THE STATE OF CANADA'S FORESTS 1991

Forestry Canada Forêts Canada

Canada

The State of Canada's Forests 1991

Second Report to Parliament

Environmental, Social and Economic Indicators

CANADA'S GREEN PLAN

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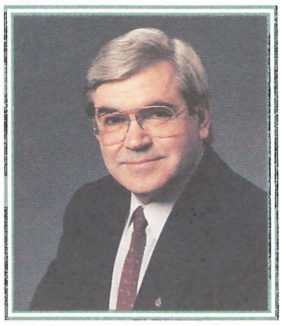
MESSAGE FROM THE MINISTER

I am honoured to place before Parliament the second annual report on the state of Canada's forests.



Last year we called our report "The State of Forestry in Canada", but I thought the title failed to capture the full range of economic, environmental and social values of our vast forest resource. Given the importance we attach to all these values, and the task we have undertaken to define and measure them so that they can be used as reliable indicators of the health and viability of our forests, it seemed appropriate that the report should now be called "The State of Canada's Forests".

In that same vein, now is the time to consider adopting other terms to describe the forest and its condition. The traditional terminology of the industry reflects mainly timber and economic values and is well suited to the professional needs of the forester. Unfortunately, it is not always well understood by the layperson, so I am proposing that we introduce definitions that are more holistic in approach and less likely to be misinterpreted.

Canada is committed to the practice of sustainable forestry. Governments, industry and the forest community are working together to achieve this goal, and we are steadily modifying our management practices as our knowledge base expands. Through 1991, the Canadian Council of Forest Ministers, which I had the honour to chair, worked to develop a National Forest Strategy that was sensitive to topical economic and environmental concerns. The Strategy, publicly released early this year at the National Forest Congress, is proof of this commitment, as is another document also released then — The Canada Forest Accord. My thanks and appreciation are due to my provincial colleagues for their cooperation in the preparation of the Strategy and Accord and for the contributions of many organizations and individuals, who are interested in the future of our forests.

In Canada we are not resting on our laurels, but are pushing ahead on research that will yield an array of benefits. These benefits include better protection of forest ecosystems, preservation of wildlife habitat, minimizing disturbance by natural means such as fire and pest infestations, and improved forest management techniques and practices. The vehicle for this vital research is the Model Forests Program that was announced in 1991 as part of Canada's Green Plan. As the harvest of the forest is transformed into lumber or pulp and paper, the environmental impact of these operations is closely scrutinized by both the federal and provincial authorities. Industries have responded to environmental concerns by allocating ever-larger amounts of their capital budgets to new equipment or process changes that will ameliorate the effect of their operations on the environment. It should be noted that Canada was the first nation to regulate dioxin and furan levels in mill discharges when it introduced a comprehensive set of new federal regulations to control mill pollution.

In 1991, the Canadian forest industry continued to suffer from the effects of the downturn in the global economy. In particular, the slowdown in the U.S. economy made it difficult for both solid wood producers and pulp and paper makers. There were substantial losses across all sectors of an industry that was plagued by weak demand, overcapacity and low prices. Organizations have responded by cutting back on their operations, by closing inefficient plants, or modernizing others to keep them competitive. There are signs that the worst is now behind us, and that markets for Canadian products will start to pick up later in 1992 and early 1993. Having undergone a difficult adjustment, Canadian exporters should be well positioned to take advantage of expanded opportunities.

Canada is custodian of 10 percent of the world's forests. We are mindful of that responsibility. I reiterate our commitment to sustainable development, and reject unfounded and ill-informed allegations that Canada is failing to discharge its stewardship obligations.

Frank Oberle
Minister of Forestry

Executive Highlights

Canada is geographically and culturally diverse, and public opinions about forestry are equally diverse.

All Canadians share an interest in ensuring that their forests contribute environmental, economic and social benefits in a sustainable manner. This year's report takes these common interests, concerns and questions, and seeks to provide the best possible responses to where Canada stands, where it is making improvements, and what challenges remain to be addressed.

Ownership of Canada's Forests

Canada is in a unique position compared to other nations. More than 90 percent of the forest land in this country is publicly owned. Furthermore, Canadian-owned companies controlled an average 74 percent of the assets of forest industries in 1988.

Conservation of Canada's Forests

Canada is also unique in that more than 50 percent of its forests are essentially wilderness areas. These resources do not form part of Canada's commercial forest lands. They constitute an estimated 244 million hectares, an area roughly equivalent in size to Columbia and Peru combined. Within the 244 million hectares are almost 27 million hectares of heritage forests (an area roughly equivalent in size to Italy) that are protected from commercial harvesting by legislation. Another 24 million hectares are protected from forest harvesting by policy. Although the number of hectares is important, the ultimate goal is to ensure the preservation of natural areas in all major ecoregions.

There is remarkably little difference in the age or species composition of managed and unmanaged forests at either the national or regional level in Canada. This is an important indicator that biodiversity is being sustained in Canada's forests. Given the limited understanding of the concept of biodiversity, the development of an indicator that reflects the total biodiversity of Canada's forests is difficult, but remains a priority.

Before the country was settled, the character of Canada's forests was shaped largely by natural forces like fire, insects, disease, wind and natural regeneration. Although harvesting has become an important factor, nature remains a major force determining the character of today's forests.

Sustaining Environmental Quality

Canada's forests continue to play an important national and international role in global health. They absorb some 135 million tonnes of carbon per year and sequester a net sink of 77 million tonnes.

Chemicals in forest management are rapidly being replaced by biological agents. The total area sprayed with chemical insecticides decreased from 98 percent in 1981, to roughly 38 percent in 1991.

While pulp and paper mill production doubled between 1960 and 1990, the Total Suspended Solids (TSS) released in effluent were reduced by 84 percent. The impact of effluent on the Biochemical Oxygen Demand (BOD) in water — an important factor in the health and survival of aquatic life — was reduced by 50 percent. Through the regulations introduced in 1991, Canada became the first country in the world to propose national regulations on dioxins and furans in pulp and paper mill effluent.

Waste from sawmilling, which was historically discarded or burned, now represents the major source of raw materials for pulp and paper industries. Its use rose from 27 percent in 1968 to almost 60 percent of the total fibre supply in 1988.

Advances in technology are bringing greater efficiency to Canada's pulp and paper industries. The introduction of chemi-thermomechanical pulping processes (CTMP) can increase fibre recovery by 15 percent. Since 1988, the Canadian newsprint industry has developed sufficient de-inking and recycling capacity to handle the total volume of newspapers used by Canadians.

Sustaining the Forest Economy

In 1990-91, Canada's forest industries experienced some of their worst financial losses since the early 1980s. A global recession, lower product prices, rising production costs, and international exchange rates contributed to a decline in export volumes.

While employment in the forest sector has been relatively stable over the past 10 years, it remains cyclical. Unemployment rates reached 15 percent in 1991 and will be further affected by ongoing market and industry changes.

Although the harvest rate in Canada has gradually increased over the past 20 years, it is still roughly 17 percent less than the allowable annual cut.

From 1986 to the end of 1989, the total increase in the growing stock in Canada's forests was estimated at 827 million cubic metres, approximately 47 percent greater than the harvesting level of 564 million cubic metres. Unfortunately, losses from fire and pests were high during the same period, raising the total depletions from all sources to 1.2 billion cubic metres. The total area harvested was 2.8 million hectares. This was offset by 3.7 million hectares of natural regeneration, planting and seeding. Major fires in Manitoba and damage by forest pests depleted 6.2 million hectares and contributed to a net increase of 5.3 million hectares in non-stocked forest land.

More of the responsibility for regeneration and management has been assigned to the companies harvesting Canada's forests. Forest management expenditures by Canadian forest industries increased by 41 percent between 1988 and 1989.

Canadian producers and their international counterparts are facing new challenges in the marketplace. Consumer demands for environmentally acceptable products, both at home and abroad, are having greater influence on investment decisions. Environmental projects in 1991 accounted for $750 million, or 27 percent of the total planned capital expenditures by Canadian pulp and paper industries, compared to 8 percent in 1989 and 16 percent in 1990.

With the integration of global financial markets, it is clear that fluctuating exchange rates are a day-to-day reality for all exporting and importing industries. As Sweden learned, artificial manipulation of exchange rates can be an effective competitive tool in the short term, but it brings negative long-term consequences.

A major restructuring is now underway within the forest industries. While the Canadian lumber industry has registered impressive productivity gains over the past 20 years, major competitors such as the United States have been quick to follow suit. Newsprint and pulp industries face a competitive disadvantage because of the small size and age of many of Canada's mills relative to those of its competitors. It should be noted, however, that seven of the eight recently installed newsprint machines are world-scale in size and have competitive wood and power costs.

Research

Research and technology are essential to environmental quality and a competitive economic position. This year's report provides an overview of research in Canada and is intended to serve as an introduction to a planned feature chapter in a future report.

The Canadian forest sector and its international competitors faced two major challenges in the past year.

The first was a recessionary economy that placed severe downward pressure on markets, product demand, and returns on investments.

The second challenge originated from a general concern about the environment, both in Canada and abroad. Responses have focussed on improving forest management practices, reducing the environmental impact of manufacturing processes, and adapting to new standards for environmentally acceptable products in the international marketplace.

NATIONAL

- The activities of provincial and territorial governments, who have primary responsibility for forest management in Canada, clearly reflected the major issues facing the forest sector. These activities included comprehensive policy reviews in support of sustainable forestry practices, the introduction of new regulations to control pulp mill pollution, and efforts to secure and protect Canada's international markets. There were also ongoing refinements in such areas as allowable annual cuts, protection policies, and tenures.
- Concerns were expressed about logging old-growth forests, particularly in British Columbia. In that province there are roughly 5 million hectares of mature coastal forests that could be referred to as old growth. Of the total, approximately 2 million hectares are considered available and suitable for harvesting. An estimated 3 million hectares are not available or are not suitable for harvesting for a variety of economic or environmental reasons. Another 200 000 hectares are located in parks and are fully protected. The stock of old-growth forest in British Columbia is substantial.

  To address issues about old-growth preservation, the Government of British Columbia has introduced several initiatives. The development of an old-growth strategy for British Columbia, is in its final stages. The objectives of this strategy are to ensure that representative samples of old growth are protected and that management practices are designed to preserve old-growth attributes where necessary. A second initiative is the Protected Areas Strategy which is aimed at doubling the province's parks and wilderness areas by the year 2000. Under this strategy, additional old-growth areas will be protected.
- The Canadian Council of Forest Ministers sponsored a series of public forums. A number of citizens, who represented a range of diverse views, were invited to contribute to a new collective strategy for Canada's forests, entitled *Sustainable Forests: A Canadian Commitment.*
- In 1991, the federal government launched Canada's Green Plan, its most important environmental program to date. Under the Green Plan, the Canadian government outlined a series of initiatives aimed at enhancing the management of Canada's forests. One of these initiatives — the $100 million Model Forests program — will provide support for the establishment of working models of innovative and sustainable forestry practices in each of the major forest regions of Canada.
- The Canadian government signed a second round of forest resource development agreements with the following provinces: Newfoundland ($64.3 million), Ontario ($50 million), Manitoba ($30 million), Saskatchewan ($30 million) and British Columbia ($200 million). In addition, a new $18.3 million federal forestry program was implemented for research, experimentation and technology transfer in Quebec. Under current federal-provincial forestry agreements

and other federal initiatives, more than $663 million have been committed over the next five years to forestry research and education, reforestation and silviculture.

- New pulp and paper regulations to improve water quality were announced late in the year. Under the *Environmental Protection Act*, pulp mills will be required to prevent the formation of dioxins and furans in effluent. Amendments to the *Fisheries Act* regulations set new limits on effluent discharge by all pulp and paper mills in Canada, and established new procedures for effluent measurement. All mills will be subject to regulations governing the discharge of suspended solids, oxygen-demanding substances, and effluents lethal to fish. These new regulations place Canada among world leaders in the control of pollutants from manufacturing processes.

- In 1991, Canada's forest industries experienced some of their worst financial losses since the early 1980s. A global recession, lower product prices, increased production costs, and the appreciation of the Canadian dollar relative to the U.S. dollar contributed to a decline in export revenues. The industries are currently restructuring to maintain their competitive position in world markets.

International

- In response to the June 1990 Declaration by the G-7 nations, Canada initiated and supported efforts toward an international convention on forests, and continued to play a lead role in developing an international statement of principles regarding the conservation and sustainable development of forests. Canada was also actively involved in a number of initiatives that lead to the United Nations Conference on the Environment and Development, held in Brazil in June 1992.

- In September 1991, Canada participated in the 10th World Forestry Congress in Paris, where delegates called for renewed commitment to reforestation and sustainable development throughout the world.

- The Canadian government terminated the Softwood Lumber Memorandum of Understanding (MOU) with the United States. This action was taken after major exporting provinces implemented significant changes in their forest management policies, including increased stumpage charges. The USA responded by initiating a countervailing duty investigation of Canadian stumpage pricing practices to determine if they subsidize Canadian softwood lumber producers and materially injure the U.S. industry. The federal and provincial governments and Canadian companies have mounted a major defence against this unjustified action.

- Canadian specialists have been working with their European counterparts to ensure that green lumber exports from Canada meet European Community regulations with respect to the presence of pinewood nematode.

- Canada exports more than 80 percent of its newsprint to the USA. Several U.S. states have passed legislation mandating a minimum recycled content for newsprint, and several more have entered into voluntary programs. Canadian newsprint manufacturers have invested in de-inking facilities to recycle old newspapers to meet this requirement and maintain their share of U.S. markets.

- Growing consumer demands for more environmentally acceptable products, both at home and abroad, continued to influence the competitiveness of Canada's forest products industries.

CHAPTER ONE

NATIONAL AND PROVINCIAL PROFILES

Forests are intimately linked to Canada's cultural, economic and social development. They make up half of the nation's landscape and are an important source of employment in many regions.

Approximately 350 Canadian communities are dependent on forests, and more than 670 000 citizens work directly for forest industries or companies that support them. In 1990, forestry contributed $18.8 billion to the country's balance of trade.

Forests figure prominently in Canada's cultural, economic and social development.

Forests offer Canadians a multitude of other values and benefits. They are a source of clean water and a habitat for a great variety of wildlife species. As well, they provide commercial and sports fishing opportunities, and satisfy countless other recreational needs.

Approximately 80 percent of Canada's forest land is provincially owned. Each province has its own forest legislation, regulations, standards and programs through which it confers harvesting rights and management responsibilities to the private sector.

Approximately 9 percent of Canada's forest land is held by private woodlot owners, including individual private landowners and large forest companies. Private woodlots are among the most productive of Canada's forest lands and are valued for the recreational opportunities they provide. They are also an important source of commercial timber. In addition, they supply Christmas trees, maple syrup and other goods, which contribute significantly to local economies and offer needed employment in many regions.

The other 11 percent of Canada's forest land is federally owned and managed, most of it in the Yukon Territory and Northwest Territories. In the Yukon Territory, the federal government oversees the management of forest lands through the Department of Indian Affairs and Northern Development. The government of the Northwest Territories, on the other hand, manages the forests within its boundaries. National parks, research areas, Indian lands, and lands administered by the Department of National Defence comprise the remaining federal Crown forest lands.

Approximately 80 percent of Canada's forest land is provincially owned.

The federal government's role in the forest sector is multifaceted and includes responsibility for industry and market development, trade relations, research, scientific exchange and technology transfer, pesticide regulation, and the monitoring of atmospheric pollution. Through cost-sharing agreements, programs with the provinces, and participation in joint councils, Forestry Canada encourages the sustainable development and multiple use of Canada's forests.

A new forest strategy was presented at the National Forest Congress in Ottawa in March 1992. The outcome of this Congress was a *Canada Forest Accord*, which places Canada foremost among nations in its commitment to sustainable forestry.

NOTES

MAP

The map on page 13 shows the highly protected sites within the boundaries of Canada's forest land area. These areas are all protected by law from commercial harvesting. The data were compiled using Environment Canada's National Conservation Areas Database, which is based on categories set by the International Union for the Conservation of Nature and Natural Resources (IUCN), now called the World Conservation Union.

The sites were identified by several federal, provincial and territorial agencies, and classified within the five-class IUCN system according to the degree of human intervention and the level of protection. With forests in mind, the following sites were selected:

- scientific reserves and wilderness areas;
- national parks and equivalent reserves; and
- some habitat and wildlife management areas.

This preliminary subset of highly protected sites within Canada's forest land boundaries represents a total of 1764 federal and provincial sites, with a combined area of 26.7 million hectares.

Private ownership of forest lands ranges from 2% in Saskatchewan to 93% in Prince Edward Island.

PROVINCIAL TREES

An illustration of the tree species designated or officially adopted as an arboreal emblem by individual provinces is included in the profiles on the following pages.

FOREST RESOURCE

* *Given the difference in the reporting system used by Quebec, the number of highly protected sites compiled by Environment Canada may appear somewhat low. Quebec reports 1.3 million hectares of highly protected sites.*

The data relating to insects were provided by provincial and terrritorial agencies, and include moderate-to-severe defoliation only.

* *No defoliation is reported by Nova Scotia. The limited amount of defoliation that occurs in the Yukon Territory is included in the figures reported by British Columbia.*

Areas harvested are regenerated naturally, or by planting or seeding. Various silvicultural activities (e.g., surveys, site preparation, spacing and weeding) are undertaken to ensure the success of both regeneration methods. In most cases, the percentages shown for regeneration methods are average or target figures.

* *The data provided by Alberta for planting and seeding may also include site preparation or a combination of treaments.*

Forestry Canada is working with the provinces to develop conventions for measuring, analyzing and reporting national forest regeneration statistics.

FOREST INDUSTRY

The national employment figure includes both direct and indirect jobs in the forest sector. The total indirect jobs provided for each province will not add up to the national total because the provincial figures do not include the indirect jobs that are created outside the province.

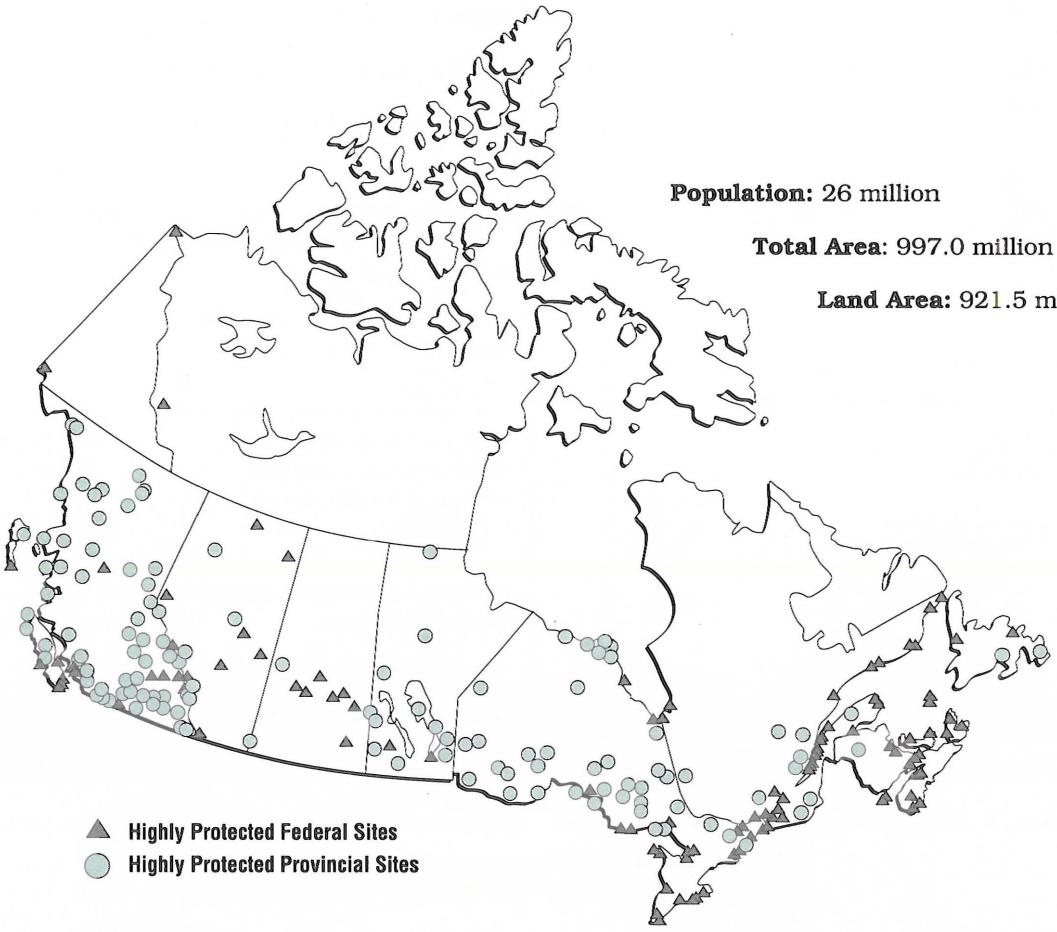
Some of the provincial data for wages, salaries and new investments are not available for reasons of confidentiality.

* *The limited number of forestry jobs in Prince Edward Island is not reported by Statistics Canada.*

SOURCES OF DATA

The main sources for the data presented in the profiles are Statistics Canada, Forestry Canada and Environment Canada. Most of the information was collected by provincial and territorial forestry agencies.

CANADA



Population: 26 million

Total Area: 997.0 million ha

Land Area: 921.5 million ha

FOREST RESOURCE

Ownership
80% Provincial
11% Federal
9% Private

		million ha
Forest Land (1990)		**453.30**
• Highly Protected Sites		26.70
— Federal	12.60	
— Provincial	14.10	
• Natural Disturbances		21.33
— Insects	20.40	
— Fire	0.93	
• Harvested		1.00
— Regeneration Method		
54% Natural		
46% Planting or Seeding		

FOREST INDUSTRY

Value of Exports (1990)		$22.2 billion
• Wood Pulp (28%)		
• Newsprint (27%)		
• Softwood Lumber (24%)		
Major Export Markets (1990)		
• United States (68%)		
• EC (15%)		
• Japan (9%)		
• Others (8%)		
Balance of Trade (1990)		$+18.8 billion
Value of Shipments (1989)		$50.4 billion
• 55% Sold Domestically		
• 45% Exported		
Contribution to GDP (1990)		$18.8 billion
Number of Establishments (1989)		14 744
• Logging	10 618	
• Wood Industries	3 380	
• Paper and Allied Industries	746	
Forestry-Dependent Communities		350
Employment (1991)		670 000
• 299 000 Direct Jobs		
• 371 000 Indirect Jobs		
• 1 Job in 18		
Wages and Salaries (1989)		$10.1 billion
New Investments (1990)		$8.4 billion

NEWFOUNDLAND

Black Spruce

Population: 573 000

Total Area: 40.6 million ha

Land Area: 37.1 million ha

FOREST RESOURCE

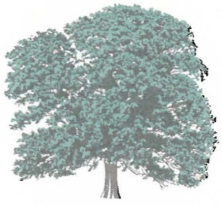
Ownership
96% Provincial
4% Private

		million ha
Forest Land (1990)		22.480
• Highly Protected Sites		0.660
— Federal	0.240	
— Provincial	0.420	
• Natural Disturbances		0.055
— Insects	0.005	
— Fire	0.050	
• Harvested		0.020
— Regeneration Method		
83% Natural		
17% Planting or Seeding		

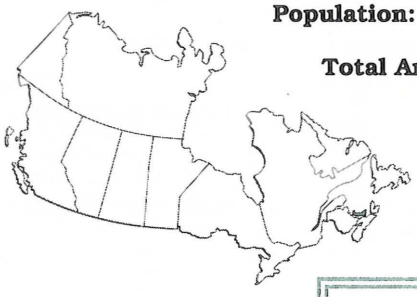
FOREST INDUSTRY

Value of Exports (1990)		$428 million
• Newsprint (86%)		
• Book and Writing Paper (13%)		
Major Export Markets (1990)		
• United States (45%)		
• EC (29%)		
• South and Central America (16%)		
Balance of Trade (1990)		$+423 million
Value of Shipments (1989)		not available
Number of Establishments (1989)		160
• Logging	109	
• Wood Industries	44	
• Paper and Allied Industries	7	
Forestry-Dependent Communities		15
Employment (1991)		8 000
• 5 000 Direct Jobs		
• 3 000 Indirect Jobs		
• 1 Job in 25		
Wages and Salaries (1989)		not available
New Investments (1990)		not available

PRINCE EDWARD ISLAND



Red Oak



Population: 130 000

Total Area: 0.57 million ha

Land Area: 0.57 million ha

FOREST RESOURCE

Ownership
7% Provincial
93% Private

		million ha
Forest Land (1990)		0.2900
• Highly Protected Sites		0.0040
— Federal	0.0030	
— Provincial	0.0010	
• Natural Disturbances		0.0002
— Insects	0.0001	
— Fire	0.0001	
• Harvested		0.0020
— Regeneration Method		
60% Natural		
40% Planting or Seeding		

FOREST INDUSTRY

Value of Exports (1990)		$1.4 million
• Softwood Lumber (51%)		
Major Export Markets (1990)		
• North Africa (70%), United States (18%)		
Balance of Trade (1990)		$+1.2 million
Value of Shipments (1989)		not available
Number of Establishments (1989)		30
• Logging	11	
• Wood Industries	18	
• Paper and Allied Industries	1	
Forestry-Dependent Communities		not available
Employment (1991)*		not available
Wages and Salaries (1989)		not available
New Investments (1990)		not available

* *See page 12.*

NOVA SCOTIA

Red Spruce

Population: 894 000

Total Area: 5.6 million ha

Land Area: 5.3 million ha

FOREST RESOURCE

Ownership
27% Provincial
3% Federal
70% Private

		million ha
Forest Land (1990)		4.000
• Highly Protected Sites		0.148
— Federal	0.140	
— Provincial	0.008	
• Natural Disturbances		0.001
— Insects *	0.000	
— Fire	0.001	
• Harvested		0.037
— Regeneration Method		
70% Natural		
30% Planting or Seeding		

* *See page 12.*

FOREST INDUSTRY

Value of Exports (1990)		$599 million
• Newsprint (39%)		
• Wood Pulp (49%)		
Major Export Markets (1990)		
• United States (72%)		
• EC (20%)		
Balance of Trade (1990)		$+580 million
Value of Shipments (1989)		$1.1 billion
Number of Establishments (1989)		464
• Logging	349	
• Wood Industries	99	
• Paper and Allied Industries	16	
Forestry-Dependent Communities		1
Employment (1991)		18 000
• 8 000 Direct Jobs		
• 10 000 Indirect Jobs		
• 1 Job in 21		
Wages and Salaries (1989)		$204 million
New Investments (1990)		not available

NEW BRUNSWICK

Balsam Fir

Population: 723 000

Total Area: 7.3 million ha

Land Area: 7.2 million ha

FOREST RESOURCE

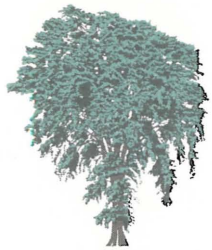
Ownership
49% Provincial
2% Federal
49% Private

		million ha
Forest Land (1990)		6.300
• Highly Protected Sites		0.070
— Federal	0.050	
— Provincial	0.020	
• Natural Disturbances		0.246
— Insects	0.240	
— Fire	0.006	
• Harvested		0.090
— Regeneration Method		
78% Natural		
22% Planting or Seeding		

FOREST INDUSTRY

Value of Exports (1990)		$1.4 billion
• Wood Pulp (45%)		
• Newsprint (22%)		
• Other Paper and Paperboard (20%)		
Major Export Markets (1990)		
• United States (60%)		
• EC (25%)		
• Japan (8%)		
Balance of Trade (1990)		$+1.3 billion
Value of Shipments (1989)		$2.7 billion
Number of Establishments (1989)		1 096
• Logging	929	
• Wood Industries	144	
• Paper and Allied Industries	23	
Forestry-Dependent Communities		41
Employment (1991)		21 000
• 13 000 Direct Jobs		
• 8 000 Indirect Jobs		
• 1 Job in 14		
Wages and Salaries (1989)		$479 million
New Investments (1990)		not available

QUEBEC



White Elm

Population: 6 769 000

Total Area: 154.1 million ha

Land Area: 135.7 million ha

FOREST RESOURCE

Ownership
87.6% Provincial
0.4% Federal
12.0% Private

		million ha
Forest Land (1990)		94.00
• Highly Protected Sites*		0.61
— Federal	0.21	
— Provincial	0.40	
• Natural Disturbances		1.04
— Insects	0.96	
— Fire	0.08	
• Harvested		0.34
— Regeneration Method		
69% Natural		
31% Planting or Seeding		

* *See page 12.*

FOREST INDUSTRY

Value of Exports (1990)		$5.2 billion
• Newsprint (47%)		
• Wood Pulp (14%)		
• Other Paper and Paperboard (20%)		
Major Export Markets (1990)		
• United States (83%)		
• EC (11%)		
Balance of Trade (1990)		$+4.5 billion
Value of Shipments (1989)		$13.2 billion
Number of Establishments (1989)		4 287
• Logging	2 903	
• Wood Industries	1 173	
• Paper and Allied Industries	211	
Forestry-Dependent Communities		126
Employment (1991)		166 000
• 89 000 Direct Jobs		
• 77 000 Indirect Jobs		
• 1 Job in 18		
Wages and Salaries (1989)		$2.8 billion
New Investments (1990)		$1.9 billion

ONTARIO

Eastern White Pine

Population: 9 743 000

Total Area: 106.9 million ha

Land Area: 89.1 million ha

FOREST RESOURCE

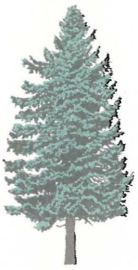
Ownership
84% Provincial
1% Federal
15% Private

		million ha
Forest Land (1990)		80.70
• Highly Protected Sites		5.86
— Federal	0.26	
— Provincial	5.60	
• Natural Disturbances		16.58
— Insects	16.40	
— Fire	0.18	
• Harvested		0.23
— Regeneration Method		
55% Natural		
45% Planting or Seeding		

FOREST INDUSTRY

Value of Exports (1990)		$4.1 billion
• Newsprint (35%)		
• Wood Pulp (21%)		
• Other Paper and Paperboard (18%)		
Major Export Markets (1990)		
• United States (94%)		
Balance of Trade (1990)		$+2.3 billion
Value of Shipments (1989)		$12.5 billion
Number of Establishments (1989)		3 006
• Logging	1 809	
• Wood Industries	846	
• Paper and Allied Industries	351	
Forestry-Dependent Communities		41
Employment (1991)		145 000
• 75 000 Direct Jobs		
• 70 000 Indirect Jobs		
• 1 Job in 33		
Wages and Salaries (1989)		$2.6 billion
New Investments (1990)		$1.6 billion

MANITOBA



White Spruce

Population: 1 091 000

Total Area: 65.0 million ha

Land Area: 54.8 million ha

FOREST RESOURCE

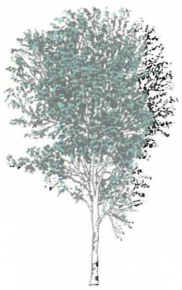
Ownership
91% Provincial
2% Federal
7% Private

		million ha
Forest Land (1990)		34.90
• Highly Protected Sites		1.30
— Federal	0.30	
— Provincial	1.00	
• Natural Disturbances		0.05
— Insects	0.03	
— Fire	0.02	
• Harvested		0.01
— Regeneration Method		
60% Natural		
40% Planting or Seeding		

FOREST INDUSTRY

Value of Exports (1990)		$195 million
• Wrapping Paper (33%)		
• Softwood Lumber (29%)		
• Newsprint (19%)		
Major Export Markets (1990)		
• United States (93%)		
Balance of Trade (1990)		$+75 million
Value of Shipments (1989)		$0.6 billion
Number of Establishments (1989)		281
• Logging	169	
• Wood Industries	83	
• Paper and Allied Industries	29	
Forestry-Dependent Communities		4
Employment (1991)		11 000
• 7 000 Direct Jobs		
• 4 000 Indirect Jobs		
• 1 Job in 45		
Wages and Salaries (1989)		$127 million
New Investments (1990)		not available

SASKATCHEWAN



White Birch

Population: 999 000

Total Area: 65.2 million ha

Land Area: 57.0 million ha

FOREST RESOURCE

Ownership
95% Provincial
3% Federal
2% Private

		million ha
Forest Land (1990)		23.70
• Highly Protected Sites		0.46
— Federal	0.41	
— Provincial	0.05	
• Natural Disturbances		0.47
— Insects	0.28	
— Fire	0.19	
• Harvested		0.02
— Regeneration Method		
70% Natural		
30% Planting or Seeding		

FOREST INDUSTRY

Value of Exports (1990)		$269 million
• Wood Pulp (51%)		
• Other Paper and Paperboard (32%)		
Major Export Markets (1990)		
• United States (80%)		
• Japan (11%)		
Balance of Trade (1990)		$+251 million
Value of Shipments (1989)		not available
Number of Establishments (1989)		253
• Logging	174	
• Wood Industries	73	
• Paper and Allied Industries	6	
Forestry-Dependent Communities		7
Employment (1991)		8 000
• 5 000 Direct Jobs		
• 3 000 Indirect Jobs		
• 1 Job in 56		
Wages and Salaries (1989)		not available
New Investments (1990)		not available

ALBERTA

Lodgepole Pine

Population: 2 471 000

Total Area: 66.1 million ha

Land Area: 64.4 million ha

FOREST RESOURCE

Ownership
89% Provincial
7% Federal
4% Private

		million ha
Forest Land (1990)		37.70
• Highly Protected Sites		7.00
— Federal	6.30	
— Provincial	0.70	
• Natural Disturbances		1.53
— Insects	1.50	
— Fire	0.03	
• Harvested		0.04
— Regeneration Method		
23% Natural		
77% Planting or Seeding*		

* *See page 12.*

FOREST INDUSTRY

Value of Exports (1990)		$658 million
• Wood Pulp (57%)		
• Softwood Lumber (26%)		
Major Export Markets (1990)		
• United States (84%)		
Balance of Trade (1990)		$+589 million
Value of Shipments (1989)		$1.8 billion
Number of Establishments (1989)		599
• Logging	353	
• Wood Industries	213	
• Paper and Allied Industries	33	
Forestry-Dependent Communities		10
Employment (1991)		23 000
• 13 000 Direct Jobs		
• 10 000 Indirect Jobs		
• 1 Job in 54		
Wages and Salaries (1989)		$370 million
New Investments (1990)		not available

BRITISH COLUMBIA

Western Red Cedar

Population: 3 126 000

Total Area: 94.8 million ha

Land Area: 92.9 million ha

FOREST RESOURCE

Ownership
95% Provincial
1% Federal
4% Private

		million ha
Forest Land (1990)		60.30
• Highly Protected Sites		6.53
— Federal	0.63	
— Provincial	5.90	
• Natural Disturbances		0.91
— Insects*	0.83	
— Fire	0.08	
• Harvested		0.22
— Regeneration Method		
45% Natural		
55% Planting or Seeding		

* *See page 12.*

FOREST INDUSTRY

Value of Exports (1990)		$9.3 billion
• Softwood Lumber (41%)		
• Wood Pulp (33%)		
• Newsprint (12%)		
Major Export Markets (1990)		
• United States (48%)		
• Japan (19%)		
• EC (21%)		
Balance of Trade (1990)		$+8.8 billion
Value of Shipments (1989)		$17.3 billion
Number of Establishments (1989)		4 557
• Logging	3 801	
• Wood Industries	687	
• Paper and Allied Industries	69	
Forestry-Dependent Communities		103
Employment (1991)		162 000
• 84 000 Direct Jobs		
• 78 000 Indirect Jobs		
• 1 Job in 9		
Wages and Salaries (1989)		$3.3 billion
New Investments (1990)		$3.3 billion

YUKON TERRITORY*

Population: 26 000

Total Area: 48.4 million ha

Land Area: 47.9 million ha

FOREST RESOURCE

Ownership
100% Federal

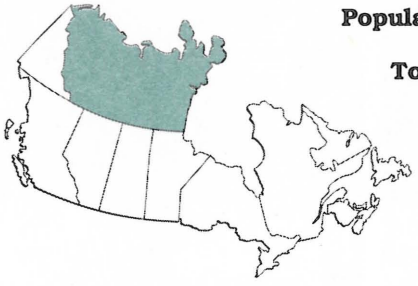
		million ha
Forest Land (1990)		27.300
• Highly Protected Sites		3.200
— Federal	3.200	
— Territorial	—	
• Natural Disturbances		0.170
— Insects*	—	
— Fire	0.170	
• Harvested		0.002
— Regeneration Method 100% Natural		

* *See page 12.*

** The Yukon Territory has not yet adopted an official tree.*

NORTHWEST TERRITORIES

Jack Pine



Population: 53 000

Total Area: 343.0 million ha

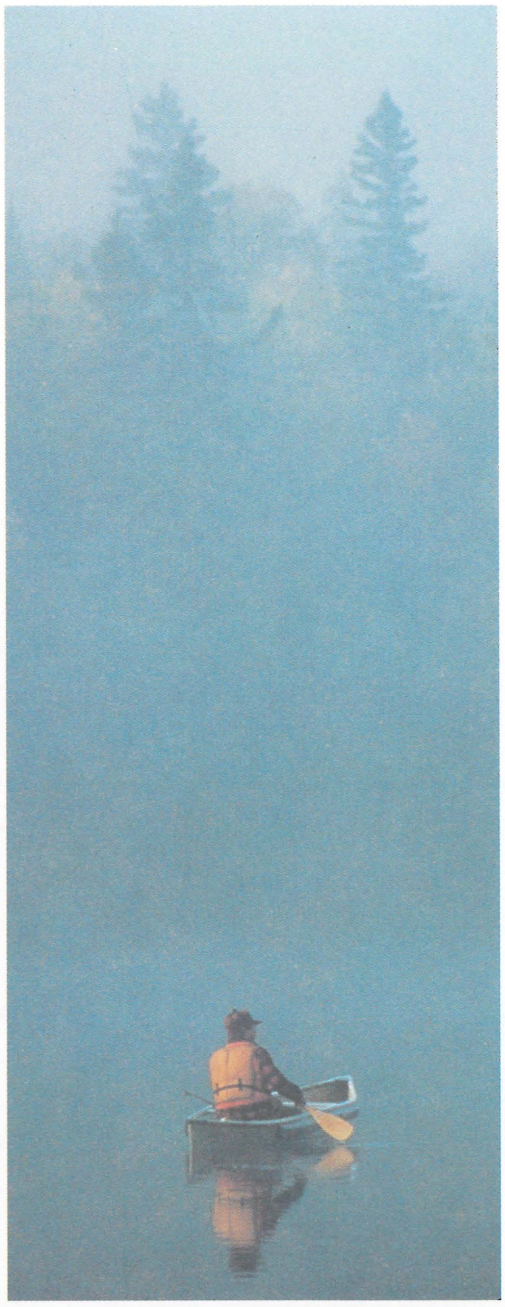
Land Area: 329.3 million ha

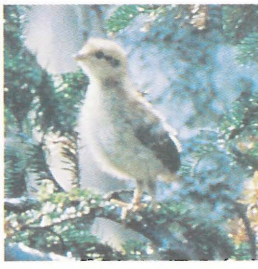
FOREST RESOURCE

Ownership
100% Federal

		million ha
Forest Land (1990)		61.5000
• Highly Protected Sites		0.8050
— Federal	0.8000	
— Territorial	0.0050	
• Natural Disturbances		0.2100
— Insects	0.1100	
— Fire	0.1000	
• Harvested		0.0005
— Regeneration Method 100% Natural		

Chapter Two





CANADA'S FORESTS

ENVIRONMENTAL, ECONOMIC AND SOCIAL INDICATORS

Canada is geographically, biologically and culturally diverse, and public opinions about forests reflect these variations.

Issues related to the evaluation and use of Canada's forests are of major interest. Across the country, news reports offer various perspectives on clearcutting, old-growth forests, jobs, wilderness, trade and related topics. Furthermore, attitudes about these issues differ greatly among regions, rural and urban communities, and individuals.

Canada is geographically, biologically and culturally diverse, and public opinions about forests reflect these variations.

Many of the issues regarding Canada's forests relate to the search for a balance among the preservation of environmental quality, the enhancement of economic wealth, and the development of social benefits. None of these objectives can be met in isolation; however, it is possible to manage forests for a combination of environmental, economic and social values.

Much of the language now used to describe forests is oriented toward timber management and economics. The term "unproductive forest," for example, means "not suitable for growing merchantable timber." Even though such terms are useful to give an account of the timber values of Canada's forests, they do not adequately portray the entire forest. Although half of Canada's forests may be unproductive for commercial timber, they are not biologically unproductive. In fact, forests that are considered commercially unproductive may be very productive for wildlife and recreation and for their contribution to global environmental quality.

To broaden the discussion on Canada's forests, more information is required, and the terms used to describe forests must reflect a more holistic view. The set of terms presented in the table on the next page are proposed as an initial step.

A further step in expanding the description of Canada's forests is to develop reference points or indicators that help track the nation's progress in achieving environmental, economic and social objectives. The indicators should serve a purpose similar to more familiar indexes, such as the Consumer Price Index or the Gross National Product. They should be quantifiable, and they should provide policy makers and the public with some indication of just how our forest resources are being managed. Notwithstanding regional variations, forest indicators should also be national in scope.

The indicators presented in this report offer a preliminary assessment of Canada's performance.

The indicators presented in this chapter were developed following a series of cross-Canada meetings held in the spring of 1991 with a broad range of forestry stakeholders and users. Ideas put forth during these discussions were used to develop a set of themes that addressed environmental, economic and social values. For each theme, an indicator was selected to represent Canada's performance. These indicators were based on the best available data, and efforts to enhance and refine definitions and data are continuing.

CANADA'S FORESTS
A New Perspective

• HERITAGE FORESTS (protected by legislation)		27 million ha[a]
• PROTECTION FORESTS (protected by policy)		24 million ha
• COMMERCIAL FORESTS (capable of producing timber and a variety of non-timber products)		209 million ha
— Managed Forests (currently managed for timber production)	112 million ha	
— Unallocated Forests (currently unallocated and unaccessed)	97 million ha	
• OPEN FORESTS (small trees, shrubs and muskegs)		193 million ha
TOTAL FOREST LAND		**453 million ha**

[a] Preliminary estimates.

Source: Forestry Canada.

Twelve themes relating to Canada's forests are presented in this year's report. The first five address the environmental aspects of Canada's forests — their diversity, protected status, productivity, health and contribution to the global environment. Themes 6 through 10 pertain to the economic use of forests and cover the issues of economic benefit, competitiveness, wood processing, resource control, employment and community stability. Themes 11 and 12 relate to the social issues of public involvement and access to nature.

More than 70 species of mammals live in Canada's forests, and approximately 300 species of birds nest in the forests.

Each theme highlights a major issue of interest to the Canadian public. The theme's corresponding indicator then gives a relative measure of Canada's performance. Some indicators are more fully developed than others simply because of the availability of statistical information. There is an ongoing program to gather better data.

The indicators presented in this report offer a preliminary assessment of Canada's performance in balancing the economic, environmental and social values of the forest. This first set of indicators is intended to stimulate further discussion and refinement of the measurement of Canada's performance as a forest nation.

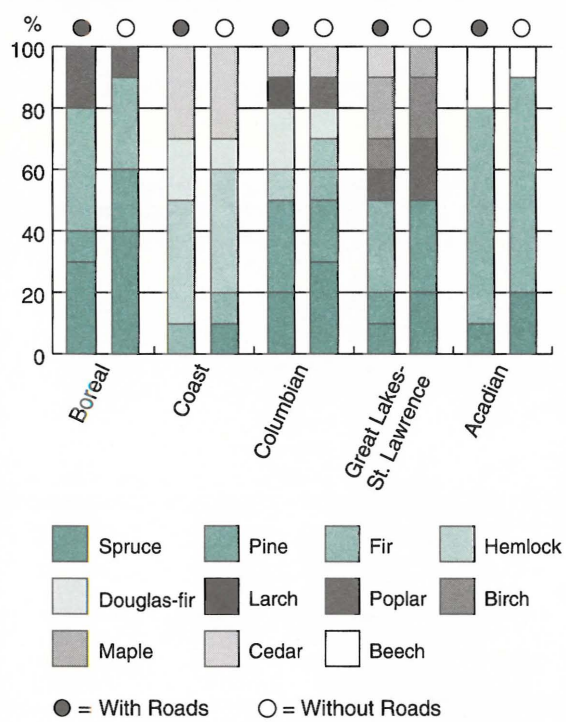
1 The Diversity of Canada's Forests

"HAS HUMAN INTERVENTION CHANGED THE FUNDAMENTAL NATURE OF CANADA'S FORESTS?"

Timber harvesting has been a key factor in Canada's economic development. As a result, forests have historically been perceived in terms of their commercial value.

In recent years, biological diversity or "biodiversity" has assumed a prominent place on the public agenda. Biodiversity can refer to the diversity of forest habitats, species (flora, fauna and invertebrates) and genetic material. Introducing an indicator that reflects the total biodiversity of Canada's forests is difficult. However, it is possible to depict forest diversity and, by extension, habitat diversity by describing the predominant tree species and age classes in each forest region.

Forest Composition by Species and Region



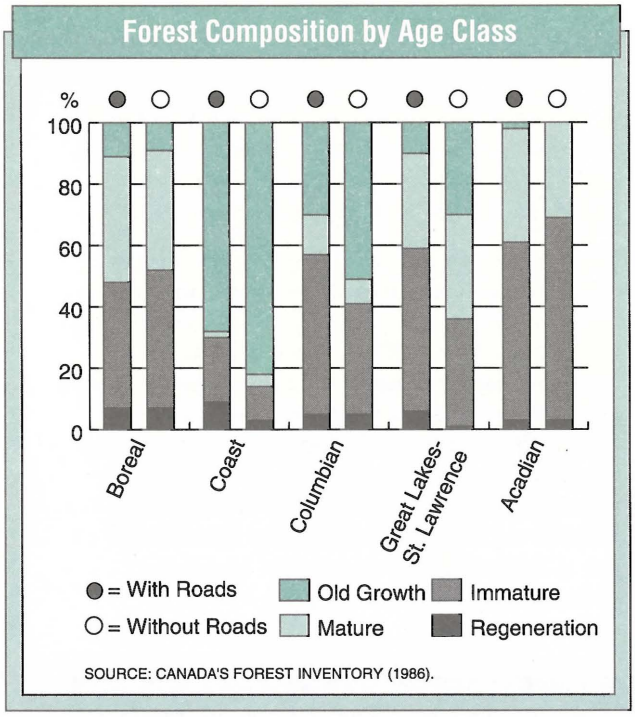
SOURCE: CANADA'S FOREST INVENTORY (1986).

Questions have often been asked regarding the extent to which human intervention has changed the natural biodiversity of forests. The degree of human impact can be broadly estimated by comparing the character of forests in areas with road access to those without, if it is assumed that the areas without road access are indicative of what might be a wild state of the forest.

A statistical snapshot of the diversity of the nation's principal forest regions is provided in this graph, which lists species composition for areas with and without road access. If the areas without roads are used as an indicator of forests in their natural state, human intervention is shown to have reduced the proportion of white pine in the Great Lakes-St. Lawrence forest region from 30 percent to 10 percent. The proportion of Sitka spruce has also decreased, while Douglas-fir has increased in the Coast region. A slight decline in spruce and pine, and an increase in poplar and balsam fir are evident in the Boreal forest region. The percentage composition of leading species does not vary between the areas with and without road access in the Coast region, where hemlock and cedar make up 70 percent of the forest cover, or in the Acadian region, where balsam fir represents 70 percent of the forest cover.

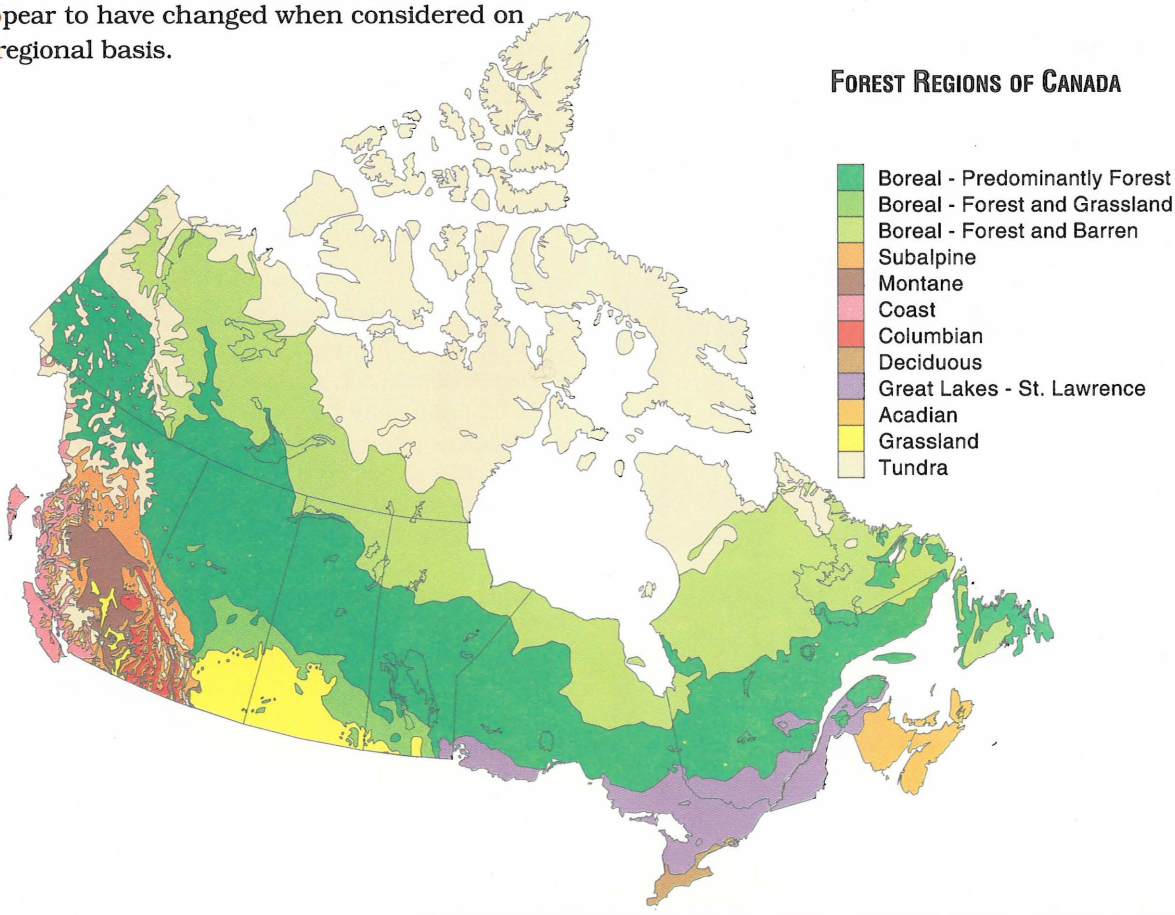
Changes in forest composition may result from three factors. 1) Ecological differences exist between harvesting and natural disturbances like fire or insect epidemics. Wildfire often provides better seedbed conditions for conifers like jack pine, and it burns off brush and lower vegetation that are not removed by logging. 2) In areas where old forests have been harvested, pioneer or early successional species like poplar or birch tend to be established first, followed by species such as spruce or pine. 3) Through planting, there may be intentional enrichment of commercially valuable species like Douglas-fir.

The fundamental nature of the forests does not appear to have changed when considered on a regional basis.



The graph illustrates the percentage distribution of trees by age class in five forest regions for areas with and without road access. The greatest change is evident in the Coast, Columbian and Great Lakes-St. Lawrence regions, where a reduction in the proportion of older forests is identified. However, in the Boreal and Acadian regions, the proportion of trees in each age class is quite similar in the areas with and without road access.

Overall, these indicators suggest some evolution in Canada's forests. However, the fundamental nature of the forests does not appear to have changed when considered on a regional basis.



2 The Preservation of Wilderness Areas

"ARE THE NATURAL QUALITIES OF CANADA'S FORESTS BEING SAFEGUARDED?"

During the past century, in many regions of the world, forests have changed significantly as the result of increased demand for food (met by converting forested lands into agricultural lands), fuelwood, livestock fodder, and timber products. These pressures are likely to rise in conjunction with increases in the world's population.

The preservation of natural forests has become an issue of global concern. As custodian of 10 percent of the world's forest resources, Canada has an important role to play in ensuring that sufficient forest areas are set aside for the enjoyment of future generations. Wilderness areas are important for aesthetic and spiritual values, but they also provide an important baseline for ecological studies of the functions of natural ecosystems.

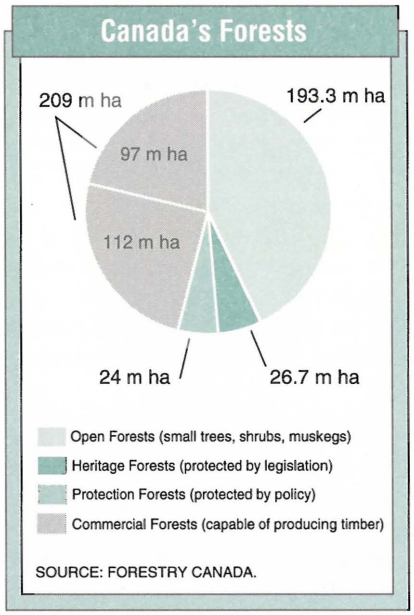
An issue of local, national and, more recently, international debate is whether the present efforts to preserve wilderness areas will be sufficient.

There are currently 74 million hectares of land in Canada with some degree of protection. Almost half of this land is considered "highly protected" from commercial activities such as harvesting and mining.

Preliminary estimates indicate that there are 1764 highly protected federal and provincial sites (26.7 million ha) within Canada's forest land boundaries (*see map on page 13*). Forestry Canada is working with Environment Canada to determine the exact number of forested sites in these highly protected areas.

There are also more than 24 million hectares of forests set aside to protect sensitive sites like watersheds and steep slopes. These forests are protected from harvesting by policy.

In summary, over 50 million hectares of forests in Canada are protected from industrial activity by either policy or legislation. In addition, there are no large-scale harvesting operations on more than 190 million hectares of open forests located in northern Canada.



Under the Green Plan, the Government of Canada has stated its intention to set aside 12 percent of the nation as protected space (the equivalent of approximately 120 million ha). In some areas, this objective may have been reached already. A more important goal, however, is to ensure the preservation of representative areas of each forest ecosystem in Canada. The new National Forest Strategy commits Canada to working toward achieving this objective by the year 2000.

Over 50 % of Canada's forests remain as wilderness areas.

The Government of Canada has stated its intention to set aside 12 percent of the nation as protected space.

3 Sustaining Forest Productivity

"To what extent are human activities changing the natural dynamics of Canada's forest lands?"

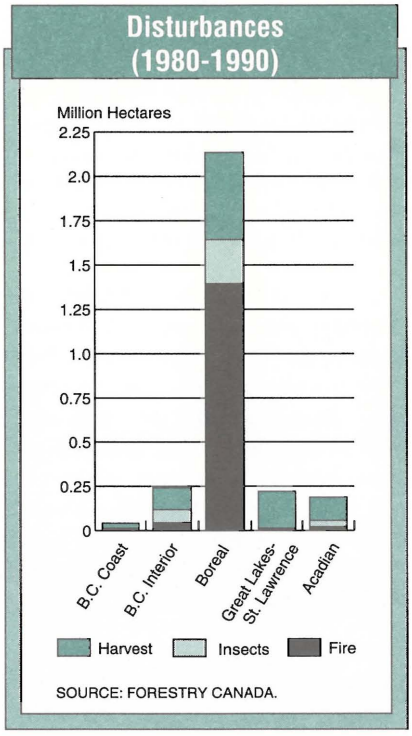
The productivity of an ecosystem refers to both its resilience to disturbance and its rate of growth. As part of their natural cycle, forest ecosystems respond to natural disturbances caused by fires, windstorms and insect epidemics. Human intervention, such as harvesting, pest management and fire control, may alter the natural cycle of the forest. However, forest ecosystems can usually tolerate these changes. Most forests that have been disturbed by nature regenerate on their own, whereas harvested areas are reforested by either natural regeneration or planting.

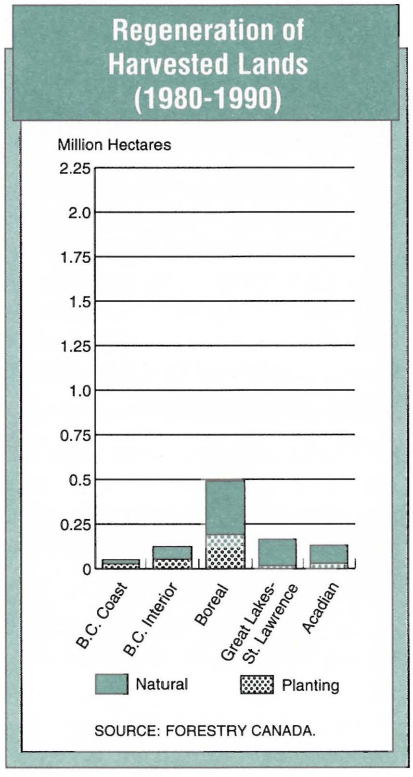
Most of Canada's forests have been continually cycled by natural forces such as wildfire and insect epidemics. Harvesting is a relatively recent and minor intervention. However, it has become the dominant force of change in some regions. These graphs show the extent of harvesting in some of Canada's forest regions, as well as the degree of regeneration by nature or planting.

Natural disturbances, such as fire, insects and disease, and natural regeneration remain the dominant agents of change in the forests of Canada.

In the major forest regions of Canada, more land area is affected by fire than by harvesting, and the majority of fires occur in the Boreal region. Harvesting is now the dominant agent of forest change in the Coast, Great Lakes-St. Lawrence and Acadian regions. In most regions, forest land still regenerates largely by natural methods. In the coastal forests of British Columbia, the seedlings of a number of local species are used to regenerate more than half the area harvested.

Note: Data on disturbances and regeneration generally are not compiled by forest region. The data presented in these graphs are best estimates.





4 Environmental Quality

"What steps are Canadians taking in forest management and manufacturing activities to protect the environment?"

Many people are worried about pollution and the use of chemicals. In particular, some Canadians have expressed concerns about the use of pesticides in the forest and the presence of contaminants in the effluent and air emissions from pulp and paper mills.

Trends in the use of chemicals for pest management and in the level of mill discharges provide an indication of how Canada is addressing these concerns.

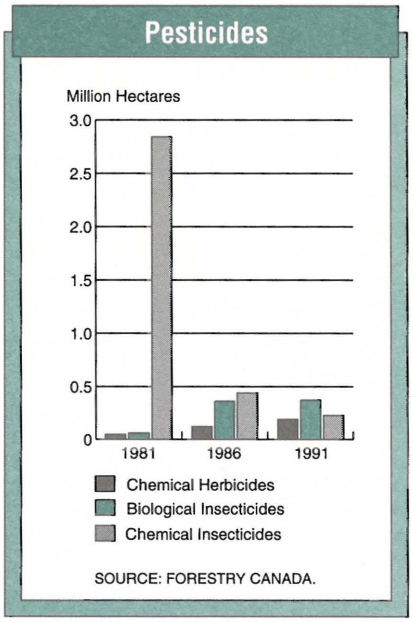
Use of Pesticides in Forest Management

To protect the value of commercially productive forests, pesticides are applied to control insect epidemics and competing vegetation. In 1991, less than 0.3 percent of the forest land in Canada was treated with pesticides. The pesticides that are currently used in forest management are tested and approved under federal government regulations, and their application is strictly controlled by the provinces.

Of all the pesticides applied in Canada in 1991, only 2.5 percent were used in forest management. In response to public concern, alternative methods of insect and disease control are being developed, ranging from the use of biological agents to the use of pheromones to lure insects into traps. One biological agent that has proven successful in reducing the intensity of spruce budworm epidemics is *Bacillus thuringiensis (B.t.)*. In 1981, biological insecticides were applied to 2 percent of the total forest area treated in Canada. By 1991, biological control had increased to almost 62 percent. Although the use of herbicides has increased during the past decade, the forest area treated with biological and chemical insecticides has decreased by 80 percent.

Effluent from Pulp and Paper Operations

Bleaching pulp with chlorine creates unwanted by-products called "chlorinated organics", often referred to as "AOX" (adsorbable organic halogen). They include dioxins and furans — two complex classes of organic chemicals that are deemed toxic under the *Canadian Environmental Protection Act.*



Although total mill production doubled between 1960 and 1990, TSS discharges have been reduced by 84 percent, and BOD has been cut by 50 percent.

It is only in recent years that measurement techniques have been sensitive enough to detect minute amounts of dioxins in bleached chemical pulps and in sludge from pulp and paper mills.

Public awareness and concern have prompted changes in production processes to reduce these unwanted by-products. Canadian bleached kraft pulp mills have

taken important steps over the past three years to reduce the production of dioxins and furans in pulping processes. Once process changes have been completed at all mills, dioxins and furans will be virtually eliminated from the pulping process.

The amounts of BOD (Biochemical Oxygen Demand) and TSS (Total Suspended Solids) in pulp mill effluent can be used as indicators of Canada's performance in dealing with mill emissions. Indeed, Canada has substantially reduced these levels over the past 30 years. Although total mill production doubled between 1960 and 1990, TSS discharges have been reduced by 84 percent, and BOD has been cut by 50 percent.

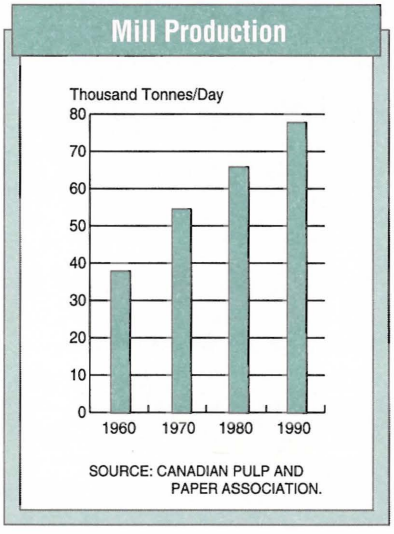
The new federal regulations announced in December 1991 will require the virtual elimination of dioxin pollutants from Canadian pulp mills by 1994. Many provinces have introduced further regulations to ensure the protection of the environment.

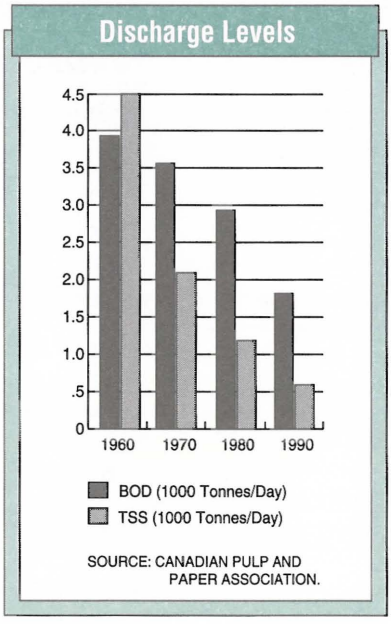
The federal regulations require that the industries introduce changes to pulp and paper processing to prevent the formation of dioxins and furans, to greatly reduce organochlorine levels overall, and to strictly control conventional pollutants in pulp mill effluent.

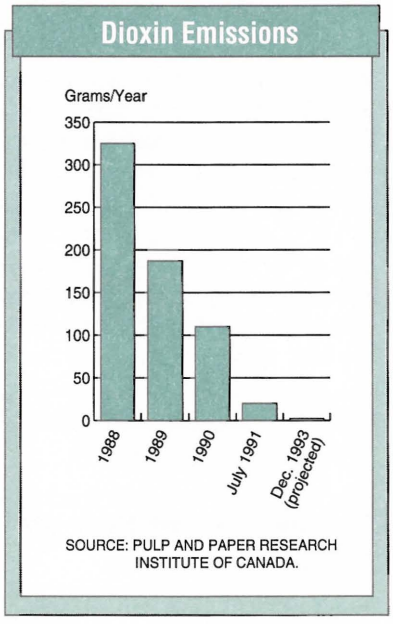
Canada is the first country in the world to implement national regulations on dioxins and furans.

Some mills have already implemented the required changes by substituting chlorine dioxide for elemental chlorine in the bleaching process. Cleaner chemical defoamers and the use of uncontaminated wood chips have brought about substantial reductions in the chlorinated organic compounds in effluent. Almost 60 percent of the Canadian mills that use chlorine bleach currently meet the new federal regulations.

Canada is the first country in the world to implement national regulations on dioxins and furans in pulp mill effluent. Government- and industry-funded studies are underway to promote the development of alternatives to chlorine bleaching.







5 The Role of Forests in Environmental Quality

"What contribution do Canada's forests make to the global environment?"

Forests contribute significantly to the health of the environment. They help to regulate atmospheric conditions and moderate the effects of external forces on soil and water. Plants protect the soil by sheltering it from strong water flow and wind. Tree roots absorb water and nutrients from the soil, and their leaves absorb carbon dioxide from the atmosphere, returning oxygen as a by-product. The carbon fixed during this process in tree trunks, branches, roots and forest soils is stored for decades or even centuries.

Carbon storage is extremely important in the context of global warming; increased concentrations of carbon dioxide and other gases in the atmosphere will cause average temperatures around the world to rise. Sound forest management can help regulate carbon dioxide levels.

Worldwide, the amount of carbon currently released into the atmosphere, primarily through the burning of fossil fuels, is estimated at between 5 and 6 billion tonnes per year. As many as 2 billion tonnes are released annually by the clearing and burning of tropical forests for agricultural and other purposes. The amount of carbon released through these processes has increased dramatically over the past 50 years.

As steward of almost 10 percent of the world's forests, Canada can play a positive role in addressing the global problem of increasing atmospheric carbon dioxide levels. It is extremely difficult to accurately estimate the carbon inventory . However, Canadian research scientists are improving their ability to measure and assess the nation's carbon balance.

As steward of almost 10 percent of the world's forests, Canada can play a positive role in addressing the global problem of atmospheric carbon dioxide.

The preliminary estimates of carbon accumulation and release presented in last year's report have been further refined. Forestry Canada now estimates that in

Canada's Current Carbon Inventory

	(billion tonnes)
Forest Biomass	12.0
Soils	76.4
Forest Products	0.6
Total Forest Sector	**89.0**
Peatlands	135.0
Total Carbon Inventory	**224.0**

1986, after allowing for losses from decomposition and burning, a net 77 million tonnes of carbon were sequestered in Canada's forests and peatlands. The forest sector was therefore considered a net carbon sink for that year. In other words, forests absorbed more carbon than they released. By keeping forest lands healthy, productive and managed as forest ecosystems, Canada can make an important contribution to national and international environmental quality.

Sound forest management can help regulate carbon dioxide levels.

Beyond the role of Canada's forests in regulating carbon, there are serious concerns about how global environmental problems will affect forests. If global warming occurs as predicted, there will be a major impact on the type and location of future forests. A longer growing season would be beneficial. However, higher temperatures would increase the likelihood of fires and insect epidemics. Similarly, pollutants carried to Canada's forests by prevailing winds could damage their health and productivity. For this reason, Canada has expanded its Acid Rain National Early Warning System (ARNEWS) to monitor changes in the health and vitality of representative ecosystems affected by acid rain and other pollutants, and to monitor forest responses to possible climate change.

Canada's Forest Sector Carbon Budget 1986

	(million tonnes)
Carbon Release	
Forest Biomass	20
Forest Soils	15
Forest Products	23
Net Carbon Release	**58**
Carbon Accumulation	
Forest Biomass[a]	- 8
Forest Soils	73
Forest Products	44
Peatlands	26
Total Carbon Accumulation	**135**
Net Sink 1986	**77**

[a] The actual biomass decreased as the sequestered carbon was transferred (primarily by fires) to forest soils.

Source: Forestry Canada estimates.

6 Sustainable Economic Benefit

"Will Canada's forests continue to supply sufficient fibre to sustain the long-term economic needs of Canadians?"

The forest industry is a major component of Canada's economy. Sustaining the industry's contribution to the economy depends, in part, on maintaining the supply of timber. Yet uncertainty about future wood supply has led many Canadians to question whether current harvest rates are in fact sustainable.

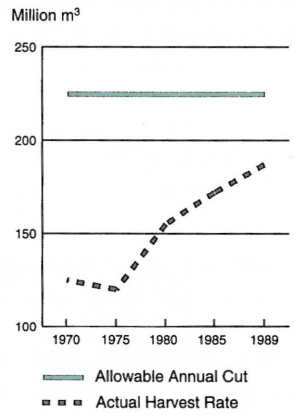
As owners of the majority of Canada's forest lands, the provinces control the rate of timber harvesting. The harvest rate is regulated through an "allowable annual cut" (AAC), which is based on a consideration of biological, economic and social factors. There is no one correct harvest rate for a forest, but rather a range of rates that correspond to various public policy options that reflect the age structure of the forest, the intensity of planned management activities, and the intended uses.

Selecting a harvest rate is a complex process. A balance must be struck between the need for wood products and jobs, the long-term sustainability of the productive capacity of the forest, and the need to maintain wilderness areas.

An indication of the sustainability of the economic benefits that Canadians derive from their forests may be obtained by comparing the AAC to the annual harvest rate. The average AAC in Canada has remained quite stable over the past two decades. Harvest rates have increased gradually from approximately 120 million cubic metres per year in the early 1970s, to an estimated 190 million cubic metres in 1989. However, the average harvest rate is still 17 percent less than the allowable annual cut.

Recent studies indicate that the national timber supply is sustainable over the next 30 to 60 years; nevertheless, regional supplies vary considerably and some local shortages have been identified.

Timber Supply



SOURCE: FORESTRY CANADA.

The average harvest rate is still 17 percent less than the allowable annual cut.

Over the longer term, further developments in silviculture and technology will help sustain Canada's forest resources. It should be noted that reforestation efforts in this country have increased dramatically since the 1970s. More intensive treatment of the forests allocated for commercial use will result in much higher yields of timber. Sweden, whose geoclimatic conditions are similar to those experienced in Canada, has obtained yields that are three times higher by intensively managing its forests.

7 The Competitiveness of the Forest Industries

"Can Canada's forest industries compete in the global marketplace?"

Canada is one of the world's major suppliers of forest products, accounting for 19.4 percent of the global market in 1989. Despite a decline of its market share in recent years, Canada has retained a number of competitive strengths in the international marketplace, including high-quality wood fibre and low-cost energy. Chapter 3 presents a more detailed discussion of this subject.

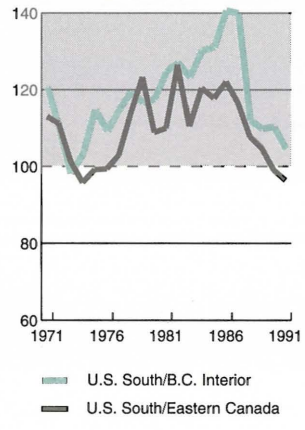
The future international competitiveness of Canada depends on a wide range of economic and policy factors, its ability to develop and adopt new technology, and its success in responding to a marketplace that fosters innovation and competition.

As producers of commodity products like lumber and pulp, Canada's forest industries compete in international markets primarily on the basis of price. Given the direct link between price and cost, a useful measure of the industries' competitive position can be based on the average cost of production in Canada compared with that of a major competitor — the United States. Over time, such a competitive index reflects changes in relative input prices (e.g., wood, labour and capital), relative input productivity, and currency exchange rates.

When the index is equal to 100, average production costs are the same in both countries. If the index is greater than 100, average U.S. costs are greater than average Canadian costs, which gives Canadian forest producers a competitive cost advantage. The opposite is true when the index is less than 100.

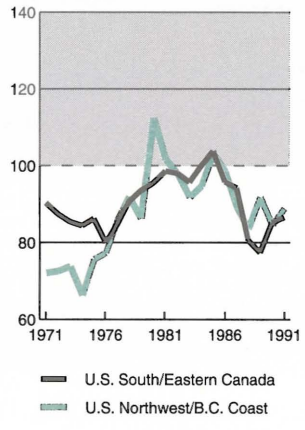
The graphs below illustrate competitive indexes for lumber, pulp and newsprint industries for the chief producing areas of Canada. On the basis of relative costs, these graphs show that Canada's primary forest products have become less competitive since the mid-1980s due to the appreciation of the Canadian dollar and the rising costs of wood and energy. This decline in competitiveness has lead to a restructuring within the forest industries and has forced less efficient producers to modernize, change their product mix, or cease operations. All things being equal, these adjustments may be expected to lead to a rise in Canada's competitive indexes as Canadian producers improve their relative cost position.

Lumber Competitive Index for Canada and the USA



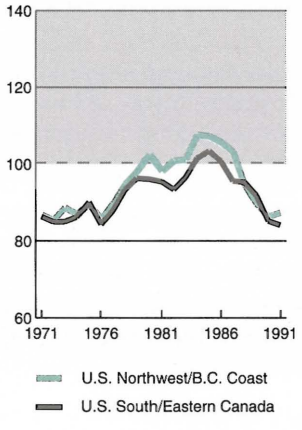
SOURCE: FORESTRY CANADA.

Pulp Competitive Index for Canada and the USA



SOURCE: FORESTRY CANADA.

Newsprint Competitive Index for Canada and the USA



SOURCE: FORESTRY CANADA.

8 Efficient Use of Wood

"Is Canada's timber efficiently harvested and processed?"

At the harvesting level, wood utilization is considered in terms of the recovery of timber from the forest, and at the processing level, in terms of the recovery of products from the log.

At the harvesting level, Canadians are concerned that too much wood is left on the site as waste after logging. At the processing level, concern centres around the amount and value of product recovered from each log, and the use of by-products and waste from lumber manufacturing.

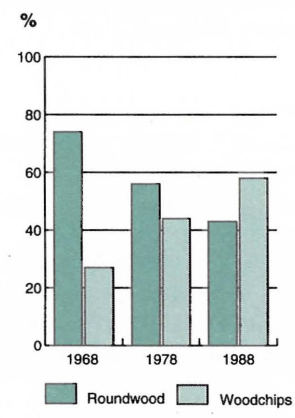
Wood left after harvesting may be viewed as wasteful on the one hand and beneficial on the other. Wood "waste" protects against wind, sun and rain, and offers shelter to an immense variety of plant and animal species. Later, as it decomposes, it provides valuable nutrients to the forest soil.

Wood waste from sawmilling, which was formerly discarded or burned, now represents the major source of raw materials for pulp and paper industries.

The standards that govern the recovery of wood harvested on Crown lands are set by provincial governments. In certain provinces, companies that leave merchantable timber on harvested sites are required to pay a stumpage fee for this material and, in some cases, a penalty for violation of the recovery standards.

There is no one indicator of Canada's performance in the area of wood waste recovery. However, the source of pulp raw materials and the amount of paper recycled can be used to indicate the trends in efficiency at the processing level.

Source of Pulp Raw Materials



SOURCE: FORESTRY CANADA.

Over the past few decades, significant improvements have been made in the amount and use of wood products recovered from roundwood logs. For example, wood waste from sawmilling, which was formerly discarded or burned, now represents the major source of raw materials for pulp and paper industries. This use of wood residues has reduced the volume of timber harvested to produce the same quantity of pulp.

When pulp production shifts from the old sulphite production process to the chemi-thermomechanical pulping process (CTMP), fibre recovery increases by 15 percent.

Advances in pulping technology have improved both the quality and quantity of production per unit of raw material. For example, when pulp production shifts from the old sulphite production process to the chemi-thermomechanical pulping process (CTMP), fibre recovery increases by 15 percent.

In addition to these technological developments, gains are being made through the recycling of wastepaper. In fact, the percentage of paper produced from recycled fibres is growing each year. By 1993, 57 percent of all of the paper consumed in Canada will contain some wastepaper, compared with 30 percent in 1988. The following table shows the recycled content of certain products manufactured by Canadian pulp and paper industries. It also shows the consumption of paper produced from recycled fibres.

By 1993, nearly 40 percent of all of the newsprint produced in Canada will contain recycled fibre, compared with just 3 percent in 1988. The number of de-inking mills in Canada is projected to rise from 1 in 1988 to 16 in 1993. The Canadian newsprint industry will then have the capacity to recycle virtually all of the wastepaper from Canadian consumers.

CANADIAN PULP AND PAPER INDUSTRIES

Recycled Content and Consumption

	1988	1993 (projected)
Recycled Content of Products		
Tissue	30%	55%
Newsprint	2%	12%
Other Printing/Writing Grades	0%	2%
Consumption of Paper with Recycled Content	30%	57%

Source: Canadian Pulp and Paper Association.

9 Control of Canada's Forest Resources

"WHO OWNS AND CONTROLS THE FORESTS AND FOREST INDUSTRIES IN CANADA?"

The Canadian public owns and controls 90 percent of Canada's forests.

Provincial governments grant tenures to companies for harvesting rights on provincial Crown lands. These tenures enable the provinces to implement public policies while retaining ownership of the lands. Longer contracts provide industries with more incentive to make the long-term investment required for large-scale, efficient processing plants and forest management programs.

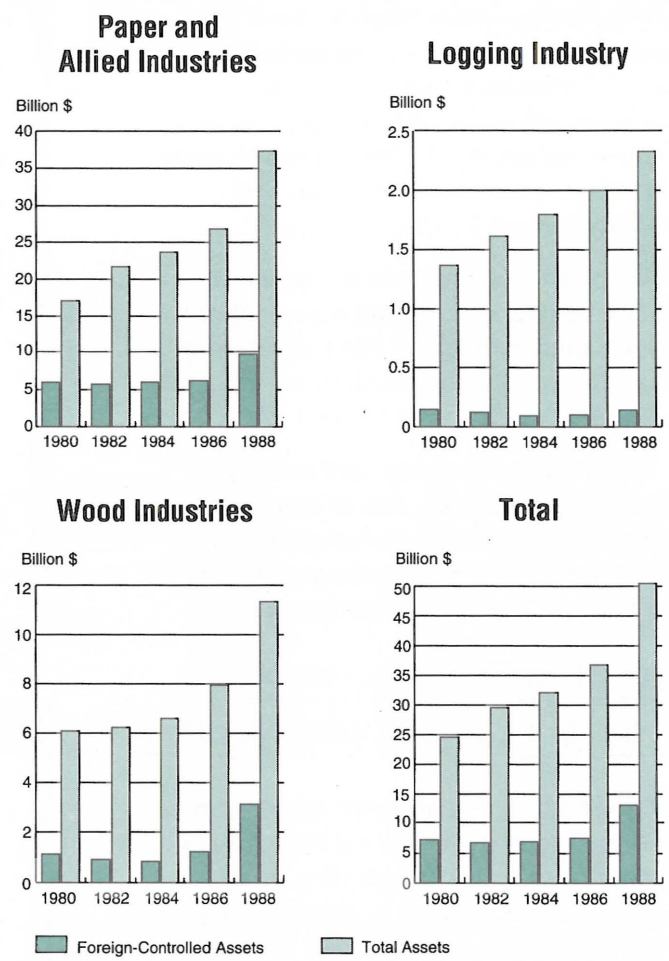
The Canadian public owns and controls 90 percent of Canada's forests.

Tenures can be granted for a specified period to small companies, aboriginal organizations, or large companies that own processing facilities. They are based on either volume of timber or area of forest land. Through competitive bidding, provincial governments may also sell the rights to various amounts of standing timber for a set length of time.

Overall, Canadian-owned companies control 74 percent of forest industry assets.

Some Canadians are concerned about foreign control of Canada's forest resources and the concentration of industry control over harvesting rights.

Ownership of Canada's Forest Industries



SOURCE: STATISTICS CANADA.

Foreign ownership of the logging industry remained stable during the past decade. It increased slightly for paper and allied and wood industries. Overall, Canadian-owned companies control 74 percent of forest industry assets.

10 Employment and Community Stability

"WILL THE FOREST SECTOR CONTINUE TO PROVIDE QUALITY EMPLOYMENT AND COMMUNITY STABILITY?"

Like people in other developed nations, Canadians have been experiencing a shift from a rural to urban lifestyle. Even so, smaller communities remain an important part of Canadian society, and their continued prosperity depends largely on resource industries. Indeed, approximately 350 communities across Canada rely on forest industries for their survival.

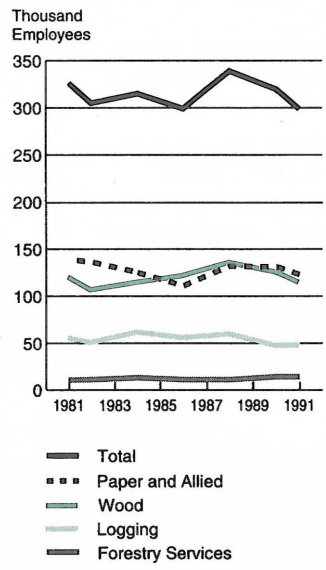
The forest sector is one of Canada's major employers, providing 6 percent of the nation's employment. In 1991, for example, the sector provided approximately 299 000 direct jobs and 371 000 indirect jobs.

Historically, the forest sector has provided well-paying jobs, but is associated with fluctuating rates of unemployment. The number and type of jobs available are also being affected by technology change.

Historically, the forest sector has provided well-paying jobs.

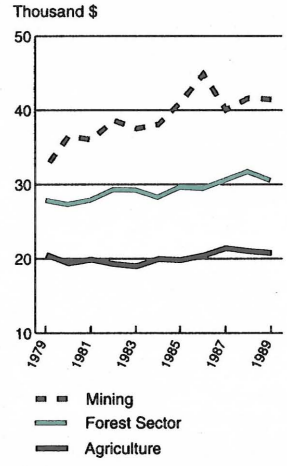
Forest sector employment trends can be illustrated by the average salaries and skill levels of workers. Although they earn less than miners, employees in the forest sector remain well paid. Over the past decade, their average income increased by 9 percent, compared with 28 percent in mining, -1 percent in agriculture, and -5 percent in fishing and trapping (not shown).

Direct Employment



SOURCE: STATISTICS CANADA.

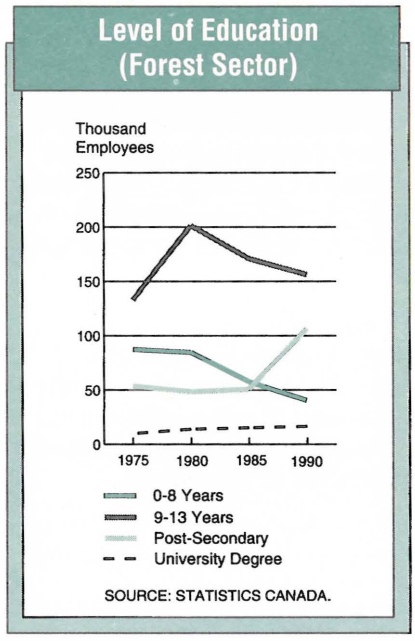
Average Income



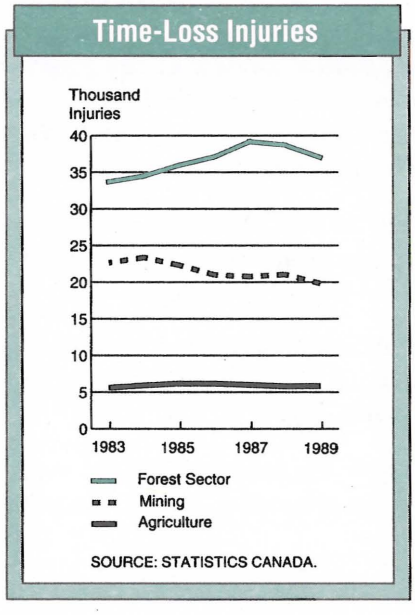
SOURCE: STATISTICS CANADA.

As world competition in forest products intensifies, some restructuring is required. Employment opportunities are shifting away from conventional logging and milling jobs to positions in research, affiliated forest resource fields (stand tending and other silviculture activities), and the service sector. The trend toward more skilled and professional positions is reflected in the education level of forest sector employees.

Employment opportunities are shifting away from conventional logging and milling jobs to more skilled and professional positions.



Another important employment indicator is the level of risk associated with the job. Time-loss injuries in the forest, mining and agriculture sectors are presented in the graph. Accident rates in the forest sector, particularly in the wood industries, rose between 1983 and 1987 in tandem with the increased growth in the sector. Between 1987 and 1989, injuries decreased by 5 percent.



11 Public Involvement in Decision-Making

"Does the public have the opportunity to participate in decision-making with respect to the management of Canada's forests?"

Governments manage the forests of Canada to achieve certain environmental, economic and social objectives. The process of setting and achieving these goals is continually evolving to keep pace with changing public values.

There is a perception among some citizens that they have little input into forestry decision-making. However, the five cross-country forestry forums held during 1991 revealed that concerns about participation are not limited to the public. Government departments, decision-makers and resource managers are all searching for improved mechanisms for involving the public in forest management and land-use decisions.

Opportunities for public participation are currently available, as outlined below. The challenge remains to develop effective mechanisms to accommodate the broad range of interests that determine how Canada's forests are perceived and used.

Public Input

An Overview of Current Practices

1. **Broad Policy Review at the Provincial Level**. Comprehensive planning and policy reviews are currently underway in three of the major producing provinces — British Columbia, Ontario and Alberta. In 1991, Quebec completed a full public review of its forest protection practices.
2. **Review at the Management Plan Level**. Forest management plans in Canada are public plans and, in the majority of provinces, public consultation on these plans is required by law or policy.
3. **Operational Plans.** Operational plans may or may not be subject to public discussion. Usually, operational plans are prepared and executed by professional forest managers.
4. **Land-Use Planning**. While the methods vary enormously throughout Canada, it is standard practice to enable the public to participate in major decisions governing land use.

12 Access to Nature

"What roles do forests play in satisfying the recreational needs of Canadians?"

Forests are not only a source of employment for Canadians, but also a backdrop for leisure and recreation.

Hunting, fishing, camping, hiking and a growing number of other forest-based activities are an integral part of the lifestyle of many Canadians. Forests are also of increasing importance to Canada's reputation as a world-class tourist destination.

Hunting and fishing, considered "consumptive", are longstanding, traditional uses of the forests. During the past five years, there has been a steady increase in the "non-consumptive" use of Canada's forests, through such activities as camping, hiking, bird watching and park visits. The increase in the non-consumptive use of Canada's forests is provided as a preliminary indicator of the importance of forests for recreation.

Leisure activities make a significant contribution to Canada's economy. For example, a Statistics Canada survey in 1987 estimated that wildlife-related activities alone accounted for $6.5 billion of Canada's Gross Domestic Product, $2.5 billion of government tax revenues, and 160 000 jobs.

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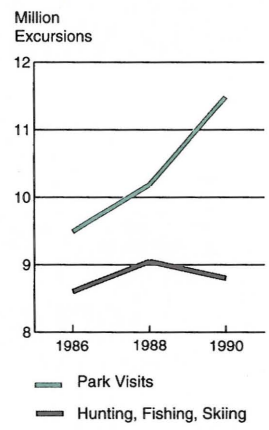
Forest-Based Recreation



SOURCE: FORESTRY CANADA.

To date, limited research has been done to determine the nature of forest-based recreation in Canada or the degree to which it is affected by management activities. Although forest harvesting and management may increase recreational opportunities by providing access and services to remote areas, they may also diminish the quality of recreational experiences if they adversely affect the natural forest landscape. Better information is needed to assess the increasing use of forests for recreational purposes and the impact of forestry operations on these leisure activities.

PUBLIC OPINIONS ABOUT FORESTRY ISSUES

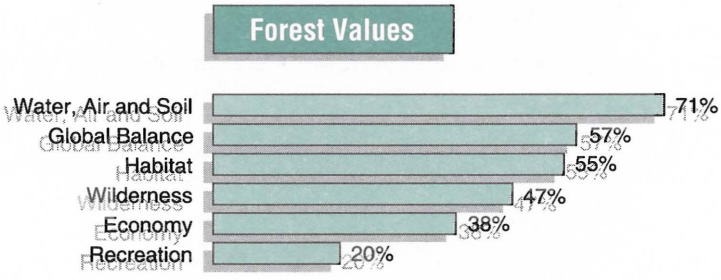
Forests have always played a vital role in the lives of Canadians. Historically, they were valued principally for their economic contribution, providing both employment and a renewable resource for construction and manufacturing. Forests have also been treasured for a variety of recreational pursuits, such as hunting, fishing and hiking. More recently, Canadians have come to appreciate the role of forest ecosystems in maintaining environmental quality, providing a habitat for wildlife, and regulating climate.

To better understand the importance that Canadians place on different forest values, Forestry Canada commissioned a nation-wide public opinion poll in 1991. The Department wanted to measure public perceptions of new forestry issues, as well as changes of opinion on key issues covered in an earlier survey. It also wanted to gauge the extent of public support for new forest management initiatives.

Values

The underlying values that citizens place on their forests represent the way in which society defines the resource and how it should be managed. The current conflicts over forest management issues reflect competing interests that emphasize divergent forest values.

The survey focussed on six broad values attached to forests: a place for recreation and relaxation; a source of economic wealth and jobs; a habitat for a variety of animal and plant life; a balance for the global ecosystem; a means of protecting Canada's water, air and soil; and a preservation of wilderness.



Overall, Canadians value forests most for the protection of water, air and soil. The next most important values are balancing the global ecosystem, providing habitat for animal and plant life, and preserving wilderness areas. Forests are less likely to be valued as a source of economic wealth and jobs, while the least important value is that of providing a place for recreation and relaxation.

The ranking of these forest values is essentially the same across the country and across demographic groupings of Canadians according to income and gender. The responses of rural and urban residents are also very similar.

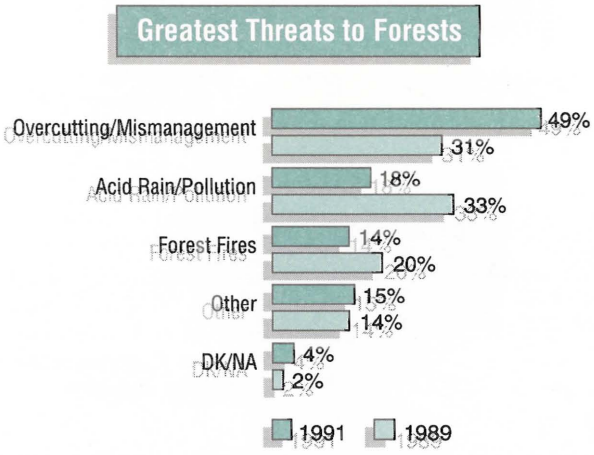
Other differences do emerge, however. For instance, forests as a source of economic wealth and jobs are most valued in Atlantic Canada (47%) and Quebec (43%), and least valued in the prairie provinces (31%). The priority of economic values tends to increase with the age of the respondent.

Ecological values like wildlife habitat and wilderness preservation are less valued by older Canadians, but the importance of wilderness preservation increases with community size. As might be expected, the importance of forests as a place for recreation and relaxation increases with the frequency of outdoor pursuits like hunting, fishing, camping and hiking. Wilderness preservation is also of greater significance to frequent recreational users, with the exception of active hunters.

Overall, Canadians value forests most for the protection of water, air and soil (71%).

Threats to the Forest

Compared to the results of an earlier public opinion poll, carried out in 1989, this survey showed a continued evolution in Canadians' concerns about forests. The focus is shifting away from the traditional problems of fire, insects and disease, to concentrate on the broader issues of forest management, such as harvesting and timber supply. This shift reflects the perception that Canada's forests are disappearing because trees are not being replaced as rapidly as they are being cut.

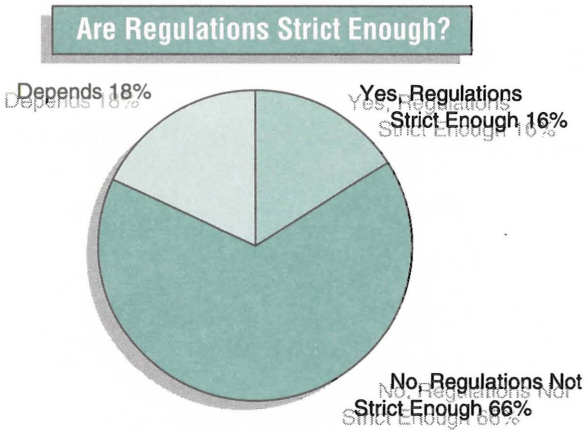


Respondents were asked what they perceive as the greatest threats to Canada's forests. Almost half pointed to bad forest management practices (clear-cutting, 37%; poor management of the forests, 7%; inadequate reforestation, 5%). This is a dramatic increase since 1989, mostly as the result of concern over clear-cutting (up 17%). On the other hand, the perceived threat from acid rain and pollution has dropped. The same can be said of forest fires.

Industry and the Environment

The 1991 survey results reflect the general increase in environmental awareness and understanding, as well as the rising public expectations for environmental quality and responsible actions on the part of industry and government. Nevertheless, an increasing proportion of Canadians feel that the forest industries are taking steps to address these issues. Although it is unlikely that most Canadians believe

environmental problems are fully under control, this trend does appear to represent a significant shift in their opinion of forest industries.



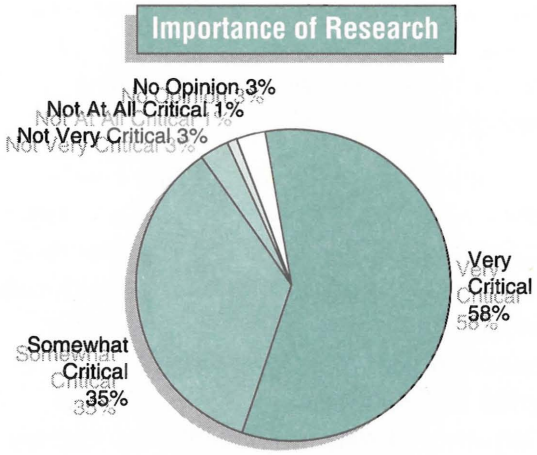
The greatest concern about pulp and paper mills is water pollution (59%), although 18 percent of respondents are more concerned about air pollution. Thirty-six percent say that mills now pollute less than they did ten years ago. Although most Canadians do not believe that mill emissions are getting worse, 66 percent think the current regulations are not strict enough.

Note: The survey was conducted prior to the announcement of new federal regulations to control pulp mill pollution.

Research

Respondents were asked about the importance of research aimed at improving the understanding of forest ecosystems and at developing technologies for forest management and new and innovative products. Three in five Canadians (58%) say such research is very critical to the future of Canada's forests, while another 35 percent deem it somewhat critical.

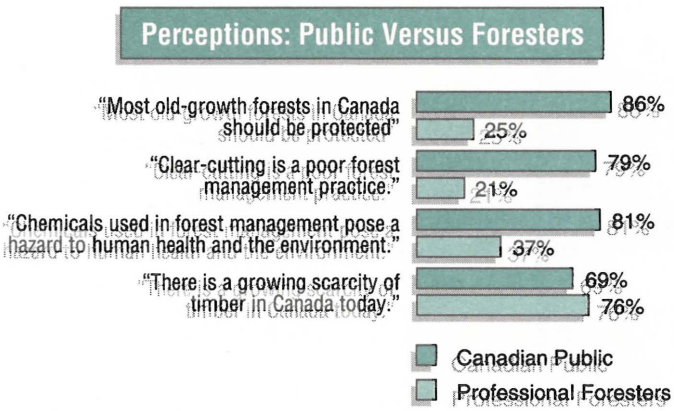
There is similar support for educating the public with respect to forestry research. Almost everyone says it is either very (70%) or somewhat (27%) important that the public be educated and informed about forestry research activities.



Foresters Versus the Public

Forestry Canada surveyed professional foresters in 1990; the results of that survey were highlighted in the first report to Parliament on the state of Canada's forests.

The public shares the view of professional foresters that there is a growing scarcity of timber. However, their views differ widely on other points. Eight in ten Canadians think the chemicals used in forest management pose a hazard to human health and the environment, while only four in ten foresters hold that opinion.

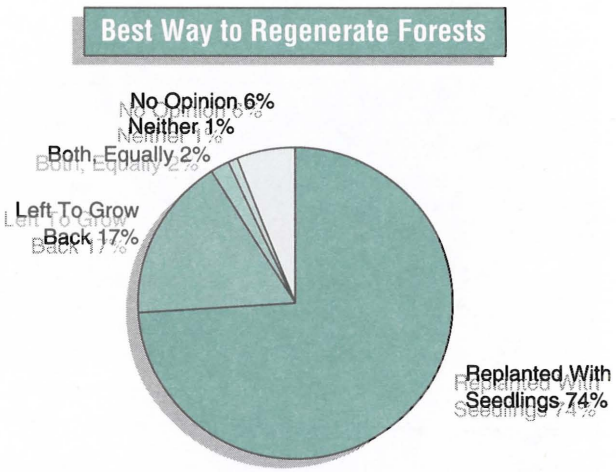


The difference in attitudes with respect to harvesting issues is even more pronounced. Eighty-six percent of Canadians say that most old-growth forests should be protected, but only 25 percent of professional foresters think so. Four in five Canadians believe that clear-cutting is a poor forest management practice, but only one in five professional foresters would agree.

Reforestation

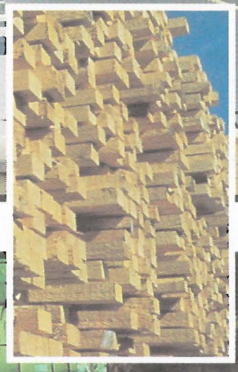
Seventy-four percent of Canadians think that active replanting produces better quality forests than leaving harvested areas to grow on their own. The 1991 public opinion poll demonstrated that Canadians are strongly supportive of community tree planting programs and would be prepared to participate in other new initiatives. Such programs may offer citizens a means of channelling their concerns into concrete actions.

The results of this survey clearly demonstrate that concerns about environmental problems are largely undiminished by the economic hardships currently facing Canada. While the public places great importance on economic recovery, there is little willingness to trade off environmental quality for economic objectives. Canadians continue to expect that both goals can be achieved simultaneously or, perhaps, that neither is viable in the long run without the other.



(The survey was conducted by Environics Research Group Ltd. and Corporate Research Associates Inc. between November 12 and December 2, 1991. It consisted of telephone interviews with a representative sample of 2510 Canadians. A sample of this size is considered accurate to within plus or minus 2 percent, 95 times in 100.)

Chapter Three



COMPETING IN A WORLD MARKET

Canada is a trading nation, and forest products are one of its most important exports. In 1990, forest industries contributed $18.8 billion to Canada's balance of trade — almost as much as agriculture, fisheries, mining and energy combined.

The export of forest products contributes significantly to Canada's high standard of living. Approximately 122 000 workers are employed in the solid wood products sector, 115 000 in the paper and allied products sector, 48 000 in the logging industry, and another 14 000 in the forest services industry. Directly and indirectly, forest industries provide 1 out of every 18 jobs in Canada. Roughly 350 Canadian communities are economically dependent on forest industries.

The continued success of Canada's forest products in international markets cannot be taken for granted. Canadian exports of forest products increased between 1970 and 1990. However, Canada's share of world markets for forest products decreased during the last five years.

With Canada's heavy reliance on international trade and the current economic difficulties of the forest sector, the factors that influence Canada's competitive position are undergoing intensive reviews by business, and by provincial and federal governments.

In 1989 Canada's forest products were valued at more than $50 billion.

This chapter examines some of the factors that affect the competitiveness of Canada's forest products industries and explores their influence on Canada's position in the marketplace.

Canada enjoys many natural advantages with respect to forest products manufacturing. They include high-quality wood fibre, abundant energy and water, and efficient transportation and distribution systems. Unfortunately, Canada is also faced with some inherent disadvantages. For example, forests grow slowly in Canada's northern climate, and extensive road networks are required to sustain forest industry operations in a nation this size.

The export of forest products contributes significantly to Canada's high standard of living.

The remoteness of foreign markets presents Canada with many obstacles to trade. Other challenges are more easily resolved or alleviated. They include the cost of wood fibre, the age and size of Canada's mills, and the education and training needs of its work force. Modern, world-scale facilities and a highly trained labour force operating in a flexible and innovative manner can help ensure that Canada's forest industries remain cost competitive. To accomplish this, some industries are presently undergoing a major restructuring.

HOW IS COMPETITIVENESS DETERMINED?

When industries from different countries sell similar products in the same market, each competes for customers based on price, quality and reliability as a supplier. Thus, competitiveness is a relative rather than absolute concept. The competitive position of a country is determined in part by how its abilities compare with those of its competitors.

Historically, Canada's forest products industries have produced a large proportion of high-quality standardized or commodity products, such as lumber, pulp and newsprint, for export markets. Although more diversified products and market niches are being developed, the emphasis on commodity manufacturing has meant that many

companies have competed primarily on the basis of price, by offering a commodity product at the prevailing market value.

The position of Canadian forest products in international markets is generally determined by:

- the costs of inputs (timber, energy, labour and capital) to manufacturing and distribution processes;
- the efficiency of manufacturing and distribution processes in using these inputs (i.e., their productivity);
- the currency exchange rates between Canada and its competitors; and
- the competitive quality of Canadian products.

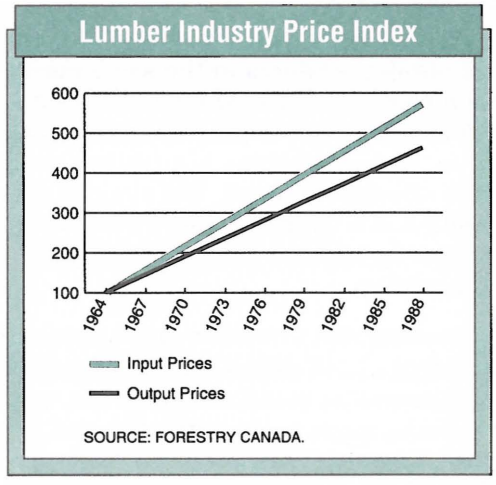
One of the central tenets of Canada's competitive strategy has been to minimize production costs and, more recently, to increase quality. If a competitor offers a product equal in quality to a Canadian product and has lower input costs, greater productivity, or a more favorable exchange rate, it can sell its product at a lower, more appealing price.

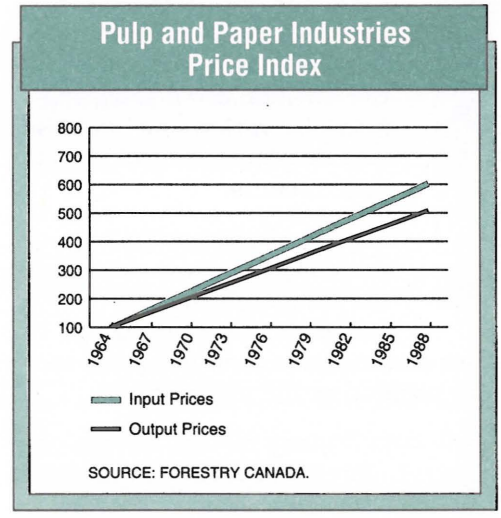
Historically, Canada's forest products industries have produced high-quality commodity products.

Canadian producers are most vulnerable to competition from countries with low production costs. These include developing countries with low-cost labour and fast-growing forests, technologically advanced countries with highly efficient manufacturing systems, and countries that actively manage their exchange rates for the short-term benefit of their exporting industries.

To minimize costs in the production of commodities, Canada must continually improve its manufacturing efficiency. This imperative is evident from the graphs below, which illustrate the trends in input and output prices in the lumber and pulp and paper industries.

Disregarding the normal fluctuations that occur over the business cycle, input prices (e.g., wage rates and energy prices) have historically risen at a faster rate than





product prices throughout the Canadian forest products sector, particularly in the lumber industry. Continuous growth in productivity is necessary to maintain profit margins. An alternative to an exclusive focus on productivity growth is to alter the sector's product mix to use less expensive inputs or produce more valuable products.

The Foreign Challenge

The United States purchases 68 percent of Canada's exports, followed by the European Community (15%) and Japan (9%). Sweden, Finland and the United States are the chief competitors in Canada's export markets.

Canada's natural endowments of abundant energy and wood supply, coupled with proximity to the U.S. market, have traditionally given this country a competitive edge. However, foreign competition, new technology, and the changing nature of Canada's timber resources are eroding these historical advantages.

Canada's wood supply, once considered almost boundless, is now reaching its economic limit because of high labour, transportation and harvesting costs. The economic supply of timber can be expanded through intensive forest management, changes in processing technology, and improved pest and fire control methods. However, the cost of further increasing the nation's wood supply cannot be borne by current product prices without increasing the manufacturing productivity.

In 1990 forest industries contributed $18.8 billion to Canada's balance of trade

The low-cost energy advantage of Canada has declined somewhat because of technological innovations by competitors. In response to high energy prices, Scandinavian countries have reduced the energy requirements of their production processes. For example, Finland and Sweden now have relatively low energy costs because they both recover energy in their production processes. In the USA, the energy produced by many pulp and paper mills is becoming an important source of revenue.

Improvements in communications and international transportation have increased the global reach of competitors who were previously confined to regional markets. For instance, Scandinavian producers are selling paper products to U.S. markets that were manufactured in Sweden from wood chips obtained in Chile.

Improvements in communications and international transportation have increased the global reach of competitors.

In response to these trends, Canada's forest products industries have become more cost conscious. The logging industry has reduced production costs through the mechanization of timber harvesting, and sawmills have increased the amount of usable wood recovered from each log. Although such efforts have improved Canada's short-term competitive position, their effects are not permanent. The Canadian lumber industry is under constant pressure from competitors who are improving their productivity, and from a variety of wood substitutes such as steel, aluminum, plastics and advanced composite materials.

Competitive pressure is also being felt by Canada's pulp and paper industries. Southern U.S. producers, with more modern mills, generally have lower wood fibre, labour, capital and transportation costs, and higher levels of productivity. In addition, Chile and Brazil have emerged as new competitors.

Taking these factors into consideration, a continued examination of Canada's strengths and a fine-tuning of its competitive strategies will be essential to maintain a prosperous forest sector.

Competitiveness and the Canadian Dollar

The Canadian dollar fluctuates in value relative to other currencies in response to a variety of economic factors. Exporters such as forest product industries have little influence over these fluctuations, and can only react to them by trying to limit their vulnerability. With the integration of global financial markets, all exporting and importing industries now face fluctuating exchange rates as a day-to-day aspect of doing business.

Any appreciation of the Canadian dollar relative to the U.S. dollar hurts exporters because it reduces their profits when they sell in the U.S. market.

Canada is now perceived by the international community as a low-inflation country and the Canadian dollar as a relatively hard currency.

In the short term, a high Canadian dollar reduces the cash flow and profitability of producers. If the dollar remains high for an extended period of time, the industries' long-term competitiveness will be diminished because they will be less able to invest new capital in equipment, research and development, and education and training.

The Canadian dollar appreciated by 24 percent from $0.71 US in January 1986 to $0.88 US in December 1991. To place this recent appreciation in perspective, three points should be considered:

- Although Canadian exporters were hurt by an appreciating Can$/US$ exchange rate between 1986 and 1991, they had been helped by a depreciating rate from 1976 to 1986.
- The recent appreciation is not high by international standards. For example, from January 1985 to December 1991, the Japanese yen and German mark appreciated by roughly 85 percent and 75 percent respectively, vis-à-vis the U.S. dollar. Canadian exporters have benefited in Asian and European markets from a depreciation of the Canadian dollar vis-à-vis the Japanese yen and major European currencies.
- The strength of the Canadian dollar increasingly reflects an expected rate of inflation that is lower in Canada than in the United States. As a result, Canadian exporters can expect the prices they pay for labour and raw materials to rise more slowly than would otherwise be the case. Canada is now perceived by the international community as a low-inflation country and the Canadian dollar as a relatively hard currency.

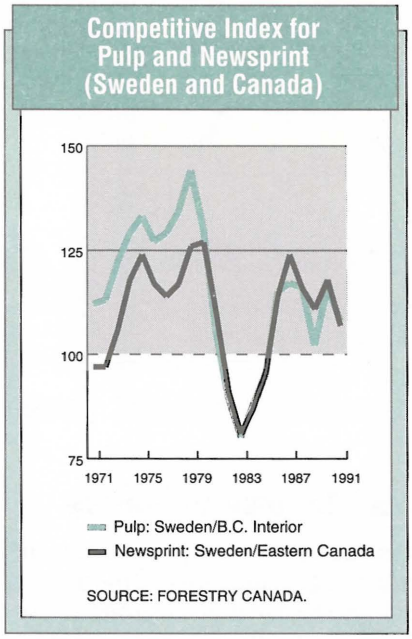
Although exchange rate fluctuations have significant short-term impacts on exporters, they often have a limited effect on aggregate economic activity over the longer term. This difference occurs because, over time, prices in the domestic and foreign countries adjust in response to changes in the exchange rate. The transitory impact of exchange rate fluctuations is evident from the Swedish experience presented on the following page.

Although exchange rate fluctuations have significant short-term impacts on exporters, they often have a limited effect over the longer term.

The Swedish Experience with Competitive Devaluations

In 1979 and 1980, Swedish pulp and newsprint producers were at a significant cost disadvantage compared with Canadian producers. This was largely due to the high prices of their inputs to production.

In response to this situation, the Swedish government allowed the krona (SKr) to depreciate sharply against the U.S. and Canadian dollars. The impact on relative costs was dramatic. In 1979, average Swedish pulp costs were almost 45 percent higher than average British Columbia Interior pulp costs. However, by 1983, Swedish costs were 20 percent lower than British Columbia costs. As a result, Canadian pulp products were pushed out of Europe, and Swedish exports made significant inroads into the U.S. market.



Manipulating the SKr/Can$ exchange rate was an effective competitive tool in the short term, but it had negative long-term economic consequences. The depreciation of the SKr was the start of a chain reaction, unleashing significant inflationary pressures on the Swedish economy, and causing SKr prices of fibre, energy and labour to increase. Following these increases and a subsequent appreciation of the SKr, average Swedish pulp costs increased to the point where, in 1990, they were back to being almost 16 percent higher than average production costs in the British Columbia Interior.

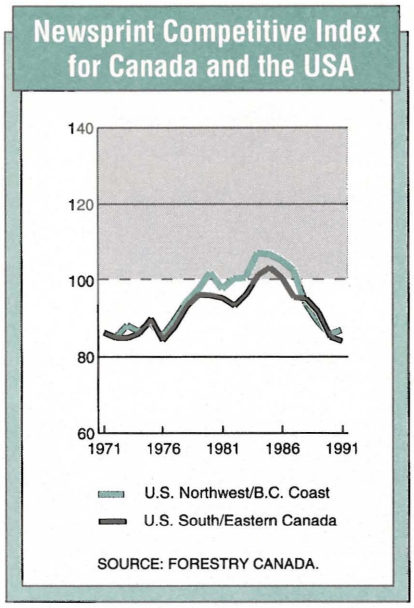
It is worth noting that the SKr was pegged to the European Currency Unit (ECU) in 1991; hence, future competitive devaluations by Sweden are unlikely.

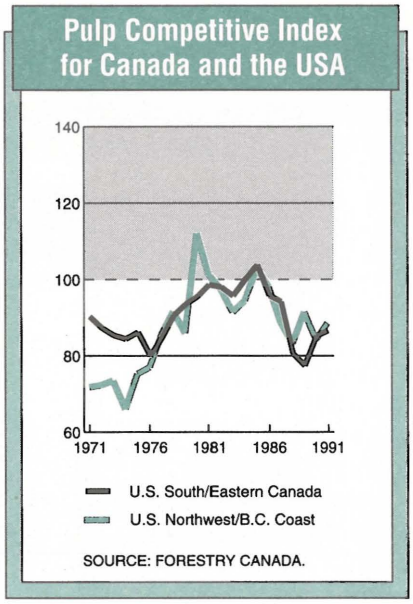
Measuring Competitiveness

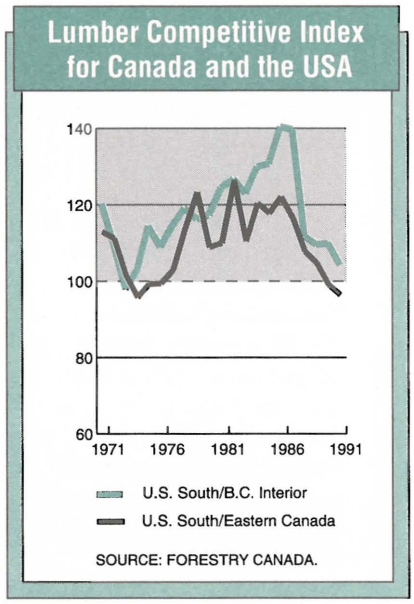
Given that the USA is Canada's most important export market and one of its major competitors, a useful index of Canada's ability to compete is the comparison of this country's production costs with those of the United States. This index reflects the changes that have occurred over time in relative input prices, productivity, and the Can$/US$ exchange rate. The graphs on the following page track the indexes from 1971 to 1991 for newsprint, kraft market pulp, and softwood lumber. These three products comprise most of the Canadian forest sector's total value of exports.

When the index is equal to 100, production costs are the same in both countries. If the index is greater than 100, average American costs are greater than average Canadian costs, and Canadian forest products are more competitive. When the index drops below 100, the situation is reversed and Canadian forest products are less cost competitive.

Although the competitive index focusses exclusively on relative costs, it should be noted that quality factors are also important. For example, lumber from the British Columbia coast is relatively costly, but it commands a premium in international markets because of its superior quality.







Canadian Lumber Products

In assessing the competitiveness of Canada's lumber industry, attention is focussed on the British Columbia Interior and eastern Canada producing regions. The lumber graph on this page shows that the cost competitiveness of these regions improved consistently from the mid-1970s to the mid-1980s. This improvement was primarily the result of a steady depreciation of the Canadian dollar against the U.S. dollar and greater gains in productivity in Canada relative to the United States.

Productivity gains were particularly impressive in the British Columbia Interior between 1981 and 1985. The introduction of highly automated sawmills was largely responsible for this achievement. These mills employed new technologies such as thin-kerf saws to reduce the amount of wood lost as sawdust, and microcomputer-controlled scanners to monitor log dimensions and set saw patterns.

By the late 1980s, the factors that had favoured the British Columbia Interior and eastern Canadian industries in the first half of the decade were less important. The fortunes of the Canadian lumber industry, under attack by protectionist elements in the USA, began to decline following a general deterioration in market conditions during the 1990-91 recession.

As indicated earlier, the Canadian dollar appreciated by almost 25 percent from 1986 to 1991. As well, stumpage charges and forest management costs increased substantially in the major producing regions.

Reduced production levels meant less efficient use of capital, equipment and labour, and higher overhead costs per unit of product. Although Canada's productivity growth slowed during this period, the productivity of one of its major competitors — the U.S. South — increased.

The decline in relative productivity growth, the increase in sawlog and forest management costs, and the appreciation of the Canadian dollar contributed to the drop in Canada's share of the U.S. market in the latter half of the 1980s. These events took place at a time of reduced activity in the overall global marketplace.

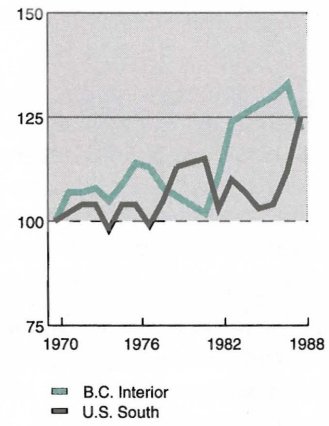
Total Factor Productivity in the North American Lumber Industry

Productivity is the efficiency with which an industry uses its inputs of labour, capital and raw materials to manufacture a product and deliver it to market. Greater productivity means greater prosperity.

Although there are many specific indicators of productivity, labour is usually emphasized in discussions about competitiveness. However, the productivity of an industry cannot be attributed to a single input. For example, higher labour productivity may be the result of investments in automated equipment, or increased skills in the labour force.

Total factor productivity is a more complete measure of productivity. The accompanying figure illustrates the growth in total factor productivity in the competing lumber industries of the U.S. South and the British Columbia Interior. The never-ending race to gain a productivity advantage over the competition is evident. The British Columbia Interior industry registered higher productivity growth in the first five years of the 1970s and 1980s, but it lagged behind the U.S. South industry in the second five years of those decades. Although the British Columbia Interior has tended to be the first to innovate and adopt new technologies, its competitors in the U.S. South have been quick to follow suit.

Lumber Industry Productivity (North America)



SOURCE: FORESTRY CANADA.

This scenario illustrates the vulnerability of Canada's lumber industry to external developments. Higher-cost or less-well-financed producers will continue to be at risk. However, the efficient segments of the Canadian lumber industry are well positioned to benefit from the expected economic recovery.

Canadian Newsprint and Pulp

In general, Canada's major lumber producing regions have modern and highly efficient machinery and equipment. This is less true in segments of the pulp and paper industries. The need to modernize equipment and eliminate inefficient mills — triggered by the downturn in markets throughout the industrialized economies in 1990-91, a shift toward recycled fibre in the U.S. market, and the strength of the Canadian dollar — has precipitated a restructuring of Canada's pulp and paper industries. This restructuring is still underway.

The relative cost position of Canadian newsprint producers has been steadily eroded since 1985. In 1990, it cost roughly 15 percent more on average to produce a tonne of newsprint in Canada than it did in the USA.

The cost disadvantage of Canada's newsprint and pulp industries is largely due to the age and small size of many of its mills relative to those of its competitors. In a comparison of Canada's newsprint mills and

machines with those of its major competitors, the following facts can be noted:

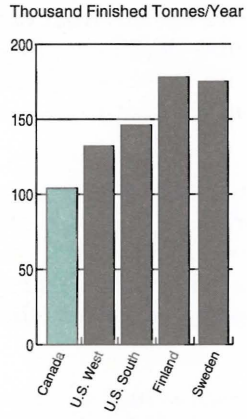
- The average Finnish mill has a 70 percent greater capacity than the average Canadian mill — a critical factor in an industry where economies of scale are important.
- Canadian mills employ more workers per finished tonne than U.S. and Scandinavian mills. This is largely due to the prevalence of labour-intensive stone groundwood mills and small newsprint machines.
- Canadian producers consume the highest volume of virgin wood fibre per finished tonne. Newsprint producers in the western USA have reduced their requirement for virgin fibre by using recycled fibre. Sweden has accomplished similar savings by using high-yielding mechanical pulps.
- Newsprint mills can be designed to recover and re-use steam energy, and Swedish mills recover twice as much steam as Canadian mills.

Notwithstanding the comments above, it should be noted that averages can be misleading because the range of mill sizes in Canada is much wider. In Scandinavia, many of the smaller and older machines were phased out of production in the 1970s. U.S. mills are also much newer than Canadian mills.

Although Canada's "average" newsprint machine is not highly efficient by international standards, each of the seven or eight recently installed machines are world-scale in size and have competitive wood and power costs.

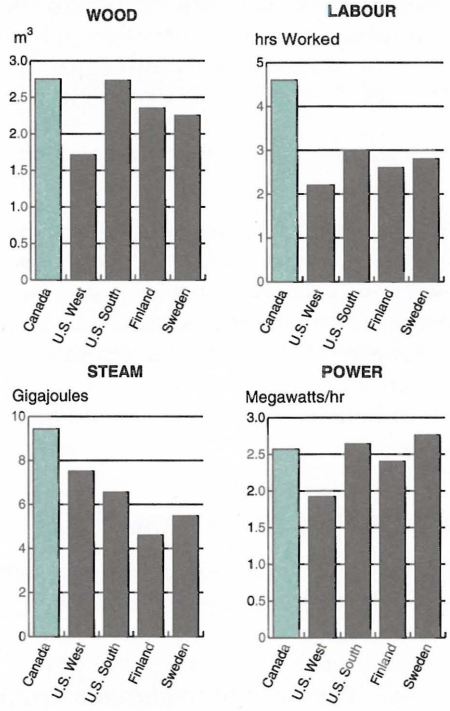
A comparison of Canada's pulp mills with those of its competitors tells a similar story. Restructuring is currently underway and will be difficult for some of the communities that are dependent on pulp and paper industries. However, the industries' current problems are correctable, and Canada

Average Capacity of Newsprint Machines (1990)



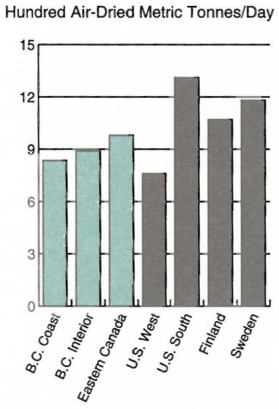
SOURCE: FOREST SECTOR ADVISORY COUNCIL NEWSPRINT COST STUDY.

Average Inputs for Newsprint Mills per Finished Tonne (1990)



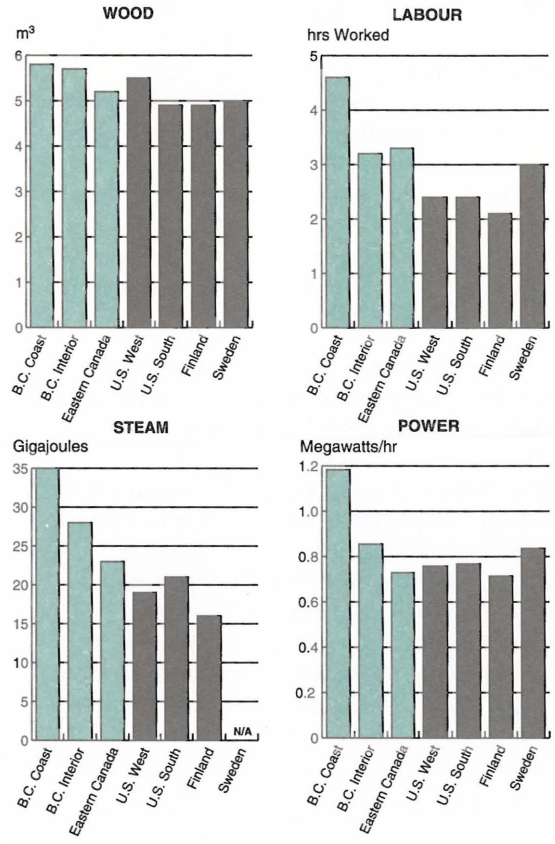
SOURCE: FOREST SECTOR ADVISORY COUNCIL NEWSPRINT COST STUDY.

Average Pulp Mill Capacity (1990)



SOURCE: FOREST SECTOR ADVISORY COUNCIL MARKET PULP STUDY.

Average Inputs for Pulp Mills by Air-Dried Metric Tonne (1990)



SOURCE: FOREST SECTOR ADVISORY COUNCIL MARKET PULP STUDY.

retains a number of important competitive advantages that are not enjoyed by the USA or Scandinavia. For example, pulp and paper production requires substantial amounts of energy, and Canada has relatively low energy prices.

Competitiveness and the Environment

Environmental quality is a major concern of the 1990s, and its influence at home and abroad is already affecting the direction being taken by Canada's forest industries. Consumers of Canadian forest products, particularly in Europe, increasingly favour products that contain some recycled materials and that have been manufactured by environmentally advanced technologies.

On the home front, Canadians aspire to strong social programs, a vibrant culture, a high standard of living, well-paying jobs, and a healthy environment. Attainment of these goals requires economic prosperity, and a sound forest sector will contribute significantly to this prosperity.

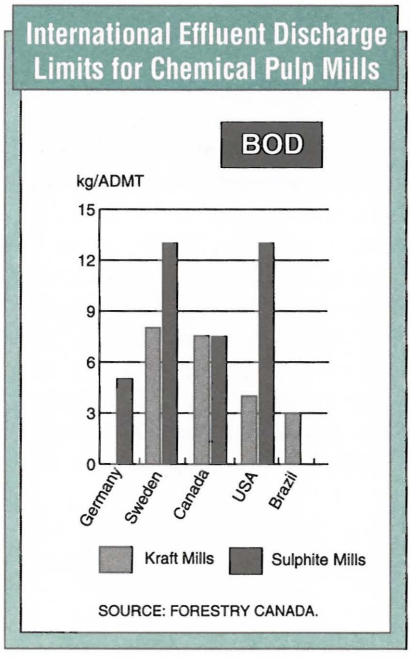
Environmental concerns affect competitiveness. In 1991, environmental projects accounted for $750 million or 27 percent of the total planned capital expenditures in the pulp and paper industries. This was a marked increase from 8 percent in 1989 and 16 percent in 1990. Most of the additional expenditures were directed at reducing dioxin emissions into waterways, installing secondary treatment facilities for mill effluent, and controlling the odor at kraft pulp mills. Roughly 75 percent of the expenditures targeted improvements in water quality.

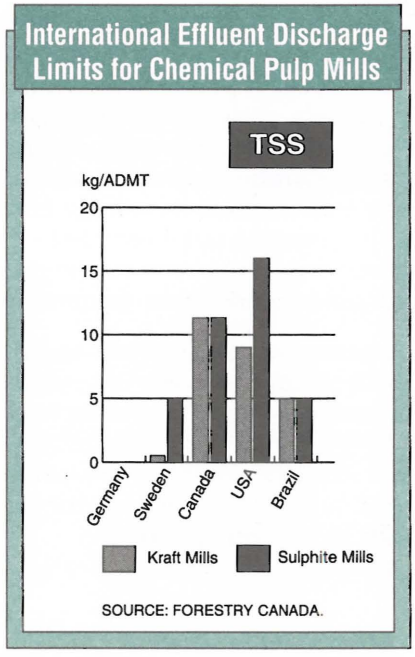
Canada's pulp and paper industries are currently devoting a significantly greater percentage of their total planned investment to pollution abatement than their U.S. competitors (25% versus 11% in 1991). The current difference in investment rates between Canada and the USA is partially reflective of Canada's older physical plants, but it also relates to the environmental regulations that were implemented in the United States during the 1970s. As new standards were adopted around the world, the USA was able to export its secondary treatment technology.

Many countries are in the process of establishing new environmental regulations for pulp and paper mills. The following graphs show current regulations for the levels of Biochemical Oxygen Demand (BOD) and Total Suspended Solids (TSS) in various countries, including the levels recently introduced in Canada. The majority of Canada's new regulations will come into effect in 1994. Canada's newer pulping facilities are able to exceed all current and most proposed regulations. (It should be noted that Germany does not control the levels of BOD and TSS at its kraft mills, and it measures TSS in parts per million at its sulphite mills. Brazil has no regulations for BOD at its sulphite mills.)

In certain markets, consumer action exceeds government regulations. For example, in 1991, consumers paid Canadian producers a $20 per tonne premium on pulp bleached with chlorine dioxide (as opposed to elemental chlorine), and chlorine-free pulp sold at prices $50 to $80 higher than the price of standard bleached northern softwood kraft pulp.

Another important environmental challenge facing pulp and newsprint industries is to reduce the volume of paper that ends up in landfill sites. In the USA, legislative proposals have been introduced in almost every state specifying a minimum recycled fibre content for newsprint. These bills herald significant changes for Canada's newsprint industry.





To maintain their share of U.S. markets, and to take advantage of the increased availability of domestic supplies that has resulted from the "Blue Box" program, Canadian newsprint manufacturers have invested heavily in equipment to remove ink from old newspaper — the first step in the recycling process. The number of de-inking mills in this country has risen from 1 in 1988 to 13 in 1991. A total of 16 mills are projected for 1993.

Because Canada's population is relatively small, the availability of old newspaper is limited. As a result, imports from the USA are required to augment the supply. This back-hauling and de-inking will increase production costs and present new competitive challenges for Canadian industries.

Indeed, for mills far from the U.S. market, recycling old newspaper may not be economical, and modified products or new markets may be required. As legislation on recycled newsprint is enacted in the USA, new newsprint mills are being built closer to urban centres, where the supply of old newspaper is greater.

The number of de-inking mills in Canada has risen from 1 in 1988 to 13 in 1991.

Over the past 3 years, the forest industry has invested more than $2 billion in pollution control.

Forestry Canada will complete an in-depth study of the implications of increased waste paper recycling in the North American pulp and paper industry in 1992.

Technology, Education and Competitiveness

To compete in their traditional commodity markets, Canada's forest industries will continue to

New Federal Regulations to Control Pulp Mill Pollution

In December 1991, following extensive consultations with provincial governments, pulp and paper industries, environmental groups, and the Canadian public, the federal government announced a pulp and paper regulatory package to achieve major improvements in water quality.

The new regulations require the industry to introduce changes to pulp and paper processing that will prevent the formation of dioxins and furans, greatly reduce organochlorine levels overall, and strictly control known pollutants in pulp mill effluent. Canada is the first country in the world to implement national regulations on dioxins and furans in pulp mill effluent.

Government and industry both recognize the benefits to the aquatic environment that will be realized from a reduction in pulp mill pollution. Federal standards provide a level playing field for the industry across the country. This means that Canada has a national standard in place to ensure the protection of the environment and to satisfy the preferences of consumers both at home and abroad.

improve the productivity of their manufacturing processes. Furthermore, to compete on the basis of product quality, new manufacturing processes, products, markets and distribution systems will need to be developed and refined. Technological innovation will be critical to both competitive goals.

Innovative technology can be created by a research and development program employing a core group of scientists and technicians. Successful implementation will require a significant investment to provide the work force with the skills needed to apply the new technologies.

Although forest industry education and training programs exist, many are underutilized. There are also some gaps in programming and obstacles to delivery. Basic literacy and a thorough grasp of mathematics are prerequisites to technology-specific training programs. In many cases, industry workers lack general educational qualifications.

A preliminary study prepared for Forestry Canada identified the operational workforce and middle management as having the greatest training needs. A coordinated approach to industry training by federal and provincial governments and by industry and labour groups was recommended.

Manufacturing

The need for retraining in forest products industries is, to a large extent, the result of rapid technological innovation.

The substantial increase in mechanical pulp capacity over the past decade has left pulp and paper industries short of mechanical pulping expertise. The industries lack an adequate supply of engineers with chemical and mechanical process-control expertise, who have the ability to link computer-controlled processes with mill-wide and company-wide systems.

Training and Educational Requirements of Forest Sector Employees

Requirements:	Operations Personnel	Middle Management	Senior Management
1. Higher Education and Training Standards	Substantive	Moderate	Minor
2. In-house Training and Continuing Education	Moderate	Moderate	Moderate
3. Fundamental Skills	Substantive	Minor	Minor
4. Knowledge Transfer	Moderate	Moderate	Moderate
5. Technology Awareness	Substantive	Minor	Moderate
6. Acquisition of Special Skills	Substantive	Moderate	Minor
7. Overall Education or Training Strategy	Substantive	Substantive	Substantive

Minor — Moderate — Substantive

SOURCE: FORESTRY CANADA (adapted from H.A. Simmons).

Major investments in mill effluent reduction, closed-system processing, and new bleaching systems have created a need for skilled professionals who can implement, operate and maintain these new technologies. Engineering and production expertise are also required to introduce recycling procedures.

The changing character of Canada's forest resources also requires new skills of its workforce.

The changing character of Canada's forest resources also requires new skills of its workforce. Increasing wood costs and the declining availability of large-sized logs place an emphasis on maximizing product recovery or upgrading the product mix. Sawmill automation and computerization can increase labour and wood productivity, but only if sawmill operators acquire a knowledge of these technologies and are experienced in their use.

New products will be required to counter the trend to substitute alternative building materials for wood products. In the future, more engineered and composite wood products will be manufactured in Canada. The research and development of new products will require the training and recruitment of masters- and doctorate-level employees. Even the adoption of new product technologies that originate elsewhere will require qualified technologists.

Major investments in mill effluent reduction, closed-system processing, and new bleaching systems have created a need for skilled professionals.

The Sawmill Training Program at the Maritime Forest Ranger School

A Canadian Success Story

The Sawmill Training Program at the Maritime Forest Ranger School in Fredericton, New Brunswick is a program of training and continuing education unique in North America. Started in 1988, the program is firmly supported by the industry because of the many benefits it provides to employers. The program updates skills, prepares employees for new positions, introduces companies and employees to new technologies, and serves as a research facility for specific problems.

Faculty members work closely with the industry so that specialized courses can be developed around industry-wide problems. Once a concern has been identified, the school locates qualified instructors from among equipment suppliers, teachers or industry members, and designs and markets the course to the industry.

Forest Management and Harvesting

The continued availability of timber will depend on the forest sector's ability to maintain and increase the productivity of Canada's commercial forests. Ongoing training in silviculture and forest protection is required, as is the development of skills to meet the challenges facing Canada in land-use planning and forest management.

As public values change regarding the forest, and as the demands on Canada's forest sector mount, forest managers and workers will take on new roles. Good communication skills will be paramount at all levels.

Given the public's growing interest in forest issues, forest managers will need to become more familiar with methods of accommodating the various economic, environmental and social demands made on Canada's forests. Training in consensus building and problem solving will be required.

In addition to a broadening of forestry education programs, increased specialization can be anticipated. More biologists, recreation planners and hydrologists will be needed, along with experts from allied fields like remote sensing, computer modeling and geographic information systems.

Technological innovations such as robotic harvesting systems are eliminating unskilled and semi-skilled jobs. Computer-based drafting and mapping systems, and the development of other forest management tools are having a similar impact. These are some of the specific and known changes that are already apparent in the sector. The challenge will be to orient Canada's education programs to respond to these emerging needs.

Competitiveness – Summary and Prognosis

- Although Canada's exports of forest products increased from 1970 to 1990, its share of world markets for forest products declined.
- The emphasis on commodity export markets has required Canadian companies to compete primarily on the basis of price and to focus on minimizing their production costs.
- The rate of growth in the cost of inputs (labour, capital, timber and energy) has exceeded the rate of growth in product prices since 1964. Closing this widening gap would constitute part of a successful response to the challenge of improving Canada's competitive position.
- The Canadian lumber industry has registered impressive productivity gains over the past 20 years, and U.S. producers have been quick to follow suit. However, the industry is well positioned to benefit from the anticipated economic recovery and will remain competitive within any open and fair market system.
- The need to modernize pulp and paper mills and equipment has been triggered by a downturn in markets throughout the industrialized economies in 1990-91, a shift toward recycled fibre in the U.S. market, and the relative strength of the Canadian dollar. The restructuring of Canadian pulp and paper industries is still underway.
- The relative strength of the Canadian dollar vis-à-vis the U.S. dollar since the mid-1980s has had a significant impact on the cost competitiveness of Canadian exporters in their major market.

- Canada's efforts to maintain a relatively low inflation rate will help the long-term cost competitiveness of Canadian exporters.
- Environmental quality is a major concern in the 1990s. Pulp and paper industries are devoting a particularly high proportion of their new investments to pollution abatement and the installation of de-inking facilities for handling waste paper. Such investments will better position Canada to compete in an international marketplace that increasingly places a premium on environmentally advanced products.
- Technological innovation is critical to the competitiveness of Canada's forest products industries. Education and training of forest sector workers, professionals and management staff are central to maintaining Canada's ability to compete.

The analysis presented in this chapter stresses some of the challenges faced by Canada's forest industries. These challenges are real, but so too are Canada's opportunities to improve its competitive position.

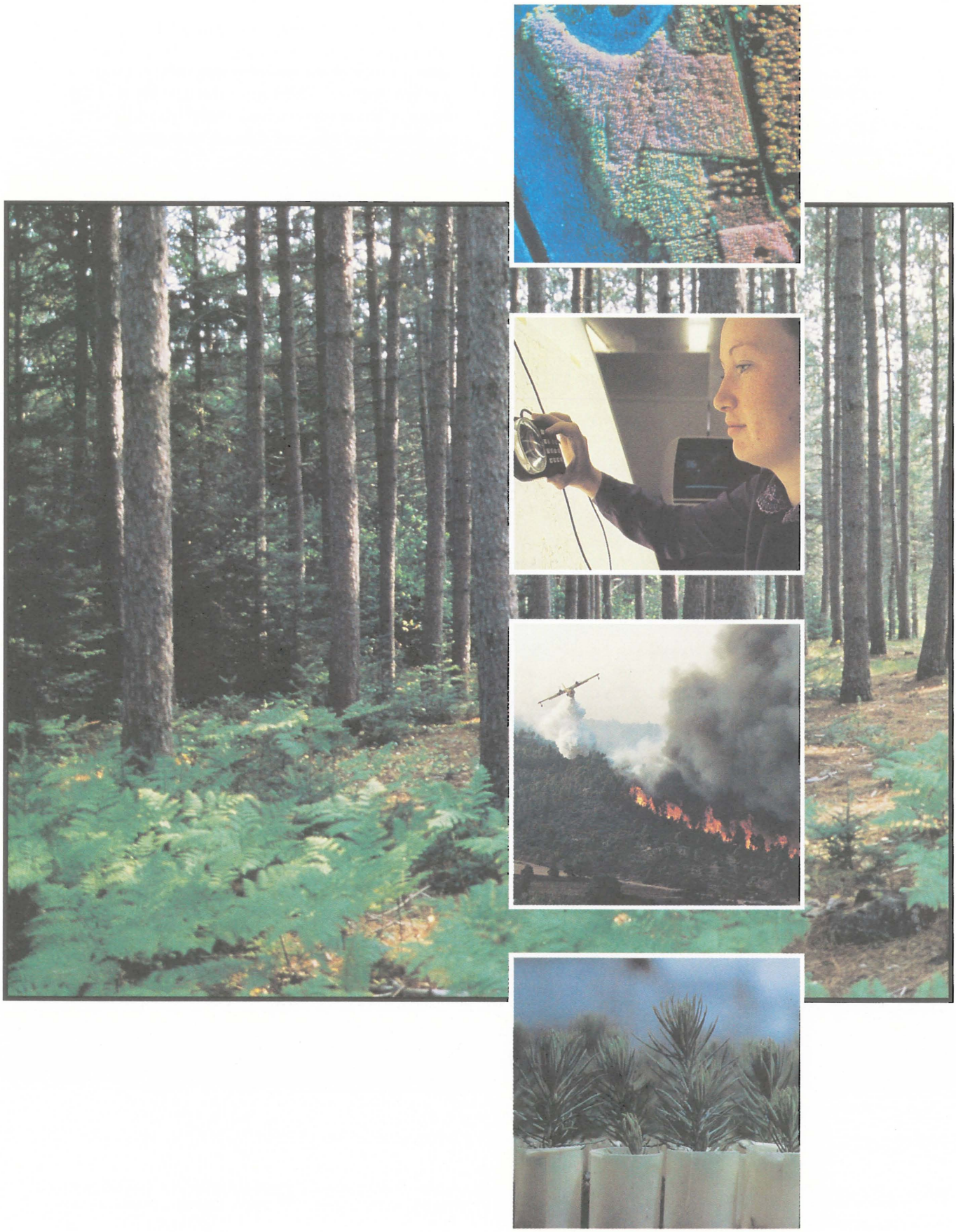
Canada's challenge is to build upon its strengths and achieve technological excellence through the continual upgrading of its physical and human capital.

The 1980s saw the longest economic expansion since the 1930s. This growth allowed the continued operation of older mills, while encouraging investment in new capacity.

The 1990-91 recessionary period has sharpened Canada's focus on the competitive quality of its existing manufacturing infrastructure. The forest industries should emerge from the current restructuring with renewed energy and a fresh competitive edge.

Canada continues to hold its comparative advantage in manufacturing forest products because of expertise, an abundant energy and water supply, high-quality wood fibre, and an efficient transportation and distribution system. Canada's challenge is to build upon these strengths and achieve technological excellence through the continual upgrading of its physical and human capital.

Chapter Four



Canadian Forestry Research

AN OVERVIEW OF R&D

Research plays a significant role in the wise use and management of forest lands. It can also contribute to growth in Canada's competitive position in such broad-ranging areas as forest renewal, product development, manufacturing and market identification.

This chapter provides an overview of forestry-related research in Canada. It is intended as an introduction to a planned feature chapter, which will explore the directions that science may take over the coming decade and will examine the potential priorities and achievements.

Research is essential to the long-term success of Canada's forest industries and the health and sustainable development of its forests.

The Nature of Canadian Forestry Research

Research plays a most important role in Canada's forest sector and is conducted in two major areas — forest management and harvesting, and forest products development.

Basic research in forest management increases the knowledge of the biological processes that shape Canada's forest ecosystems. Applied research draws on that knowledge to devise forest management and harvesting practices for the sustained use of Canada's forest resources.

Basic research in forest products development leads to an understanding of the chemical and physical properties of wood. This knowledge allows researchers to develop new and improved products and processes.

By helping solve the environmental problems of the forest industry, research can also increase the acceptance of Canada's forest products by environmentally aware consumers in both domestic and international markets.

A third, and currently much smaller area of research focusses on forest equipment development, which involves the adaptation and application of equipment to the harvesting and management of Canada's forests and to manufacturing processes and technology within the forest industries.

Research Agencies

In Canada, forestry research is carried out by federal and provincial governments, universities, forest companies, and privately and cooperatively funded institutions.

The federal Department of Forestry plays a major role in Canadian forest management research. Operating across Canada in six regional forestry centres, two national forestry institutes, and seven regional sub-offices, Forestry Canada carries out short- and long-term, basic and applied research.

The focus of federal forestry research is to increase the productivity and competitiveness of the Canadian forest sector and to maintain the environmental integrity of the resource base. Forest management, protection and environmental quality are continuing priorities.

*In 1989 Canada spent **$356 million** on forestry R&D.*

Other federal agencies and departments, such as the National Research Council, Environment Canada, Agriculture Canada, and Energy, Mines and Resources Canada, also make significant contributions in their respective areas to the federal research effort in fields linked to forestry.

Applied forest management research is a major focus of three provincial governments. Studies on the development of improved planting technology, biotechnology, pest control, ecological classification, and geographic information systems are carried out by forestry research branches in Ontario, Quebec, and British Columbia. Some other provinces contract out projects as required. Several provinces also provide research extension services to small-scale private woodlot owners and the general public.

More broadly based provincial research agencies, such as the Science Council of British Columbia, the Alberta Research Council, the Centre de recherche industrielle du Québec (CRIQ), the Ontario Research Foundation, the New Brunswick Research and Productivity Council, and the Nova Scotia Research Foundation, undertake specialized research into forest management and forest products.

Seven Canadian universities conduct basic and applied research, and six of them maintain graduate programs to train research scientists through their faculties of forestry. In each of the past three years, roughly 430 students have been enrolled in graduate studies. Canadian universities without forestry faculties also make recognized contributions to forestry research in areas ranging from agro-forestry to wood chemistry and the physiology of conifer reproduction. Another 400 graduates are trained each year in forestry-related research programs outside forestry faculties.

Better Information = Better Decisions

Canadian research into computer technologies improves the quality of information available to forestry decision-makers.

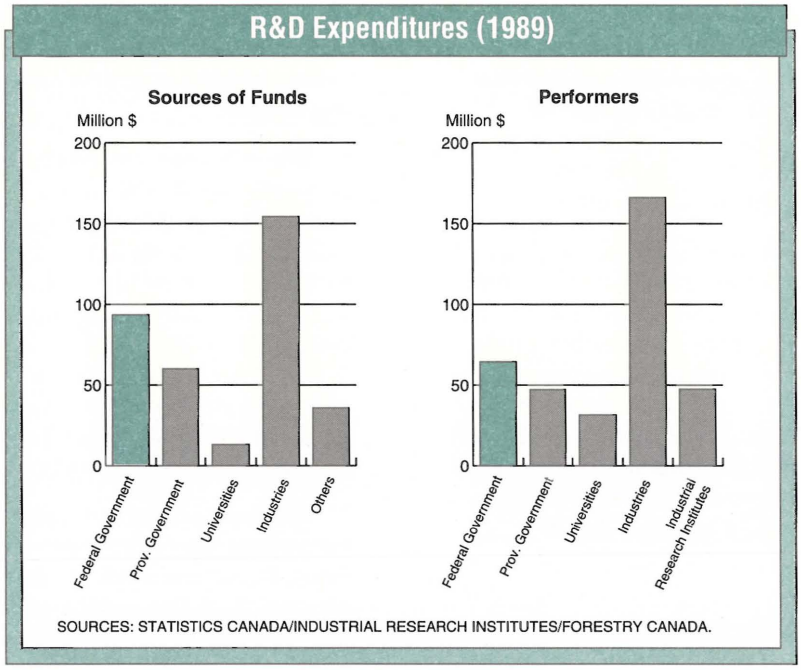
Canada's Multispectral Electro-Optical Imaging Scanner for Forestry and Mapping (MEIS-F/M) provides detailed digital imagery of ground and forest conditions for a broad range of applications, ranging from forest inventories to forest protection. The MEIS-F/M is just one of the powerful tools available to forest planners and managers in this country.

Over the past three years, the support for university research in forestry has been strengthened by the development of the first forestry mission statement by the Natural Sciences and Engineering Research Council (NSERC). This statement sets forth research priorities and terms of reference for strategic grant proposals and provides a clear framework for results-oriented research. NSERC and Forestry Canada have also established a partnership program to provide university research with increased resources from industry and the federal government.

In the area of wood harvesting and mechanized silviculture, research and development are carried out by the Forest Engineering Research Institute of Canada (FERIC).

Forest products research is undertaken by two cooperatively funded industrial research corporations: the Pulp and Paper Research Institute of Canada (PAPRICAN), which specializes in pulp- and paper-related research; and Forintek Canada Corporation, which specializes in solid wood products development.

In the private sector, two companies with substantial private forest land holdings (MacMillan Bloedel Limited and J.D. Irving Ltd.) support their own forest management research programs. The major Canadian companies carrying out forest products research are MacMillan Bloedel Limited, Canadian Forest Products Limited, Abitibi-Price Inc., Stone Consolidated, Domtar Inc., and Noranda Forest Products Limited.



The 1989 R&D expenditures by the Canadian forestry research community are featured above. These expenditures helped support numerous research projects. Some notable success stories are profiled throughout this chapter.

The information on overall forestry R&D expenditures does not include data from several of the non-traditional disciplines and institutions that have recently initiated forestry programs, particularly in the environmental sciences. It also does not include the emerging investment in processing, product development and environmental technologies that is being fostered in the private sector by agencies such as the Atlantic Canada Opportunities Agency (ACOA) or the Department of Western Economic Diversification (WD). This information will be included in future updates. Forestry Canada is now in the process of establishing a more complete national database on forestry research that will include information on researchers, sources and levels of funding, and topics and locations of studies.

Canada's Research Opportunities

Forest Management Research

The widespread public ownership of Canada's forest land has shaped forest management research by influencing the participants, level of funding, and priorities.

It is only recently that forest companies have had direct responsibility for forest management. In the past, they had little economic incentive to invest in research involving the growing of timber or the enhancement of forest values. Government, as the principal landowner, traditionally made the research investment and determined the research priorities.

The policy changes that have been implemented across Canada since 1987 have transferred greater management responsibilities to industry tenure holders. These policy changes are now emerging in the form of increased demands for forestry research.

Because of Canada's abundance of mature timber, early research efforts focussed mainly on protection against fire and pests, and on the regeneration of cutover forest lands. These topics remain priorities, but the nature and breadth of research have changed substantially.

Public concerns about Canada's forests have precipitated a new research philosophy that focusses on managing forests as ecosystems and combines a number of disciplines. In an ever-increasing number of research programs, scientists are investigating the environmental implications of forest management practices, and their impact on non-timber resources and the sustainable development of all of Canada's forest resources.

Forest Products Research

Historically, forest products research in Canada centred around products and processing. Canadian industries were based primarily on the production of commodity products like lumber, newsprint and market pulp. Research efforts therefore focussed on developing the knowledge and technology required to produce a quality product while minimizing production costs and maximizing output.

Today's research is changing in two respects. While Canada is maintaining its research thrust toward quality products and efficient processing, other efforts are now focussed on new and value-added products and on the environmental aspects of processing activities and consumer products. The research into new and value-added products seeks to move Canadian producers upscale in terms of market niches and the market value of products.

Environmental research is being driven by regulatory reform and consumer preference. Regulatory reform has spurred an effort to find the means of reducing the dependency on chemicals. At the same time, consumer preference is the driving force behind research into more environmentally benign products and products produced from recycled materials.

New Processes

The development of the ALCELL process, a new alcohol-based wood pulping process, is enabling Canada to produce a high-quality pulp from hardwoods for use in the commercial production of papers. This process is the outcome of a $70 million R&D ALCELL prototype plant built in 1988 by Repap Enterprises Inc. in Newcastle, New Brunswick.

The ALCELL process promises far-superior environmental performance compared to conventional chemical wood pulping. It also has the advantage of producing marketable chemical by-products. The process offers new opportunities in alternative wood pulping technology and could be applied in the retrofit or expansion of existing chemical pulp mills.

Canadian Expertise

Canada's achievements in forest fire research have gained international recognition and made a significant contribution to national efforts to reduce the risk of forest fires. Of particular interest are the Canadian Forest Fire Danger Rating System (CFFDRS) and the Fire Management Systems Project.

The primary purpose of the CFFDRS is to enable forest fire managers to judge the resources required to combat a fire and to determine what resources are available. All fire management agencies in Canada use the current system. Several other countries, including New Zealand, Yugoslavia and China, have adapted it to meet their specific needs.

The Fire Management Systems Project employs computer technology and fire control models to integrate information on weather, access routes and fire behaviour. This helps simplify decision-making with regard to the deployment of equipment and personnel.

Canada's forest sector depends on research to meet the challenges posed by a changing resource, increasing competition, and environmental concerns.

Forest Equipment Research

During the past two decades, Canada has had little involvement in forest equipment research. Nevertheless, by building on the successful development of mechanized harvesting equipment in the 1960s, new opportunities could be created for equipment manufacturing in Canada's wood products and pulp and paper industries. The mechanization of silviculture and the continued improvement of pulping technologies are just two possibilities.

Application of Research

The knowledge gained through research and the technology developed as a result are effective only if put to use. This process, frequently referred to as "technology transfer," includes both the acquisition and dissemination of technology.

Much of the technology required by the forest sector is available from Canadian sources, but a significant portion must also be sought outside Canada.

All science- and technology-based federal departments or agencies are engaged in technology transfer through partnerships or alliances with outside organizations. These programs actively promote the transfer of technology to the private sector by giving firms access to the pool of expertise existing in Crown agencies, and by allowing them to obtain intellectual property (such as expertise or patents) resulting from successful technology development.

The future will see an increase in patents from forestry research programs, particularly in the fields of information systems and biotechnology. One example of a new patent is the invention entitled "Portable Luminous Insect Trap". The trademark product LUMINOC™ will soon be licensed for commercialization.

The success of any R&D program can be measured by how well the resulting technology is used.

Companies that develop innovative technology can derive commercial benefit by transferring the technology to their subsidiaries, or by selling it in the form of licences or consulting expertise. In addition, a company with in-house expertise will be better equipped to evaluate foreign research and its potential.

The success of any R&D program can be measured by how well the resulting technology is used. In this context, skilled and highly trained professionals are essential. Education and training are discussed more fully in Chapter 3.

Optimizing Canadian Research

Research funding is always an issue, and there is concern about the level of funding and its impact on the continuity, amount and direction of research. Because forestry research is often long-term in nature, it is vulnerable to cyclical swings in funding.

To maximize the impact of forestry research dollars, and to mobilize Canadian talent and focus it on national concerns, a number of cooperative initiatives are being supported. Partnerships, networks and collaborative ventures among governments, universities, forest companies, environmental groups, and other research agencies are a few of the mechanisms being used. Steps are also being taken to improve the overall coordination and focus of the national forestry research effort.

Partnerships

Through the Green Plan's Partners for Sustainable Development of Forests Program, the federal government is accelerating forestry research in government, the private sector and universities. The program includes supporting the establishment of a network of model forests to test and demonstrate holistic forest management, an enhanced research program that focusses on forest resource management for all values, and an expanded data-gathering and bio-monitoring network to improve forest resource decision-making.

Among the program priorities are research into decision-support systems, integrated pest management, forestry practices, forest fire management, bioenergy, and environmentally acceptable forest products and processes. The establishment of a national forestry database, ecological reserves, and a national seed and gene bank are also priorities, as is the development of an ecological land classification system.

World Leader in Forest Biotechnology

Canadian scientists have developed tissue culture techniques that enable them to grow clones of genetically identical conifer trees. The ultimate goal is to improve the genetic stock of Canada's slow-growing forests by using better, faster-growing trees in regeneration programs.

New Products

B.C. Chemicals Ltd. of Prince George, British Columbia, and Arbokem Inc. of Vancouver are Canadian leaders in the research and development of new forest-based chemical products. In 1990, their efforts resulted in the construction of a state-of-the-art tall oil up-grading plant in Prince George.

In addition to the traditional uses for tall oil and its many chemical components, the up-grading facility has introduced novel research and development activities involving new and exciting applications. They include road stabilization chemicals, asphalt rejuvenators, non-CFC-based solvents, insect anti-feedants, pharmaceutical steroids, and diesel fuel additives. Several research findings have already resulted in new exports to the Asia-Pacific region.

Networks of Centres of Excellence

As part of the federally sponsored Networks of Centres of Excellence Program, two centres have been established that promote basic and applied forestry research in coordinated, multi-year programs across the country. The Centre of Biotechnology for Insect Pest Management will work to integrate forest management research efforts, and the Centre of Science and Engineering for High-Value Papers from Mechanical Wood Pulps will work to integrate forest products research efforts. Representatives from industry, universities and both levels of government are participating in these initiatives.

National Coordination

The Forestry Research Advisory Council of Canada (FRACC) was established in 1983, and advises the federal Minister of Forestry on research priorities and policies at the national level. Its terms of reference were expanded in 1987 to include the preparation of an annual national overview of research priorities and concerns for the Canadian Council of Forest Ministers. As part of this effort, FRACC has identified five priority research areas for Canada: managing the forest as an integrated ecosystem, renewing the forest, protecting the forest, producing improved products from the "new" forest, and improving technology transfer.

Forestry research priorities and resource allocations have shifted dramatically in the past five years.

In addition, senior managers at each of the federal forestry establishments receive advice on research priorities from multi-agency advisory committees. These advisory committees provide input to FRACC as part of the national priority-setting process. Major institutions such as PAPRICAN, Forintek and FERIC have strong advisory mechanisms in place, with committee members from other research and client organizations.

Other coordinating mechanisms are also in place to assist in setting research policies and priorities at national and international levels. This is required when dealing with broad topics such as climate change, energy or acid rain.

The International Energy Agency (IEA) Bioenergy Agreement coordinates research and co-ventures among its 15 member countries. Canada has played a strong role in this agreement since its establishment in 1978; for example, it has led research into the use of forest biomass to offset the need for fossil fuels.

In recent years people have caused 60% of all forest fires in Canada.

At the national level, federal energy R&D activities, including bioenergy, are coordinated and funded through an interdepartmental Panel on Energy R&D (PERD). Funds provided by PERD for forest bioenergy research are managed by Forestry Canada through the Energy from the Forest Program (ENFOR), which involves a wide range of government, university and industrial agencies in its delivery.

In addition to the various coordinating mechanisms, there are nationally appointed committees that make recommendations pertinent to specific fields of forestry research. In November 1991, for example, the National Biotechnology Advisory Committee issued its annual report through the Minister for Science. The report identified significant market opportunities in areas where Canada has strengths in biotechnology, and recommended strategies for developing industrial capabilities to realize these opportunities. The areas include waste management, forestry, food, agriculture and bio-pharmaceuticals. A number of far-reaching recommendations were made for the forest sector; they involve forest management and the biological treatment of industrial waste water in the pulp and paper sector.

Forestry research priorities and resource allocations have shifted dramatically in the past five years in response to advice and input obtained from national and international experts. Furthermore, the number and type of agencies involved in forestry research have increased.

Research For Tomorrow

With the new imperative of sustainable development at local, national and international levels, the demands on scientists and science managers have become global in nature. The BOREAS study in the Boreal forest is one example of international cooperation.

The use of highly skilled teams operating cooperatively from geographically dispersed centres provides a new dimension to today's research. The Centres of Excellence initiatives promoted by NSERC, and national research initiatives like the Long Range Transport of Air Pollutants (LRTAP) program are examples of such activities.

Forestry research is assuming global dimensions.

New approaches in forest science will yield opportunities to develop products that are traditionally outside the domain of forestry. In fields like forest biotechnology, while seeking a new biological control for budworm, scientists have made discoveries that could have considerable impact on medicine and veterinary science. Such spin-off benefits may increase as Canada adds to its knowledge of forest ecosystems and organisms. Canada's skill in handling large quantities of geographic and biological data will permit novel applications of remote sensing and geographic information systems in resource management.

In the area of forest products development and processing, focussed research will be necessary to maintain Canada's cost competitiveness, develop new products, and exploit new markets for value-added and specialty products. Canada's research effort will also continue to deal with environmental issues and concerns.

BOREAS

(Boreal Ecosystem Atmosphere Study)

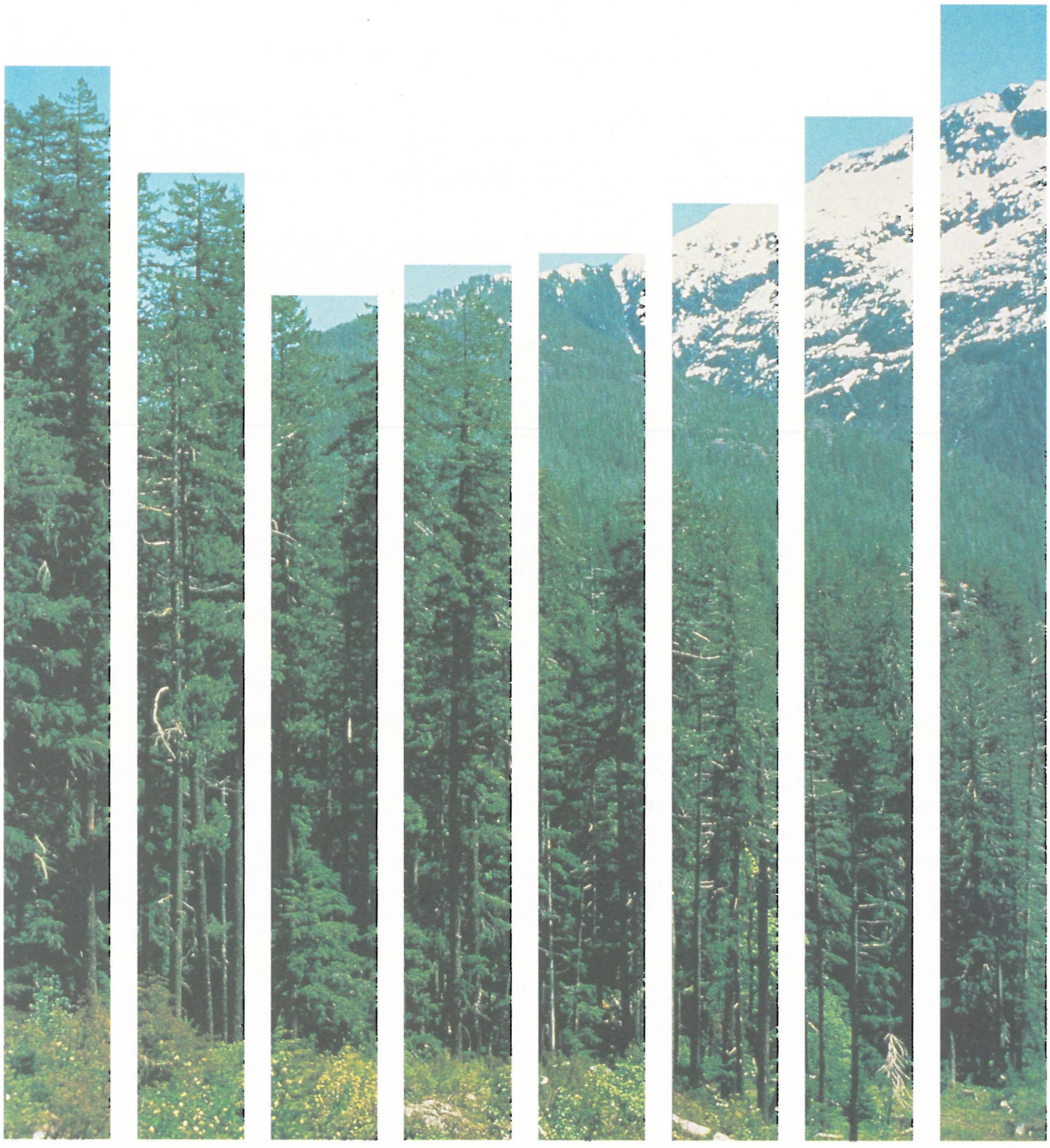
- This is a major international study to understand the interaction between the Boreal forest and the atmosphere, and to better understand global change.
- The Boreal forest is a major circumpolar ecosystem believed to have an important role in ecosystem atmosphere dynamics.
- This cooperative study will involve Canadian departments and agencies (Forestry Canada, Canada Centre for Remote Sensing, the Atmospheric Environment Service and the Natural Sciences and Engineering Research Council) as well as U.S. organizations (the National Aeronautics and Space Administration, the National Oceanic and Atmospheric Administration, the Environmental Protection Agency and the National Science Foundation).
- Over 100 scientists will be involved in BOREAS at the peak of activity in 1994; the field campaign will involve surface, airborne and satellite technologies on sites in Saskatchewan and Manitoba.
- The scientists will undertake research in three areas. They will conduct a study of the plant communities in the Boreal forest and the controls on growth and productivity. They will establish what types of gases are taken up and given off by the Boreal forest, and they will determine how the forest interacts with and controls climate.

Research in equipment development will contribute to competitive advantages through the design of new equipment. Furthermore, it will enable Canada to use and modify technologies designed for other conditions. In the areas of processing and product and equipment R&D, the level of collaboration and networking, both nationally and internationally, will be a major factor in determining the success of efforts.

This chapter has provided an introduction to forestry research in Canada, focussing on current research, some of the major agencies, and the existing policy framework. A future report will examine the ways in which research may influence activities in the forest sector by the end of this decade.

Focussed research will be necessary to maintain Canada's cost competitiveness, develop new products, and exploit new markets for value-added and specialty products.

Chapter Five



PERFORMANCE INDICATORS

This chapter summarizes the key factors involved in measuring Canada's forest resources and forest industries, and provides a 10-year perspective for some important performance indicators.

Many of the indicators are presented in an accounting format and note year-to-year changes. The tables and charts illustrate the trends and changes over time. Together, they show the evolution of Canada's forests and forest industries, and the improvements in forest management practices.

The various tables may contain data from different time periods and sources; the reader is therefore cautioned against making direct comparisons between tables. To assist in interpreting the information, brief introductions or explanatory notes accompany each table and graph. All economic values are given in current dollars.

Although much progress has been made in developing a national forestry database, in some cases, only estimates based on the best available data can be provided. The improvement of a national forestry database remains a high priority of the Canadian Council of Forest Ministers.

HIGHLIGHTS OF THE NATIONAL ACCOUNT

	1989	1988	% Change One Year	Annual % Change Ten Years
Total Area Harvested (million ha)	1.02	1.09	– 6.4	+ 2.5
Volume Harvested (million m^3)	191.4	190.3	+ 0.6	+ 2.2
Value of Shipments (billion $)	50.4	49.04	+ 2.7	+ 8.4
Direct Jobs per Thousand m^3 Harvested	1.82	1.78	+ 2.2	– 2.3
Value of Shipments per Job (thousand $)	144.8	144.7	+ 0.1	+ 8.6
Value of Shipments per m^3 Harvested ($/$m^3$)	263.2	257.7	+ 2.1	+ 6.2
R&D Expenditures as a Percentage of Sales	0.6	0.6	—	not available

	1990	1989	% Change One Year	Annual % Change Ten Years
Balance of Trade (billion $)	18.8	19.5	– 3.4	+ 6.6

	1991	1990	% Change One Year	Annual % Change Ten Years
De-inking Capacity (thousand tonnes)	790	240	+ 229.2	not available
Total Direct Employment (thousands)	299	320	– 6.6	– 1.0

Sources: Statistics Canada/Forestry Canada.

A National Forest Account

The National Forest Account presents an overview of broad changes in the composition of the commercial forest, with some reference to the reasons for the changes. It is intended to be indicative of the nature and magnitude of change, but should not be viewed as definitive.

Every five years, as new inventories become available, the account will be updated and recalibrated to reflect changes in the factors affecting the forest that cannot be dealt with on an annual basis. Thus, the periodic five-year reports will be somewhat more authoritative than the annual reports as a measure of change in the forest estate. The next national forest inventory is due in 1992, and the results of that inventory will be incorporated into the 1992 report on the state of Canada's forests.

In 1991, more than 1 billion seedlings were established in Canada.

Last year's report provided a first assessment of the changes that had occurred in the timber-productive forests of Canada over a 10-year period, between 1976 and 1986. This second annual "statement of account" shows the timber-productive forest in 1986 and the changes that occurred between that year and 1989.

A three-year National Forest Account contains certain limitations that should be brought to the reader's attention. Given the short time frame of the Account and the lengthy growth cycle of a tree, some of the forest areas that were disturbed between 1986 and 1989 have not yet demonstrated measurable levels of regeneration. Furthermore, all of the areas known to be disturbed have not yet been surveyed to determine the extent of the disturbance or the degree of subsequent regeneration. In other areas that were surveyed, the majority of tree species were considered undesirable for commercial operations. For the purposes of this National Forest Account, all of these areas have been included under the heading "non-stocked total".

Volume

The total increase in Canada's growing stock of 827 million cubic metres between 1986 and 1989 was 47 percent greater than the total harvest level of 564 million cubic metres. However, losses from fire and pests during the same period were heavy, totalling 651 million cubic metres, contributing to a total depletion of 1.2 billion cubic metres.

Area

The area harvested between 1986 and 1989 totalled 2.8 million hectares and this was offset by 3.7 million hectares of natural regeneration, planting and seeding. Unfortunately, major forest fires during this period and losses to pests totalled 6.2 million hectares resulting in a net increase in non-stocked land of 5.3 million hectares.

Conclusions

Incremental growth in the forest volume between 1986 and 1989 was approximately 47 percent greater than the harvesting level. Natural regeneration, planting and seeding exceeded the area harvested by 900 000 hectares. Unusually high losses to fire and pests during this same period negatively influenced the stock in the commercial forests resulting in a depletion of the forest volume and an increase in non-stocked forest land.

NATIONAL FOREST ACCOUNT

	Area (million ha)	Volume (million m³)
TIMBER-PRODUCTIVE FOREST – 1986		
Regeneration	28.2	353
Immature	85.9	6 730
Mature, Overmature and Uneven-Aged	103.5	17 547
STOCKED TOTAL	217.6	24 630
NON-STOCKED TOTAL	15.5	—
TOTAL	**233.1**	—
TIMBER-PRODUCTIVE FOREST – 1989		
Regeneration	27.5	391
Immature	80.7	6 309
Mature, Overmature and Uneven-Aged	104.1	17 542
STOCKED TOTAL	212.3	24 242
NON-STOCKED TOTAL	20.8	—
TOTAL	**233.1**	—
CHANGES – 1986-1989		
DEPLETIONS		
Harvest	2.8	564
Fire	4.8	460
Pests	1.4	191
TOTAL DEPLETIONS	**9.0**	**1 215**
ADDITIONS		
Natural Regeneration	2.4	20
Planting and Seeding	1.3	74
Growth in Standing Forest	—	733
TOTAL ADDITIONS	**3.7**	**827**

Source: Preliminary estimates from Forestry Canada.

HIGHLIGHTS

- The National Forest Account provides a general indication of the changes that took place in Canada's commercial forests over a three-year period (1986-1989).

- In this Account, the term "non-stocked total" includes recently disturbed areas that have not had time to regenerate, areas where the extent of the disturbance has not yet been determined, and areas stocked with commercially undesirable species.

- Between 1986 and 1989, the total increase in growing stock was approximately 47 percent greater than the total volume harvested.

- During the same period, significant losses were reported from forest fires.

- The total depletions in Canada's timber-productive forest land were 1.2 billion cubic metres.

- Regeneration through natural means, planting and seeding exceeded the area harvested by 900 000 hectares.

- Major fires and losses to pests contributed to a net increase of 5.3 million hectares in Canada's non-stocked forest land.

Forest Management

The Forest Management Expenditures Account records expenditure levels for 1988 and 1989, as well as the annual percentage change within the year and over a 10-year period.

During the first round of forest resource development agreements, the federal and provincial governments spent more than $1.1 billion on forest management and related activities throughout Canada. More than 50 percent of the funds were allocated to regeneration activities. Under federal and cost-shared initiatives, 1.8 billion seedlings were planted between 1984 and 1991.

A second round of agreements, valued at more than $600 million, have been signed with the provinces. In this new generation of federal-provincial forestry agreements, the emphasis is placed on integrated resource management, and research and development in such areas as growth and yield, genetics and biotechnology.

During the past decade, the federal and provincial governments have funded forest management programs to increase the sustainability of Canada's forests and maintain the sector's contribution to the economy. More of the responsibility for regenerating and managing forests has been assigned to the industries harvesting these forest lands. Forest management expenditures by Canada's forest industries increased by 41 percent between 1988 and 1989.

In total, more than $2.2 billion were spent on forest management activities in Canada in 1989, an increase of 10 percent over 1988.

Forest Management Expenditures[a]

(million $)

	1989	1988	% Change One Year	Annual % Change Ten Years
Silviculture				
Provincial	483.0	464.8	+ 3.9	+ 15.3
Federal	88.0	105.6	- 16.7	+ 12.6
Industry	113.1	100.3	+ 12.8	+ 17.8
Total	**684.1**	**670.6**	**+ 2.0**	**+ 15.2**
Forest Protection				
Provincial	399.2	373.5	+ 6.9	+ 12.2
Federal	1.4	2.0	- 30.0	- 6.5
Industry	45.6	35.7	+ 27.7	+ 8.1
Total	**446.3**	**411.1**	**+ 8.6**	**+ 10.9**
Resource Access[b]				
Provincial	55.8	101.5	- 45.0	- 2.0
Federal	2.8	3.5	- 20.0	- 6.4
Industry	295.8	180.6	+ 63.8	+ 4.4
Total	**354.5**	**285.6**	**+ 24.1**	**+ 2.3**
Other Activities[c]				
Provincial	386.9	370.5	+ 4.4	+ 8.5
Federal	124.8	114.9	+ 8.6	+ 10.5
Industry	203.6	148.4	+ 37.2	+ 17.1
Total	**715.2**	**633.9**	**+ 12.8**	**+ 10.7**
TOTAL FOREST MANAGEMENT EXPENDITURES				
Provincial	1 324.9	1 310.3	+ 1.1	+ 10.6
Federal	217.0	226.0	- 4.0	+ 7.7
Industry	658.1	465.0	+ 41.5	+ 9.0
TOTAL	**2 200.0**	**2 001.3**	**+ 9.9**	**+ 9.8**

[a] Figures have been rounded off and may not add up to totals.
[b] Resource access includes expenditures for permanent roads, bridges and other supporting infrastructure.
[c] Other activities include forest management research, inventory, timber management, and administration.

Sources: Canadian Pulp and Paper Association/Forestry Canada.

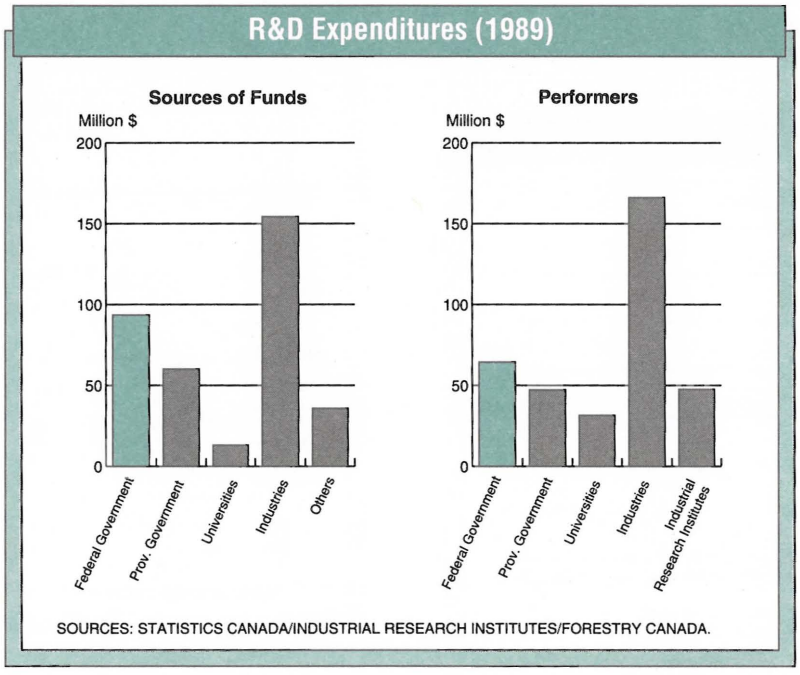
Research and Development Expenditures Account

The R&D Expenditures Account records the total contribution to R&D in forestry in 1989. Estimated expenditures are presented based on the source of funds (the total commitment for each reporting agency) and the performers (the total expenditures for work carried out within the reporting agencies).

In 1989, total research expenditures by the forest sector amounted to $356.8 million, an overall increase of 1.8 percent from the previous year. Federal research expenditures totalled $93.5 million, of which $64.5 million were spent in-house. Of the $60.1 million spent by provincial governments, $47.2 were allocated to in-house research. Industries, on the other hand, carried out research valued at $166.1 million; they funded $154.3 million of that total. Universities performed $31.5 million of research, but funded $13.1 million.

The research undertaken by industrial research institutes such as FERIC, Forintek and PAPRICAN amounted to $47.6 million.

Direct comparisons should not be drawn with the figures in last year's report because the composition of the categories has changed. The 1989 expenditures include consultants' fees and forestry agreement funding. R&D expenditures reported by industries may include other expenses such as upgrading equipment.



Lumber

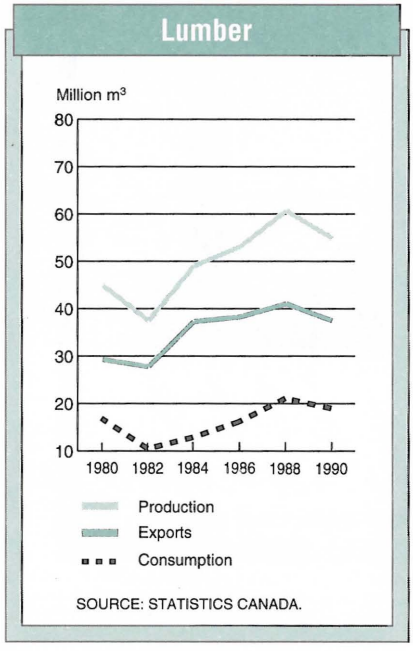
Between 1982 and 1987, Canadian lumber **production** levels followed a steep upward trend. Since that time, however, the demand for Canadian lumber has softened as a result of a slowdown in housing starts in Canada and the United States, and production has declined. A comparison of 1989 and 1990 figures reveals a reduction of 7.3 percent in the production of lumber.

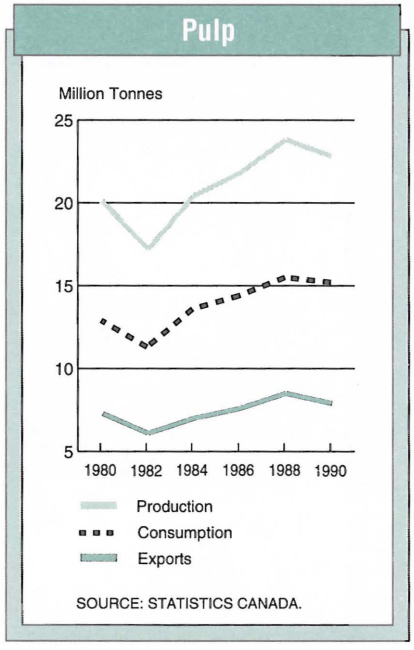
Almost 80 percent of Canada's lumber exports are shipped to the USA. The North American recession has therefore had a significant impact on the level of lumber exports. The decline in housing starts and the strengthening of the Canadian dollar further contributed to a reduction in lumber **exports**. Canada exported 40.5 million cubic metres in 1989 and only 37.5 million cubic metres in 1990 — a decline of 7.4 percent.

Canada consumes one-third of all the lumber it produces. Domestic **consumption** decreased from 20.4 million cubic metres in 1989 to 19 million cubic metres in 1990, a decline of 7 percent. Fewer housing starts and renovation projects also contributed to this downward trend.

Wood Pulp

Canada is the world's largest exporter of wood pulp. The high quality and competitive price of this country's pulp make it one of the most sought-after products in international markets. Between 1982 and 1988, Canadian **exports** of wood pulp increased at an annual rate of 5.6 percent. Since then, market conditions have led to a decline in both exports and domestic consumption.



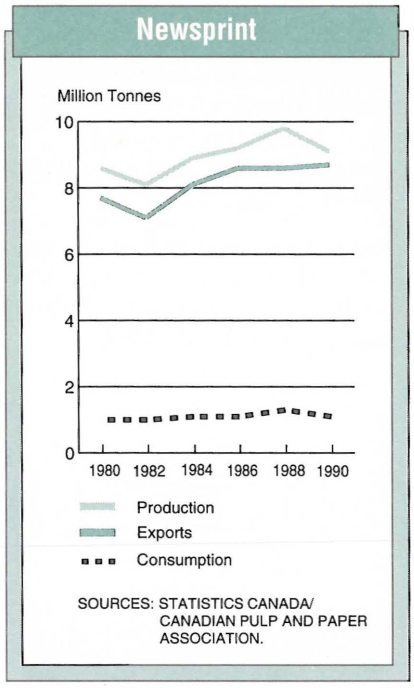


NEWSPRINT

The growth experienced by the advertising sector during the 1980s came to an abrupt halt in 1990. Newspapers and magazines were particularly hard hit. Newsprint **production** levels have declined since 1989.

Canada **exports** 84 percent of its newsprint to the USA and slightly more than 3 percent to the United Kingdom. Over the past three decades, newsprint exports grew at a modest rate of 1.3 percent annually. In 1989 and 1990, newsprint exports increased once again, to 8.5 and 8.7 million tonnes respectively.

Between 1980 and 1990, domestic **consumption** of newsprint remained stable.



PRODUCTION/EXPORTS/CONSUMPTION

(VOLUME)

	1990	1989	% Change One Year	Annual % Change Ten Years
Production of Major Commodities				
Lumber[a] (thousand m³)	54 909	59 245	– 7.3	+ 2.5
Wood Pulp (thousand tonnes)	22 836	23 708	– 3.7	+ 1.4
Newsprint (thousand tonnes)	9 068	9 640	– 5.9	+ 0.9
Exports				
Lumber[a] (thousand m³)	37 475	40 482	– 7.4	+ 2.6
Wood Pulp (thousand tonnes)	7 901	8 242	– 4.1	+ 1.6
Newsprint (thousand tonnes)	8 743	8 482	+ 3.1	+ 1.0
Apparent Domestic Consumption[b]				
Lumber[a] (thousand m³)	18 970	20 418	– 7.1	+ 2.4
Wood Pulp (thousand tonnes)	15 188	15 650	– 3.0	+ 1.4
Newsprint (thousand tonnes)	1 089	1 183	– 7.9	+ 2.5

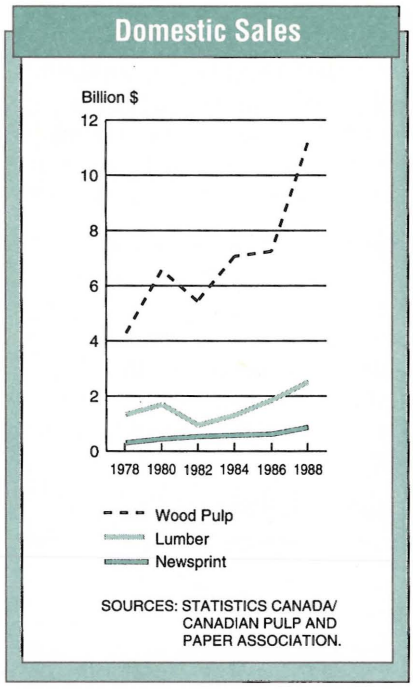
[a] Comprised of softwood and hardwood.
[b] Apparent domestic consumption = production + imports – exports.

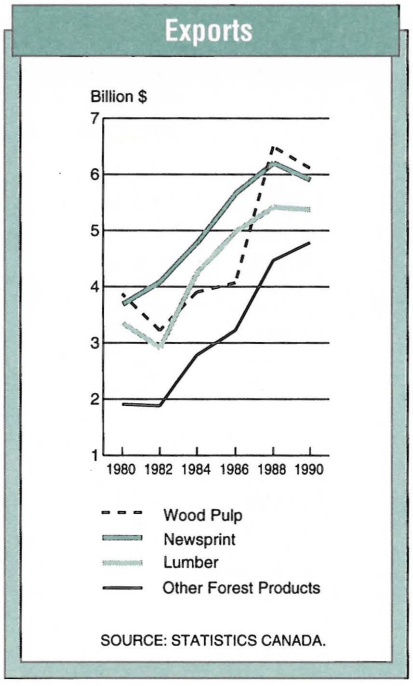
Sources: Statistics Canada/Canadian Pulp and Paper Association.

Sales

Domestic sales of the three major forest products increased from $5.8 billion in 1978 to $14.5 billion in 1988. The increase reflects the general growth in the economy that occurred during that period.

In more recent years, the recession has affected virtually every major forest industry in Canada. However, no statistics are available for domestic sales beyond 1988.





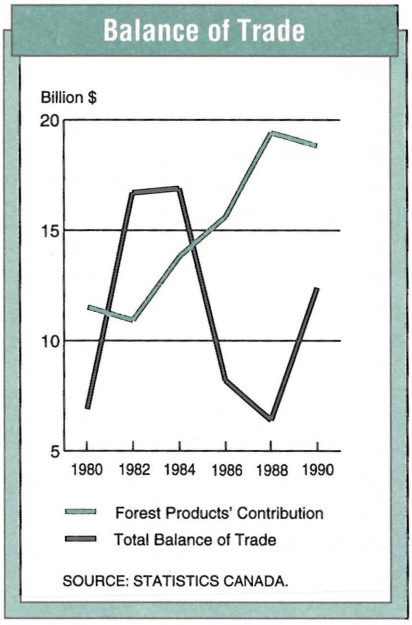
Exports

Between 1980 and 1989, total exports of forest products increased by 78 percent overall (from $12.8 billion to $22.8 billion). However, in 1990, exports remained stable or decreased slightly. The decline may be attributed to recessionary conditions, an increase in the value of the Canadian dollar, recycling, and the emergence of new competitors.

Balance of Trade

Forestry is Canada's single largest contributor to the balance of trade. However, there was a 3 percent decline in this sector between 1989 and 1990. In 1990, forest industries contributed $18.8 billion to Canada's balance of trade, almost as much as agriculture, fisheries, mining and energy combined.

In 1990, Canada's balance of trade in forest products vis-à-vis the United States was up 2 percent, although the balance of trade with the United Kingdom, other European Community countries, Japan and the rest of Asia showed varying percentages of decline.



Sales and Balance of Trade[a]
(billion $)

	1988	1986[b]	% Change Two Years	Annual % Change Ten Years
Apparent Domestic Sales[c]				
Lumber[d]	2.507	1.851	+ 16.4	+ 6.6
Wood Pulp	11.169	7.249	+ 24.1	+ 10.3
Newsprint	0.857	0.607	+ 18.8	+ 11.4

	1990	1989	% Change One Year	Annual % Change Ten Years
Export Sales				
Lumber[d]	5.371	5.516	- 2.6	+ 4.5
Wood Pulp	6.115	6.940	- 11.9	+ 7.9
Newsprint	5.898	5.866	+ 0.5	+ 6.3
Other Forest Products	4.784	4.476	+ 6.9	+ 10.8
Total Forest Products	**22.168**	**22.798**	**- 2.8**	**+ 7.0**
Balance of Trade				
United States	12.201	11.963	+ 2.0	+ 6.1
United Kingdom	1.048	1.175	- 10.8	+ 5.1
Other EC	2.073	2.115	- 2.0	+ 5.6
Japan	2.000	2.510	- 20.3	+ 10.5
Other Asia	0.765	0.829	- 7.4	+ 13.5
Total	**18.841**	**19.507**	**- 3.4**	**+ 6.6**

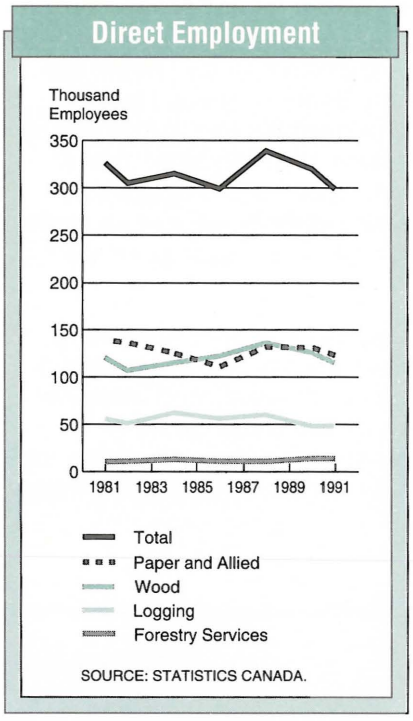
[a] Figures have been rounded off and may not add up to totals.
[b] Data for 1987 have not been compiled by Statistics Canada.
[c] Obtained by multiplying apparent domestic consumption (production + imports - exports) by an implicit price (value of shipments ÷ quantity of shipments).
[d] Comprised of softwood and hardwood.

Sources: Statistics Canada/Canadian Pulp and Paper Association.

EMPLOYMENT

Although brief fluctuations in employment trends have been apparent during downward cycles in the industry, employment in the Canadian forest sector has traditionally been relatively stable. However, in 1991, employment in wood and paper and allied industries showed varying percentages of decline, and the total unemployment rate rose by 32 percent.

Changes in technology and systems are leading to higher levels of production involving less labour-intensive employment. As this occurs, the educational and skill requirements of forest workers are increasing.



LABOUR FORCE[a]

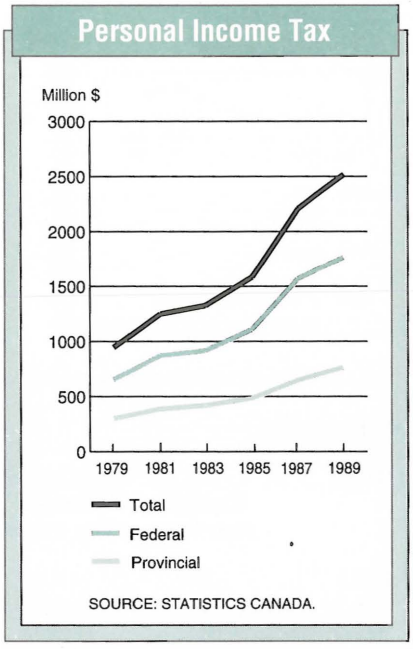
	1991	1990	% Change One Year	Annual % Change Ten Years
Direct Employment (thousands)				
Logging Industry	48	48	—	– 2.3
Forestry Services[b]	14	14	—	+ 2.2
Wood Industries	115	126	– 8.7	– 1.0
Paper and Allied Industries	122	131	– 6.9	– 0.8
Total Direct Employment	**299**	**320**	**– 6.6**	**– 1.0**
Unemployment Rate (%)				
Logging Industry	24.2	21.8	+ 11.0	+ 2.5
Forestry Services[b]	30.4	27.0	+ 12.6	+ 2.2
Wood Industries	15.3	9.9	+ 54.5	+ 2.0
Paper and Allied Industries	7.8	5.7	+ 36.8	+ 3.0
Total Unemployment Rate	**14.9**	**11.3**	**+ 31.9**	**+ 2.8**

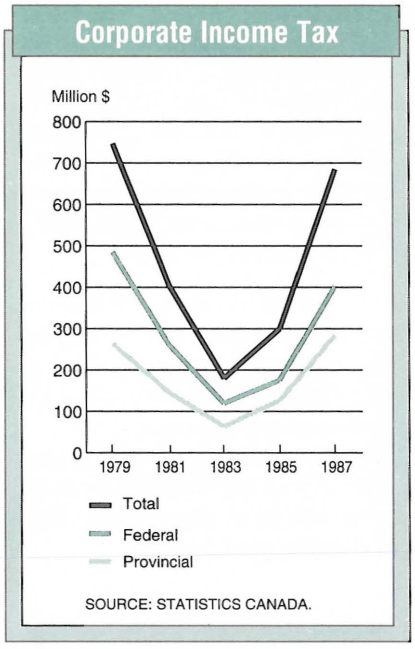
[a] Figures have been rounded off and may not add up to totals.
[b] Includes reforestation services, forest protection services and nursery services. National estimates from a variety of sources indicate that in 1990, as many as 50 000 seasonal jobs were created in silviculture. Activities included planting, site preparation, stand tending and nursery services. (1991 figures are not available.)

Source: Statistics Canada.

REVENUES

Corporate income taxes paid by Canadian forest industries are influenced by the business cycle. Accordingly, these rates are highly cyclical. A substantial increase in taxes between 1986 and 1987 reflects a very productive and profitable year.





While the inflation rate increased by an annual average of 6.4 percent between 1977 and 1987, the federal and provincial personal income taxes paid by forest sector workers increased by an annual average rate of 10 and 11 percent respectively.

REVENUES
(million $)

	1987	1986	% Change One Year	Annual % Change Ten Years
Corporate Income Taxes				
Provincial	283.7	181.7	+ 56.1	+ 9.7
Federal	401.9	224.8	+ 78.8	+ 4.7

	1989	1988	% Change One Year	Annual % Change Ten Years
Personal Income Taxes[a]				
Provincial	759.3	700.5	+ 8.4	+ 10.2
Federal	1 758.6	1 666.6	+ 5.5	+ 11.1
Stumpage and Fees				
Provincial	863.3	883.5	– 2.3	+ 6.8
Federal	5.5	7.3	– 24.7	not available

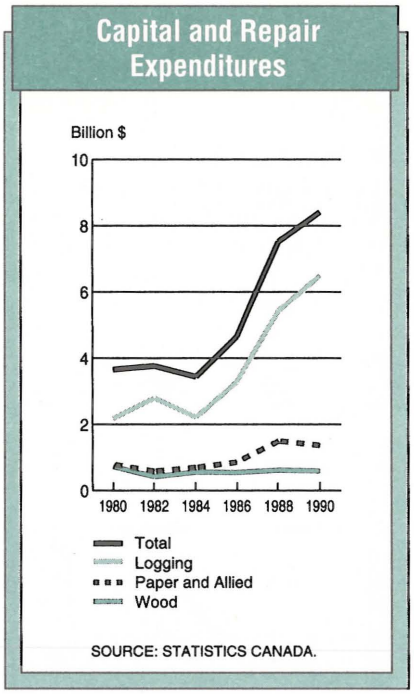
[a] Estimated.

Source: Statistics Canada.

Capital and Repair Expenditures

Over the past decade, Canadian forest industries, particularly pulp and paper industries, have spent billions of dollars to repair equipment and upgrade facilities. Capital and repair expenditures reached a record high of $9.4 billion in 1989, but dropped by 10.8 percent in 1990.

Pulp and paper industries will spend several billion dollars more for de-inking plants and for equipment to meet new environmental regulations. The Canadian Pulp and Paper Association forecasts that between 1991 and 1994, pulp and paper industries will spend $3.3 billion to meet the regulations aimed at eliminating the discharge of dioxins and furans.



Capital and Repair Expenditures[a]

	1990	1989	% Change One Year	Annual % Change Ten Years
Capital Expenditures (million $)				
Logging Industry	257.3	282.8	– 9.0	– 0.8
Wood Industries	614.9	704.1	– 12.7	+ 6.6
Paper and Allied Industries	4 339.4	5 501.0	– 21.1	+ 15.7
Total	**5 211.6**	**6 487.9**	**– 19.7**	**+ 12.2**
Repair Expenditures[b] (million $)				
Logging Industry	317.3	358.8	– 11.6	+ 1.0
Wood Industries	749.3	586.5	+ 27.8	+ 7.5
Paper and Allied Industries	2 135.6	1 996.3	+ 7.0	+ 10.8
Total	**3 202.2**	**2 941.6**	**+ 8.9**	**+ 8.4**
Total Capital and Repair Expenditures (million $)				
Logging Industry	574.6	641.6	– 10.4	+ 0.1
Wood Industries	1 364.2	1 290.6	+ 5.7	+ 7.0
Paper and Allied Industries	6 475.0	7 497.3	– 13.6	+ 14.6
Total	**8 413.8**	**9 429.5**	**– 10.8**	**+ 11.1**

Capital Stocks

Net Capital Stocks[c] (million $)				
Logging Industry	1 473.3	1 475.7	– 0.2	– 1.1
Wood Industries	4 887.2	4 790.3	+ 2.0	+ 5.1
Paper and Allied Industries	30 881.7	27 902.8	+ 10.7	+ 9.6
Total	**37 242.2**	**34 168.8**	**+ 9.0**	**+ 8.0**

[a] Figures have been rounded off and may not add up to totals.
[b] Repair expenditures also include maintenance expenditures.
[c] Capital stocks means the present value of the physical plant, equipment and other durable man-made products used in production. Investment is spending that adds to capital stock.

Source: Statistics Canada.

GLOSSARY

AIR-DRIED METRIC TONNE (ADMT) — A metric tonne of wood seasoned by exposure to the atmosphere, either in the open or under cover, without artificial heat.

ALLOWABLE ANNUAL CUT (AAC) — The amount of timber that is permitted to be cut annually from an area over a specified period of time. The AAC is used to regulate the harvest level to ensure a long-term supply of timber.

BACILLUS THURINGIENSIS (B.t.) — An organic insecticide (soil bacterium) used to control insect pests such as spruce budworm and gypsy moth.

BIOCHEMICAL OXYGEN DEMAND (BOD) — A measure of the oxygen consumption of organic material in effluent.

BIODIVERSITY — The total diversity within an ecosystem, including genetic variation between species, diversity of lifeforms, and ecosystem diversity.

CHEMI-THERMOMECHANICAL PULPING PROCESS (CTMP) — A process by which wood chips are separated into fibres between metal disks, using heat, pressure and chemicals.

CHLORINATED ORGANICS — A category of by-products produced during the bleaching process. Also known as organochlorines or AOX (adsorbable organic halogen).

CLOSED-SYSTEM PROCESSING — A processing system that prevents by-products or waste produced during the manufacturing process from being released into the environment.

COMMERCIAL FORESTS — Forest land capable of producing merchantable species of timber along with a variety of non-timber benefits.

COMPOSITE MATERIALS — Products consisting of reconstituted wood, such as particleboard or oriented strand board.

CONSERVATION AREA — An area of land set aside to fulfil a variety of purposes. May include ecological reserves, national and provincial parks, managed wildlife areas, and protected landscapes.

DEFOAMER — A surface-active agent that inhibits the formation of foam.

DIOXIN — A chlorinated hydrocarbon that may be highly toxic.

EFFLUENT — Used or waste mill water that carries solids and organic material.

FOREST BIOMASS — The mass of the above-ground portion of woody plants in a forest.

FURAN — A chlorinated compound that is an unwanted by-product of certain manufacturing processes.

GIGAJOULE (GJ) — One billion joules. A joule is a unit of work or energy.

GREEN LUMBER — Lumber with a moisture content of 19 percent or more; not dried.

HERITAGE FORESTS — Proposed name for the highly protected sites within Canada's forest land boundaries. These sites, designated by federal and provincial agencies, are classified according to the World Conservation Union categories and are protected by legislation from commercial harvesting.

IMMATURE — Trees or stands that have grown past the regeneration stage, but are not yet mature.

INDIRECT JOBS — Various employment opportunities that have been developed to meet the demands created by direct jobs in the forest sector.

INSECT ANTI-FEEDANT — A product used to discourage insects from feeding.

KERF — The width of a saw cut. This portion is lost as waste when the log is sawn for lumber, although the waste residue may be used as fuel or for other purposes.

KRAFT — A heavy paper or paperboard made from wood pulp by boiling wood chips in a sodium sulfate solution. Typically used for corrugated paper or grocery bags.

MANAGED FORESTS — Commercial forests that are currently accessible and allocated for timber and multiple-use management.

MEGAWATTS PER HOUR (MWH) — A unit of power equal to one million watts per hour.

OPEN FORESTS — Proposed name for the natural forests commonly found in northern Canada. These forests are a mixture of wetlands and small trees occasionally interspersed with highly productive forests.

PESTICIDE — A chemical or organic insecticide or herbicide used to control weeds and fungi, or insects and other pests.

PHEROMONE — Any chemical substance released by an insect that serves to influence the physiology or behaviour of other members of the same species.

PINEWOOD NEMATODE — A microscopic worm carried by wood boring insects.

PROTECTION FORESTS — Proposed name for forests protected from harvesting by policy. These forests usually protect sensitive sites such as watersheds and steep slopes.

REGENERATION — The renewal of a forest crop by natural processes (by self-sown seed or root suckers) or by sowing or planting.

ROUNDWOOD — Sections of tree stems, with or without bark. May include logs, bolts, posts and pilings.

SECONDARY TREATMENT FACILITY — Biological treatment of wastewater in which a bacterial or biochemical action is intensified to stabilize, oxidize and nitrify the unstable organic matter that is present.

STONE GROUNDWOOD MILL — A mill that produces wood fibre for pulp production by grinding pieces of wood against an abrasive wheel.

STUMPAGE CHARGE — The fee paid by companies or individuals for the right to harvest timber on Crown lands.

SUSTAINABLE DEVELOPMENT — The development of forests to meet current needs without prejudice to their future productivity, ecological diversity, or capacity for regeneration.

SUSTAINED YIELD — The yield of timber that a given forest area can sustain continuously at a given intensity of management.

TALL OIL — A by-product of the kraft pulping process derived from the resinous substance of spruce and pine trees.

TOTAL SUSPENDED SOLIDS (TSS) — The total amount of fibres or particles found in effluent.

UNALLOCATED FORESTS — Commercial forests that have not yet been allocated for timber management and that do not currently have road access.

WATERSHED — The area of land that drains naturally into a stream.

Forestry Canada Establishments

Established by the *Department of Forestry Act*, Forestry Canada became a federal department in 1989. Its mission is to "promote the sustainable development and competitiveness of the Canadian forest sector for the well-being of present and future generations of Canadians".

Within its mandate, the Department represents the forest sector's interests in international affairs and trade, is the major forest science research agency in Canada, and, with various federal, provincial and private sector partners, fosters the sustainable development of Canada's forests.

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Reader's Notes