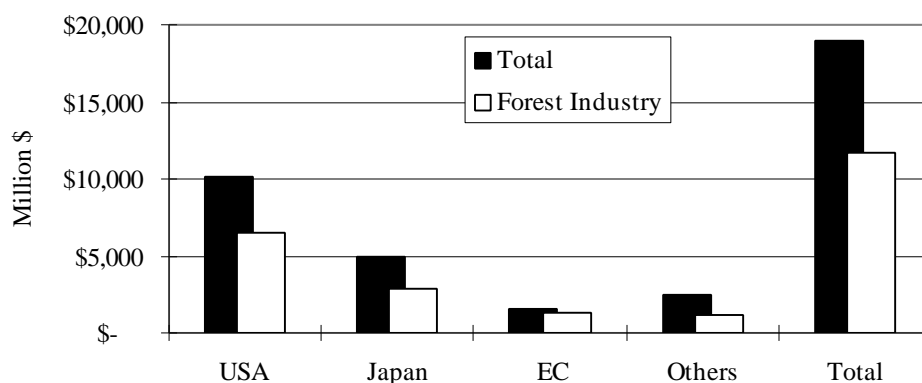


Source: COFI, Ministry of Forests

MacMillan Bloedel extracts a higher than industry average sales value from its logs. In 1993, MB's average sales value/m³ harvested was \$230/m³, \$55/m³ higher than the provincial average. This indicates that the gross sales value from products originating in TFL 39 was \$782 million in 1993. Expected improvements in pulp and paper prices should enhance this contribution in the near term provided harvest levels are maintained.

The forest industry accounted for 62% of B.C.'s total export earnings in 1993. (Figure 4) Being a small, open economy, B.C. depends heavily on this foreign currency to pay for imported goods, service the debt and maintain the province's standard of living.

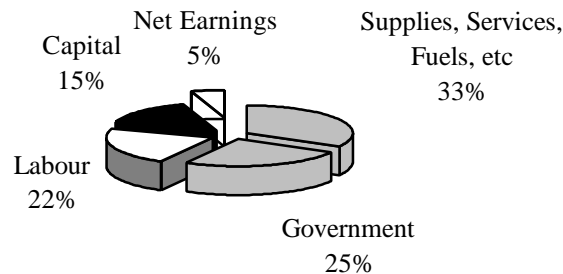
Figure 4: 1993 Provincial Exports By Destination and Sector



Source: Statistics Canada

The gross sales generated by the forest industry benefit a number of other sectors in the B.C. economy. Companies supplying goods and services to the forest industry receive about 33% of total gross sales (Figure 5)⁴. In turn, these companies employ people and generate their own economic activity.

Figure 5: Distribution of Gross Economic Activity Created by the B.C. Forest Sector



Source: Price Waterhouse

Of every sales dollar generated by the forest industry, government and labour receive about 25 and 22 cents, respectively. Governments employ people in providing services to the public and in operating the Ministry of Forests. They also buy goods and services from other companies which generates further employment. Individuals working for the forest industry (i.e. labour) create employment when they spend their income on goods and services used for personal consumption. Further discussion of some of these indirect linkages and government revenues is provided later.

Fifteen percent of the sales value on average is invested in maintaining or enhancing existing facilities, constructing new facilities and undertaking environmental projects.

Finally, shareholders receive an estimated 5% of the total sales value. It is this component that firms try to maximize. If contributions to labour and government increase excessively⁵, payments allocated to shareholders, capital and goods & services will have to decline, assuming sales revenues remain constant. Ultimately, society will be affected through reduced government revenues, industry profits, wages and jobs.

In short, the forest industry generates a significant amount of gross sales value, which creates opportunities in other sectors of the economy. In 1993, TFL 39 alone contributed about \$782 million. With expected improvements in pulp and paper prices, this value will likely increase over the next few years.

⁴ The results in Figure 5 are derived from an average of three years of Price Waterhouse data. The three years include a trough, peak and average year in a typical business cycle.

⁵ "Excessively" refers to payments made to government and labour that are above the full economic rents owing to these two economic agents. See Saunders (1993), pages 2 -5, for an excellent discussion of who bears the costs of forest practices regulations.

2. Direct Employment

The provincial forest industry directly employed over 85,000 people in 1992 and 1993 (Price Waterhouse, MB). These estimates exclude those employed by the Ministry of Forests and those working for B.C.- based companies outside the province; they account for about 4,500 and 12,000 people, respectively. It also excludes those employees working for mills consuming imported hardwood lumber.

Almost half of the employment is on the Coast compared to only 33% of the provincial harvest. This is because the Coastal forest industry is more labour intensive than the Interior industry. Furthermore, the majority of the operations that add value are situated on the Coast. On average, the direct labour coefficient for the Coastal forest industry is 1.7 direct jobs /1,000 m³ of log production (Table 2).

Table 2
Estimated Direct Forest Industry Employment By Selected Areas In B.C.
1992/93
(thousands)

Category	Province	Coast	Est. for TFL 39
Woodlands	25.7	11.0	1.5
Sawmilling	24.3	9.6	1.3
Pulp & Paper	12.3	8.5	1.2
Other Operations	9.8	6.1	0.8
Value-added ¹	9.0	6.2	1.0
Silviculture	4.0	0.4	³
Total	85.1	41.8	5.8
Harvest (avg. '92-'93) ²	76.6	24.6	3.4
Jobs/000 m ³	1.1	1.7	1.7

Sources: Price Waterhouse, MB, McWilliams & Forintek (1991)

¹ excludes value-added employment that depends on imported hardwood lumber and the value-added employment already included in the "sawmilling" category.

² log scaled volumes; includes small business

³ less than 100

MacMillan Bloedel employs a higher ratio of people per 1,000 m³ of logs because it is the largest remanufacturer in the province and maintains significant marketing, research and development capabilities. For the purpose of this analysis, however, employment estimates for TFL 39 are derived from the Coastal average labour coefficients. The exception is the value added estimate which reflects MB's higher than average role in this sector. Given these assumptions, over 5,800 direct jobs can be attributed to TFL 39. (Table 2)

Of the TFL 39 related jobs, most of the woodlands jobs are located in communities on northern Vancouver Island, Queen Charlotte Islands and the Sunshine Coast. The processing jobs occur mainly in Powell River, Nanaimo, Chemainus, and the Lower Mainland. The general administration jobs are in Campbell River, Nanaimo and the Lower Mainland.

3. Indirect Employment

The forest industry also generates indirect and induced jobs in other economic sectors. Indirect jobs refer to the jobs created by those companies that supply goods and services to the forest industry. Examples include heavy equipment suppliers, accounting and insurance firms, and fuel and gas companies.

Additional employment is realized from expenditures by households that derive income from the forest industry. This is referred to as induced employment. Examples includes restaurants, grocery stores, automobile dealerships, retail stores and , movie theaters. In this report, we refer to the combined indirect and induced jobs as “indirect” jobs.

The “indirect” employment can be estimated using employment multipliers. Estimates can vary widely and depend on the region of interest and what is included as part of the multiplier. We assume that every direct job in the forest industry supports one “indirect” job in the local areas and another “indirect” job elsewhere in the province, most likely the Lower Mainland or southern Vancouver Island. These estimates correspond to multipliers of 2.0 and 3.0, respectively. Several studies⁶ suggest that these multipliers are realistic. Some community specific information presented later lends further support to the local multiplier of 2.0.

The “indirect” jobs attributable to TFL 39 are thus in the order of 11,600, bringing its total provincial employment contribution to 17,400.

4. Community Dependencies

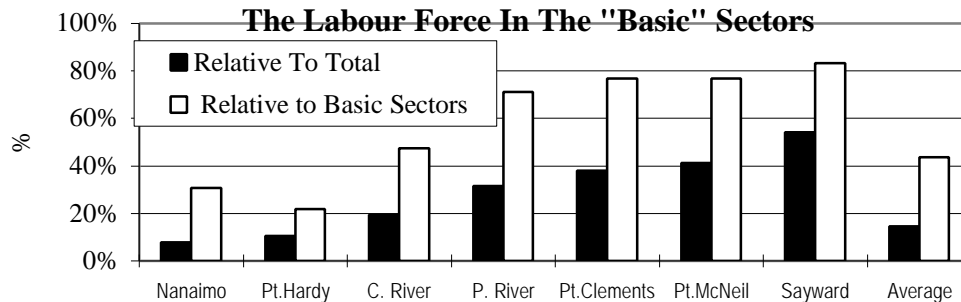
A number of communities on the Coast derive economic well-being from the timber that is harvested from TFL 39. They include Port Hardy, Port McNeill, Sayward, Campbell River, Powell River, Chemainus, Nanaimo, Port Clements, Skidegate, Sandspit, Masset and Queen Charlotte City. The Lower Mainland, where the profile is not as visible, also benefits significantly from the forest sector and therefore from TFL 39.

The forest sector is a large employer in these communities. For example, in four of the seven communities for which data were available, the forest industry

⁶ Results reported by Horne, Paul & Riley (1991), Lax and Parker (1992), Ministry of Forests (1983), White, et al. (1990), Price Waterhouse (1993) and H.A. Simons (1990).

accounts for 30% or more of the total labour force (Figure 6); in communities like Sayward it is over 50%.

Figure 6: Forest Sector Dependency in Selected Communities
Forest Sector Labour Force Relative To Total Labour Force
and



Source: Statistics Canada, BC Stats

A better understanding of the importance of the forest industry in each of these communities can be acquired by examining the ratio of forest sector employment to total basic employment. (Horne & Penner, 1992)⁷ This ratio indicates how much of the basic employment, which drives most of the economic activity in the community, is related to the forest industry. As indicated by Figure 6 (refer to the bars labeled “Relative to Basic Sectors”), the forest sector comprises anywhere from 20 to 80% of the basic employment in these communities. Consequently, a significant change in forest industry employment will have a major impact on community stability.

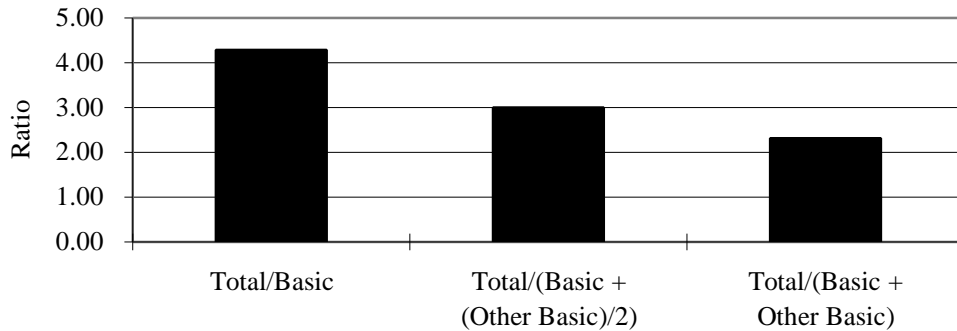
The use of labour force data by basic and non-basic sectors can also be applied to estimate local employment multipliers which were discussed earlier. Using what is referred to as the Economic Base Method, the local employment multiplier (M) is calculated as follows:

$$M = \frac{[\text{Basic} \text{ Employment} + \text{Non-basic Employment}]}{\text{Basic Employment}}$$

This multiplier measures the impact of a change in basic employment on total community employment. However, because there is often disagreement concerning which sectors actually drive the local economy, we have used three definitions of “basic” employment to calculate a range of employment multipliers. The averaged results for the seven communities, shown in Figure 7, indicate that the employment multiplier ranges anywhere from just over 2.0 to 4.0. These results confirm the local employment multiplier of 2.0 selected earlier. In fact, an M=2.0 appears to underestimate the true impacts.

⁷ This assumes that a community is essentially made up of two economic components: the basic sectors which generate revenues by selling their products outside the region, and the non-basic sectors which service the basic sectors. “Basic” sectors in this study include the traditional basic sectors of agriculture, fishing, trapping, forestry, mining & manufacturing and half of accommodation, food and beverages, construction and transportation. The remaining sectors are considered non-basic.

Figure 7: Regional Employment Multipliers Derived From The Economic Base Method



Source: Statistics Canada, BC Stats

Basic Includes Fishing, Mining, Agriculture, Trapping, Forestry & Manufacturing

Other Basic includes: Construction, Transportation, Accommodation & Food/Beverages

5. Employee Compensation & Benefits

Forest industry employees earn considerably more than the average provincial wage. According to Price Waterhouse, average compensation in the industry, including the value-added sector, was \$41,193 in 1993 compared to \$29,253 for the provincial average. Benefits provided another \$14,588 per employee bringing the total compensation and benefit package to \$55,781. Compensation and benefits in the value-added sector are estimated to be \$35,700 (Price Waterhouse, 1993) which suggests that the average package in the primary sectors was \$58,700.⁸

Incomes are directly correlated with productivity. Improvements in labour productivity in the forest industry over the last decade is the reason why the industry has been able to support higher wages than its international competitors. Higher incomes result in more disposable income and the generation of more economic wealth and activity. This is why most governments worldwide strive to enhance regional per capita income. Improving efficiency contributes greatly to this objective.

Forest industry activity derived from TFL 39 contributes an estimated \$318 million in direct compensation & benefits every year. An additional \$371 million/year is earned by those indirectly benefiting from TFL 39. (Table 3)

⁸ Derived using total employment of 92,200 and value-added employment of 11,700 (Price Waterhouse, 1993)

Table 3
Employee Compensation and Benefits Attributable To TFL 39

Sector	Employment (thousands)	Average (\$/employee)	Total (million \$/year)
Primary	4.8	\$58,700	\$282
Value-added	1.0	\$35,700	\$36
“Indirect”	11.6	\$32,000 ¹	\$371
Total	17.4		\$689

¹ estimate derived from various Statistics Canada income & labour force data.

6. Government Revenues

Governments are significant beneficiaries of activity by the forest industry. In 1993, the provincial forest industry paid \$1.6 billion dollars directly to all forms of government. Workers contributed an additional \$1.6 billion in the form of direct income taxes, for a total of \$3.2 billion. These payments do not include the income taxes generated by those indirectly employed by the forest industry nor does it account for the plethora of other taxes paid by those individuals directly or indirectly employed because of the forest industry.

The biggest single source of forest industry derived government revenues is the economic rent for the timber resource (i.e., stumpage/royalties/rents/etc.). Its contribution has been rising steadily over the last several years, reaching \$849 million province-wide in 1993. With recent increases in rates, the BC government can expect to collect \$1.5 to \$2 billion in stumpage & royalty revenue in 1994/95.

The forest industry pays other taxes such as corporate income tax & property taxes. In 1993, they amounted to about \$755 million; \$165 million of which were paid to the Federal government.

For the purpose of calculating the contribution of TFL 39 to government coffers and later for the economic impact analysis, we have determined the average contribution on a per m³ basis. These results are shown in Table 4. It should be noted that the stumpage/royalty/rent value reflects the recent changes to these rates.

Table 4
Government Contributions per m³ - Coastal Averages

Categories	Provincial/ Municipal	Federal	Total
Stumpage/Royalties/Rents ¹	\$27.50	\$0.00	\$27.50
Other Direct Taxes ²	\$7.40	\$2.10	\$9.50
Direct Employee Income Taxes	\$6.40	\$13.10	\$19.50
Indirect Employee Income Taxes	\$7.00	\$14.30	\$21.30
Other payments ³	\$0.00	\$7.60	\$7.60
Total Direct	\$41.30	\$22.80	\$64.10
Total Indirect	\$7.00	\$14.30	\$21.30
Total	\$48.30	\$37.10	\$85.40

Sources: Price Waterhouse, Statistics Canada, Ministry of Forests

¹ estimate based on recent changes to stumpage & royalty rates

² includes corporate income taxes, property taxes, logging taxes, corporate capital taxes, gas & fuel taxes, provincial sales taxes, federal sales taxes, customs excise taxes, non-resident withholding taxes, and taxes included in electricity rates.

³ includes Canada Pension Plan, unemployment insurance and WCB.

Based on the values in Table 4 and a log harvest of 3.4 million m³, activity associated with TFL 39 directly contributes about \$218 million to government revenues every year. At least another \$72 million/year in indirect payments will stem from TFL 39 harvest.

7. Summary

Table 5 summarizes the contribution of TFL 39 to the provincial economy. This establishes the benchmark data with which the various options can be compared.

Table 5
Summary of the Economic Contributions of TFL 39

	Direct	“Indirect”	Total
Gross Sales Value (million \$/year)	\$782	n/a	\$782
Employment	5,800	11,600	17,400
Employee Compen. & Benefits (mill. \$/year)	\$318	\$371	\$689
Government Revenues (million \$/year)	\$218	\$72	\$290

3.0 ECONOMIC EVALUATION

Economic impact and benefit-cost analysis frameworks are used to evaluate specific integrated resource management objectives governing the timber supply in TFL 39. Emphasis is placed on quantifying the impacts on and costs to the forest industry and those sectors of the economy that benefit from the industry.

Calculating the economic benefits is much more difficult. This is because many of the non-timber values generated by B.C.'s provincial forests are not traded in the marketplace. Consequently, valuing certain non-use benefits, such as biodiversity and wilderness experiences, and even some use benefits, becomes a daunting task.⁹ Even when values can be assigned with some confidence, it is not clear to what extent forestry activities affect some of these non-timber values.

Given these difficulties, the rest of this study concentrates on the economic impact and costs of different issues which affect the flow of timber from TFL 39, rather than trying to quantify the economic benefits generated by the different issues.

3.1 Economic Impact Analysis

Economic impact analysis is used to assess the impact of the alternative harvest schedules on macro level economic and social indicators such as employment, wages, sales and government revenues. These impacts are measured using the data supplied in Section 2.0. Most of this information has been converted into impact coefficients, denominated primarily in units/m³. These are shown in Table 6.

⁹ Van Kooten (1993, 1994a, 1994b) discusses many of the problems associated with quantifying non-timber values.

Table 6
Estimated Economic Impacts of a 1 m³ Change In TFL 39 Harvest Levels

Category	per m³
A. Direct Employment (jobs/m³)	
Logging/Forestry	0.00045
Sawmilling	0.00039
Pulp/Paper	0.00035
Others ¹	0.00054
Total	0.00173
Indirect Employment (jobs/m³)	
M=3 (provincial)	0.00346
B. Value of Shipments (\$/m³)	230.00
C. Government Revenues (\$/m³)	
Direct Prov./Municipal	41.30
<u>Direct Federal</u>	<u>22.80</u>
Total Direct	64.10
Indirect Prov./Municipal	7.00
<u>Indirect Federal</u>	<u>14.30</u>
Total Indirect	21.30
Grand Total	85.40

¹ “Others” includes value added, silviculture and overhead & administration. It also includes custom cut and shake & shingle operators that benefit from TFL 39 sourced timber.

The coefficients in the above table are applicable for measuring provincial and national impacts. The impact on employee compensation & benefits are estimated using the average income figures provided in Section 2.2. Finally, an indirect employment multiplier of 2.0 is used for measuring local impacts.

3.2 Benefit-Cost Analysis

Benefit-cost analysis is used to evaluate the relative merits of any decision. Its foundation is economic efficiency which maintains that a decision should only proceed if its marginal benefits exceed its marginal costs. From society’s perspective, a decision is economically efficient if it results in an increase in society’s economic welfare or well-being.

All values in a benefit-cost framework are net values. That is, they are the value of an activity after the cost of providing the activity has been deducted. The main costs in a benefit-cost evaluation of the forest regulations can be summarized as follows:

1. Forgone Rents

A significant economic cost is the net value of the timber that is not available for commercial timber production. If harvested, this timber would contribute to the overall economic well-being of society.

An economic loss shows up as a reduction in the rent available from the land, in producer surplus of the processing facilities and possibly in consumer surplus because of higher prices. The most significant loss is the forgone rent. It is the difference between total revenues and total variable costs and is allocated amongst government, via stumpage & royalties, business via return on invested capital and labour in the form of higher wages.

The difference between total average coastal log prices and logging costs (i.e., the “conversion return” or “ mean value index”) provides an approximation of these rents. According to data published by the Ministry of Forests, the total rents available on the Coast are presently about \$45/m³. With the recent increase in stumpage and royalty rates, a significant portion of this rent accrues to government.

2. Increase In Manufacturing Costs

Because capacity generally is fixed in the short term, a reduction in harvest will increase per unit fixed costs in both the sawmilling and pulp/paper sectors, further reducing the producer surplus. In estimating the cost of the Forest Practices Code, Saunders (1993), COFI (1994) and Van Kooten (1994b) recognized these costs as true economic costs that should be included in a benefit-cost analysis.

Table 7 demonstrates the increase in manufacturing costs if the volume of fibre to the sawmilling and pulp/paper sectors is reduced by 10%. Costs in the sawmilling sector would increase by \$2.80/m³. The impact on the pulp/paper sectors would be \$4.80 for every m³ of fibre consumed by the mill after the reduction occurs. If the fibre reduction is 5% instead of 10%, the corresponding increases would be \$1.30 and \$2.25/m³, respectively. These costs have been estimated using 1993 Price Waterhouse data and the methodology outlined by Saunders (1993).

Table 7
Potential Effect Of Fibre Supply Reductions On Fixed Costs of Primary Manufacturers - 1993

	Lumber	Pulp/Paper
Est. Fixed Costs	\$115/Mfbm	\$200/m. tonne
Recovery Factor	215 fbm/m ³	4.7 m ³ /m. tonne ¹
Est. Fixed Costs	\$25/m ³	\$43/m ³
Increase in costs when fibre supply is reduced by 10% °	\$2.80/m ³	\$4.80/m ³

Source: data from Price Waterhouse (1993); methodology from Saunders, 1993.

¹ estimated average for provincial market pulp & newsprint industry (Price Waterhouse, 1993)

² fixed costs include a ten-year industry average after tax return on assets of 2.6% (Source: Price Waterhouse 1993).

° these costs apply to the volume of fibre processed by the mill after the reduction occurs.

The costs in Table 7 will not be experienced forever. Eventually, mills will be forced to close or restructure. Therefore, it is assumed in this analysis that these higher costs will only be experienced during the first decade.

3. Increased Harvesting and Planning Costs

Regulations and constraints designed to meet integrated resource management objectives will result in higher logging and planning costs for both industry and government. Research by Nelson and Shannon (1994), Nelson and Hackett (1993) & Sedjo & Bowes (1991) found that these costs can be substantial.

MB research estimates that logging and planning costs will increase on average by about \$5.00/m³.¹⁰ This cost impact will be the result of the culmination of several constraints. In order to conduct a benefit-cost analysis of individual regulations, however, we have estimated, as indicated in Table 8 below, separate cost increases for the different types of regulations explored in this report. These estimates are based on the impact these regulations will have on the overall harvest level in TFL 39 over the next 50 years.

Table 8
Estimated Allocation of Harvesting/Planning Cost Increase

IRM Objective	Estimated \$/m³
Visual quality objectives	2.75
Deer winter ranges	0.50
Additional biodiversity set asides	0.45
Other IRM objectives	1.30
Total IRM Objectives	5.00

¹⁰ More roads, an increase in non-conventional harvest methods, more road and cutblock layouts and higher overheads due to lower production volumes are the main areas in which costs will likely increase.

The incremental administration costs to government specifically associated with TFL 39 are difficult to estimate and thus are excluded from the analysis.

4. Training & Adjustment Costs

A reduction in jobs will bring about costs in the sense of job search, retraining, moving and any other social related costs (e.g. counseling) (Van Kooten, 1994b). While these costs are real, no attempt is made to estimate them in this study.

5. Other Costs

A study by the Ministry of Forests (1992) recognized several other economic costs in their cost-benefit analysis of deer winter ranges.

- Forgone wages and salaries of those forest industry employees that lose their jobs because of the reduction in harvest levels. Their study only considered the differential between wages in the forest industry and what those individuals could earn in other sectors of the economy.
- Reduction in corporate income and logging taxes.
- Reduction in the value of the timber licence when the timber supply drops.

Some economists argue that the first two (net wages & taxes) are not true economic costs but represent income transfers. Therefore, they further argue that they should not be included in a benefit-cost analysis but are appropriate in an economic impact framework. In light of these differences in opinion, these costs are not included in our analysis.

With respect to the loss in the value of the licence, this cost is difficult to measure, as the Ministry of Forests' study noted, and hence is not included.

4.0 RESULTS

4.1 Economic Analysis of Integrated Resource Management Constraints

1. Aggregate Impact Except Additional Biodiversity

Particularly since 1987, government has introduced numerous regulations and constraints governing the management and harvesting of forest land in B.C. More regulations will be embodied in the Forest Practices Code.

The economic activity forgone because of these regulations, net of additional biodiversity measures which are addressed later, is estimated by comparing

Options 1 and 6 and described in Table 9. Harvesting activity in TFL 39 could support an additional 682 direct jobs if these regulations, aside from regulations to safeguard sensitive soils, were not imposed. In addition, these regulations cost all levels of government at least \$33.6 million each year.

Table 9
50 Year Economic Impact of IRM Constraints

	Average Annual Impacts During:
	1993-2042
Harvest Reduction (m ³ /year) ¹	394,000
Direct Jobs	682
Indirect Jobs	1,363
Total	2,045
Direct Wages & Salaries	38,021
Indirect Wages & Salaries	43,624
Total (\$000/year)	81,645
Direct Government Revenues	25,255
Indirect Government Revenues	8,392
Total (\$000/year)	33,648
Sales Value (\$000/year)	90,620

¹ 8% lower than timber supply volumes to reflect losses.

Table 10 shows the economic costs as discussed in Section 3.2. The total discounted cost of these regulations is \$766 million.¹¹ On an annualized basis, using a 4% discount rate¹², the costs equate to \$31 million/year.

Table 10
Economic Costs of Integrated Resource Management Regulations
Option 1 Versus Option 6

	Costs/year (\$000/year)	NPV (\$000)
Forgone Rents	14,117	352,921
Fixed Costs	483	12,084
Harvesting Costs ¹	16,054	401,347
Total	30,654	766,351

¹ based on \$4.55/m³ (see Table 8: total less additional biodiversity set asides)

¹¹ Derived by discounting over 90 years.

¹² To be consistent with work by Saunders (1993) and van Kooten (1994b), a social discount rate of 4% has been used.

2. Visual Quality

Option 2 includes allowances for visual landscape objectives as specified by the Ministry of Forests. As noted in the main body of the report, MB believes that visual quality objectives can be met by less constraining conditions than those incorporated in Option 2. Comparing Options 4 with 3 and Options 4 with 2 reveals the impact of more stringent visual quality standards. The economic consequences of these impacts are shown in Table 11.

Table 11
50 Year Economic Impact of VQOs
Option 4 Versus Options 3 & 2

	Option 3	Option 2
	Average Annual Impacts During:	Average Annual Impacts During:
	1993-2042	1993-2042
Harvest Reduction (m ³ /year)	135,000	240,000
Direct Jobs	234	415
Indirect Jobs	467	830
Total	701	1,246
Direct Wages & Salaries	13,028	23,160
Indirect Wages & Salaries	14,947	26,573
Total (\$000/year)	27,975	49,733
Direct Gov't Revenues	8,654	15,384
Indirect Gov't Revenues	2,876	5,112
Total (\$000/year)	11,529	20,496
Sales Value (\$000/year)	31,050	55,200

¹ 8% lower than the volumes in timber supply analysis to reflect residue losses.

The 50 year reductions will be distributed as shown in Table 14. The Queen Charlotte Islands will bear the largest impact, although no logging community associated with TFL 39 will go unaffected. Of the 701 to 1,246 jobs lost, logging communities can expect to forgo anywhere from 122 to 215 jobs¹³ with over half of these losses to likely occur in the Queen Charlotte Islands. Milling communities will be further impacted but it is difficult to determine which communities and to what degree since logs will be reallocated to their highest return.

¹³ Calculated using a woodlands labour coefficient of 0.45 jobs/000 m³ and local employment multiplier of 2.0 (see earlier discussions).

Table 12
Distribution of 50 Year Harvest Reduction Impacts

Local Areas	Option 3	Option 2
QCI area	79%	67%
Powell River area	9%	14%
Sayward, Campbell River areas	7%	10%
Pt. McNeill, Pt. Hardy, Namu areas	5%	9%

Imposing more stringent VQO restrictions will have an economic cost of \$9 to \$18 million/year depending on the severity of the restrictions (Tables 13 & 14).

Table 13
Economic Costs of VQOs
Option 4 Versus Option 3

	Costs/year (\$000/year)	NPV (\$000)
Forgone Rents	4,694	117,362
Fixed Costs	163	4,068
Harvesting Costs ¹	4,506	112,646
Total	9,363	234,077

¹ based on \$1.38/m³ which assumes that half of the visual quality cost impact in Table 8 (i.e., \$2.75/m³) is incurred when going from Option 3 to Option 2.

Table 14
Economic Costs of VQOs
Option 4 Versus Option 2

	Costs/year (\$000/year)	NPV (\$000)
Forgone Rents	8,336	208,398
Fixed Costs	256	6,406
Harvesting Costs ¹	9,299	232,465
Total	17,891	447,269

¹ based on \$2.75/m³ (see visual quality cost impact in Table 8).

3. Biodiversity

The net old-growth land base in Option 2 was reduced 4% at the request of the Chief Forester as a “further” allowance for biodiversity. Imposing this constraint (modeled as Option 5) would reduce harvest levels by an average of about 38,000 m³/year during the first 50 years. These reductions will impact almost 200 direct and indirect jobs and reduce government revenues by \$3.2 million/year. Additionally, labour income will fall by \$7.9 million/year and total gross sales will decrease by almost \$9 million per year. These impacts are summarized in Table 15.

Table 15

**Economic Impact of Additional Biodiversity
Option 5 Versus Option 2**

	Average Annual Impacts During:
	1993-2042
Harvest Reduction (m ³ /year)	38,000
Direct Jobs	66
Indirect Jobs	131
Total	197
Direct Wages & Salaries	3,667
Indirect Wages & Salaries	4,207
Total (\$000/year)	7,874
Direct Government Revenues	2,436
Indirect Government Revenues	809
Total (\$000/year)	3,245
Sales Value (\$000/year)	8,740

¹ 8% lower than the timber supply volume to reflect residue losses.

The 50 year harvest reductions will be distributed as follows:

- QCI - 38%
- Powell River area - 16%
- Sayward, Campbell River areas - 29%
- Port McNeill, Port Hardy and Namu areas - 17%

Over the next fifty years, at least 34 jobs¹⁴ and about \$1.5 million/year in labour income will be lost in these communities. Powell River will be further affected because of the impact on mill jobs and wages. The other milling communities, such as Chemainus, Nanaimo and lower mainland will also feel an impact.

The economic costs of these additional biodiversity considerations amount to \$3 million per year (Table 16). These costs relate to reducing the old growth working land-base by 8,644 ha, resulting in a unit cost of \$339/ha¹⁵.

¹⁴ refer to footnote 17.

¹⁵ When judging whether or not the benefits exceed these costs it is important to note that the provincial government recently announced the creation of 23 new parks on Vancouver Island and that 22.5% of the Queen Charlotte Islands is already preserved in parks or ecological reserves.

Table 16
Economic Costs and Benefits of Additional Biodiversity Constraints
Option 5 Versus Option 2

	Costs/year (\$000/year)	NPV (\$000)
Forgone Rents	1,434	35,858
Fixed Costs	71	1,764
Harvesting Costs ¹	1,424	35,597
Total Costs	2,929	73,219

¹ based on \$0.45/m³ (see Table 8)

4.2 Summary

Existing and proposed integrated resource management regulations, if implemented, could have a significant impact on the provincial economy. In TFL 39, the forgone opportunity because of integrated resource regulations would be about 430,000 m³/year (log scaled volume) over the next 50 years, with VQOs having the largest impact (Figure 8). Accompanying these declines would be an estimated reduction in over 2,200 direct and indirect permanent jobs, many of which would be in rural communities, and a reduction of \$100 million in gross economic activity every year. (Figures 9 and 10)

Figure 8
50 Year Impact of IRM Objectives On TFL 39 Harvest Levels

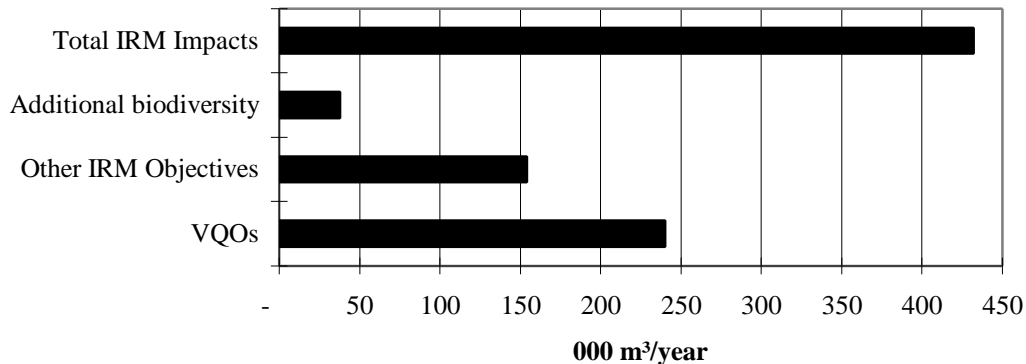


Figure 9
50 Year Impact of IRM Objectives On Employment

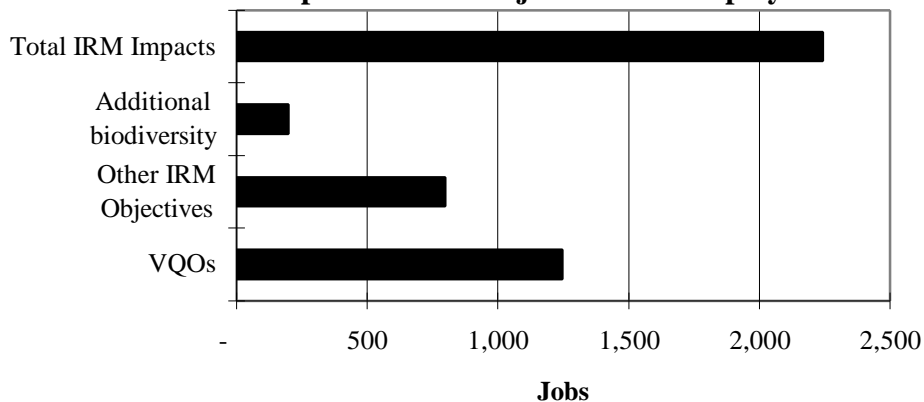
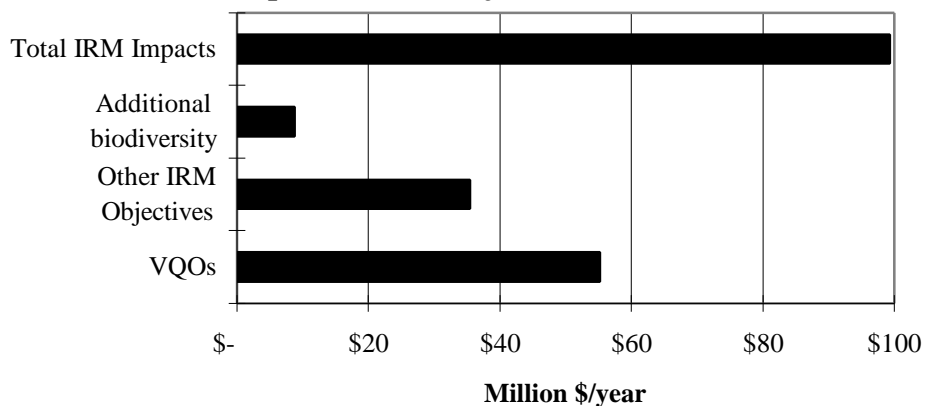


Figure 10
50 Year Impact of IRM Objectives On Gross Sales Value



Many of these costs must be incurred to ensure that certain values, particularly those that are difficult to measure and are not determined in formal markets, are generated from B.C.'s forests.

5.0 WHAT ARE THE BENEFITS?

This study has not estimated specific values for the benefits resulting from constraints imposed to meet various non-timber resource objectives. However at least three studies¹⁶ have made provincial estimates of some relevance. They indicate that the average value¹⁷ of forestry based, outdoor recreation and tourism activities in B.C. is in the order of \$20 to \$30/day which is in addition to the cost borne by the participant. These values include both use and non-use values with the latter referring to society's willingness to pay for these areas knowing they exist and will be preserved in their natural state or be preserved for future generations.

¹⁶ Ministry of Forests (1991), ALM Resources Ltd. (1990) and Shaffer, M. & Assoc. (1991)

¹⁷ It is important to base benefit-cost decision making on the marginal value of having more or less forest area for these purposes and not on the average value. However, there is very little information about these marginal values and thus it is assumed that these average values are equal to the marginal values.

If these values are valid and reflect marginal values for the areas “set aside” from logging, an additional 1.0 to 1.5 million days of outdoor activity are required each year to offset the economic costs of integrated resource management regulations, exclusive of the impact of the additional biodiversity guidelines. Of this, 0.3 to 0.6 million are due to VQO constraints.

The decision making question becomes *do these regulations attract this level of additional recreational activity?* Research by the Ministry of Forests (1991) found that provincial forests within the Vancouver Forest Region attracted about 21.5 million days of recreation activities in 1989/90. Given that TFL 39 represents about 10% of the land-base in the Vancouver Forest Region, 2.2 million of these days can be cautiously assigned to TFL 39¹⁸. Therefore, assuming that the values noted above reflect willingness to pay, recreational activity in TFL 39 would have to increase from 45 to 68% in order to offset these costs. Are these increases likely?

What are the economic benefits from preserving additional areas for biodiversity? They can only be measured by quantifying society’s willingness to pay for these areas knowing they exist and will be preserved in their natural state. Van Kooten (1994b) estimated that the provincial marginal value of wilderness and its accompanying values (e.g., biodiversity) is \$8 to \$18/ha/year. Considering these values are likely to be higher on the Coast than in the Interior, the corresponding marginal values for protecting wilderness on the Coast, derived from the work by van Kooten (1994b), are in the order of \$16 to \$94/ha/year. Comparing these against the costs of \$339/ha noted earlier in the report, it would appear that the costs exceed the benefits (see van Kooten, 1993).

It can be argued that these measures of benefits do not adequately capture the amount society is willing to pay for preserving forest land. Certain areas for example may possess extremely high values because of their unique characteristics. Nor do the benefits include additional jobs and revenues generated from other resource use activities such as tourism. On the other hand, these values do not consider the amount of area already preserved on Vancouver Island and the Queen Charlotte Islands for parks and biodiversity.¹⁹ and the fact that significant portions of the land base will be “set aside” to manage for non-timber objectives. Nor do they capture the fact that many recreational activities are compatible with timber production and visa versa.

¹⁸ Clearly land-base cannot be the best way to allocate visitor days of activity. Actual visitor days in areas like Queen Charlotte Islands, for instance, are likely significantly lower than what would be estimated using land area simply because of accessibility.

¹⁹ Van Kooten (1993) examined from an economic stand point how much wilderness should be preserved in B.C. Also, as noted earlier, the provincial government recently announced the creation of 23 new parks on Vancouver Island and 22.5% of the Queen Charlotte Islands is already preserved in parks and ecological reserves.

This evaluation provides some data to aid in the analysis of the issues in order that equitable management choices can be made.

REFERENCES

- ALM Resources Ltd., 1990. *Crown Forest Land Use: Comparison of Economic Impacts Between Forest Industry and Other Uses*. Prepared for the British Columbia Forest Resources Commission.
- The ARA Consulting Group Inc., 1993. *Resource Based Community Adjustments*. Prepared for the B.C. Ministry of Employment and Investment.
- B.C. Ministry of Environment, 1985. *The Value and Characteristics of Resident Hunting*. Wildlife Branch, Ministry of Environment.
- B.C. Ministry of Environment and B.C. Ministry of Forests, 1983. *Reservation of Old Growth Timber for the Protection of Wildlife Habitat on Northern Vancouver Island*.
- B.C. Ministry of Forests, 1982. *Benefit-Cost Analysis: The Costs of Establishing Deer and Elk Reserves in TFLs 37 and 39*. A report to the Task Force: Old Growth Vancouver Island Study. Strategic Services Branch, Ministry of Forests.
- B.C. Ministry of Forests, 1991. *Outdoor Recreation Survey 1989/90. How British Columbians Use and Value their Public Forest Lands for Recreation*. Recreation Branch Technical Report 1991-1. Victoria: Queen's Printer for British Columbia.
- Council of Forest Industries, 1994. *Review of Government Estimates of the Costs and Benefits of the Proposed Forest Practices Code*. Vancouver: Council of Forest Industries of British Columbia.
- H.A. Simons Ltd., 1990. *Contribution of the Forest Industry to the Alberni-Clayoquot Regional Economy*. Prepared for The Regional District of Alberni-Clayoquot Economic Development Commission. Strategic Services Division, H.A. Simons Ltd., Vancouver.
- Horne, G., N. Paul and D. Riley, 1991. *The Provincial Economic Impacts of a Supply Reduction in the B.C. Forest Sector*. Forest Resources Commission Background Papers, Volume 4. Victoria: Planning and Statistics Divisions, Ministry of Finance and Corporate Relations.
- Horne, G. and C. Penner, 1992. *Local Employment Impacts of the Forest Industry*. Background paper prepared for the Forest Resources Commission. Volume 4.

- Lax, L. and J. Parker, 1992. *The Economic Impacts of Selected Timber Harvest Scenarios in B.C.* Forest Resources Commission Background Paper. Victoria: Planning and Statistics Divisions, Ministry of Finance and Corporate Relations.
- Marvin Shaffer & Associates Ltd., 1991. *Socio-Economic Evaluation of Old Growth Conservation Strategies: Demonstration of a Multiple Account Approach.* Prepared for the Old Growth Values Team of the British Columbia Old Growth Strategy Project.
- McDaniels Research Limited, 1980. *An Evaluation of Wildlife Enhancement Through Silvicultural Changes in the Sayward Forests.* A report prepared for the Strategic Services Branch of the B.C. Ministry of Forests.
- McWilliams, J. and Forintek, 1991. *Profile of the B.C. Wood Products Value Added Sector.* Canada-British Columbia Forest Resource Development Agreement.
- Nelson, J.D. & J. Hackett, 1993. *An Economic Analysis of Timber Harvesting Regulations in the Tsitika Valley.* Forest Operations Research Group, Faculty of Forestry, University of British Columbia.
- Nelson, J.D. & I. Shannon, 1994. *Cost and Timber Supply Assessment of the Coastal Biodiversity Guidelines.* Department of Forest Resources Management. Faculty of Forestry. University of British Columbia.
- Price Waterhouse. *The Forest Industry In British Columbia.* Various issues.
- Saunders, 1993. *The Cost of Implementing A Proposed Forest Practices Code for British Columbia.* Report prepared by the Ministry of Forests. Vancouver: H&W Saunders Associates.
- Sedjo, R. & M. Bowes, 1991. *Managing the Forest for Timber and Ecological Outputs on the Olympic Peninsula.* Prepared for the Washington Department of Natural Resources by the Forest Economics and Policy Program, Resources for the Future, Washington.
- van Kooten, G.C., 1993. *Economics of Protecting Wilderness Areas and Old-Growth Timber In British Columbia.* Department of Forest Resources Management, Univ. of B.C..
- van Kooten, G.C., 1994a. *An Economic Analysis of the CORE Recommendations for Vancouver Island.* Report prepared for the Forest Managers and Manufacturers of the Vancouver Island CORE.