THE STATE OF FORESTRY IN CANADA

1990 REPORT TO PARLIAMENT

Forestry Canada Forêts Canada

Canada

THE STATE OF FORESTRY IN CANADA

1990 REPORT TO PARLIAMENT

CANADA'S GREEN PLAN

Catalogue No. Fol-6/1991E
ISBN 0-662-18601-X
ISSN 1183-353-X

Cover photo: MALAK

Copies of this publication may be obtained free of charge from:

Forestry Canada
Corporate and Public Affairs
Ottawa, Ontario
K1A 1G5

Tel: (819) 953-2312
Fax: (819) 953-7048

A microfiche edition of this publication may be purchased from:

Micromedia Ltd.
165 Hôtel-de-Ville St.
Hull, Quebec
J8X 3X2

Cette publication est aussi disponible en français sous le titre:

L'ÉTAT DES FORÊTS AU CANADA
RAPPORT AU PARLEMENT 1990

Printed on recycled paper

TABLE OF CONTENTS

MESSAGE FROM THE MINISTER

I am pleased to put before Parliament the government's first report on the state of forestry in Canada. This and subsequent reports will inform Canadians about the health of their forests and provide insights on forestry related issues and the policy directions of the federal government.

No longer does the management of our forests lie solely in the domain of the forester, or industry, or government. Canadians have a vital interest in the well-being of their forests because of the environmental, economic and social benefits they provide.

Today, not only do we harvest the forest for its fibre, but we strive to manage it wisely so that it yields a broad spectrum of social and cultural benefits to all Canadians. We want nature lovers, outdoor sports enthusiasts and tourists to enjoy the majestic beauty of our forests. We also want to protect and preserve this vast biodiversity and maintain a secure habitat for forest dwellers.

Forests are the bedrock of our economy and the source of much of our prosperity. They also filter the air we breathe and the water we drink. These multiple uses with seemingly conflicting objectives must be reconciled. Although the challenge is formidable, it will be met.

By practising sustainable development and investing in both basic and applied research, our forests will be able to grow and develop in harmony with our environmental obligations. As custodians of 10% of the Earth's forests, we willingly accept this international obligation.

The Green Plan is a major undertaking by the government to protect the environment, and forestry initiatives are an integral part of this Plan. As initiatives are implemented, future reports will record our accomplishments and identify future challenges.

This first report highlights research conducted by Canadian scientists led by Forestry Canada. Preliminary data for the year 1986 indicate that our forests sequestered as much carbon as emitted by our industrial activities. These studies underline the very important role that Canadian forests play in the well-being of our nation. By continuing to carefully balance the needs of the forest industry with the prudent management of our forest resource, Canada can contribute to the overall global effort to reduce the impact of carbon dioxide emissions.

In future, we will also refine and highlight changes in this, our first national forestry balance sheet. We want to inform Canadians of our success in meeting our objectives. Furthermore, we plan to review a particular facet of forestry each year and provide an in-depth analysis and commentary on that segment.

Frank Oberle

Minister of Forestry

PREFACE

Canada is a forest nation. From the beginning, Canadians have shared a strong relationship with their forests — living in them and living from the goods they provide. Forests are fundamental to Canada's social and cultural identity and well-being, and their use must be balanced to serve the needs of Canadians while maintaining a healthy forest environment.

Parliament acknowledged the importance that Canadians place on their forests in the passing of Bill C-29, the *Department of Forestry Act*, in 1989. Under this act, Forestry Canada became a federal department, and the concept of sustainable development was introduced in Canadian legislation. Forestry Canada was given the responsibility "to promote the sustainable development and competitiveness of the Canadian forest sector for the well-being of present and future generations of Canadians" — in other words, to ensure Canada's forests meet current needs without prejudice to their future productivity, ecological diversity and capacity for regeneration.

In addition to supporting the development of a competitive forest sector, Forestry Canada provides leadership in the development and coordination of national forestry policies and programs. The Department supports a world-class forest research organization and publicizes the issues and achievements of forestry in Canada.

Under the *Department of Forestry Act*, Forestry Canada is also required to report annually on the condition of Canada's forest resources and their contribution to the economy. The intent of this and subsequent reports is to provide information and perspective on Canada's forest sector. The report presents a combination of factual and analytical information about Canada's forests, and addresses topics and issues important to the future development of the Canadian forest sector.

In addition to providing an annual overview on the state of Canadian forestry, each report will feature a different theme. This inaugural report places particular emphasis on Canada's forests as a source of commercial timber, and on management and environmental issues related to timber production. Subsequent reports will address other topics in more detail, for example, the Canadian forest sector labour force, forestry research, etc. In this report, a national forest account is introduced to provide a balance sheet perspective on the activities of the Canadian forest sector. The intent of this account is to show the changes in the forest resource as it is depleted by harvesting, fire and insects, and replenished through reforestation and intensive management activities. It provides environmental as well as economic indicators of activity. The national forest account will be further developed in future reports.

Chapter 1 provides readers with basic information on Canada's forest sector. National and provincial profiles indicate the size and composition of Canada's forests and illustrate their importance to national and regional economies.

The state of Canada's forest resources is the topic of chapter 2, which discusses the amount of commercially available timber in Canada and the factors affecting timber supply. The results of a national survey of professional foresters regarding their views on the state of forest management in Canada are also highlighted.

Chapter 3 addresses some of the major environmental issues associated with Canada's forests, including the contribution of Canadian forests to the carbon balance.

Chapter 4 discusses the health of the forest industry today and its prognosis for the future.

Chapter 5 provides account sheets of forest sector activity in the past decade and presents selected indicators which describe the historical performance of Canada's forest sector with respect to growth and management of forest industrial activity and the environment. These indicators will be updated in subsequent reports to monitor ongoing developments within Canada's forests and forest sector.

The major sources for the data in this report are Statistics Canada and Forestry Canada. Canada's Forest Inventory (1986) provides information on area, volume, species composition and maturity of Canada's forest resource. Canada's Forest Inventory is a cooperative effort between Forestry Canada and the provincial and territorial agencies responsible for managing the forest resource. This Inventory is updated every 5 years.

It is hoped that members of Parliament, the forestry constituency, interest groups, trading partners and the Canadian public will find this material informative and useful, and that this report will further public debate on the future of forestry in Canada.

EXECUTIVE SUMMARY

Nearly half of Canada's land base — roughly three times the forest land of Europe — is forested. These forests are as diverse as the landscapes that support them and teem with life that has evolved to suit each forest environment.

As Canada has evolved as a nation, the demands on its forests have changed and grown. Though commercial timber production remains the major resource use of Canada's forests, it is now accompanied by substantial demands for non-timber values, including recreation, wilderness, fish, water, wildlife and aesthetics.

Canadian forests are characterized by a preponderance of mature stands, prized for both their timber and non-timber values. The forest industry depends on some of these stands to maintain its harvests over the next 30 to 60 years until second-growth managed forests are ready to cut. Other users value them for the maintenance of biodiversity, wildlife and fish habitat, aesthetics and a host of recreational pursuits.

As Canada seeks to integrate these disparate demands, it will need to improve its understanding of all the forest's resources and the interactions among them. This will require further development of resource databases such as national forest accounts, planning processes and systems of management.

Increasingly, non-timber values will be integrated into forest management strategies. In some cases, guidelines already exist for managing forests for specific wildlife, fisheries and recreation values. These will be expanded to address additional species and values, including the ecological value of the forest as a whole. Forest ecosystems will be valued and managed as gene pools, carbon repositories and regulators of climate. In the future, forestry practices will be planned and carried out to maintain the biological diversity within Canada's forests and to safeguard their ecological integrity.

Timber production methods will become more intensive to maximize the return from each site. Continuing improvements in regeneration systems, tree improvement and stand tending practices will enable Canada to produce more wood on the forest land available for commercial harvesting. At the same time, advances in forest protection will help to safeguard Canada's highly valued mature standing timber, as well as its investments in managed forests.

Technological innovations will remain important throughout the forest sector as Canada strives to maximize its efficiency in growing, harvesting, transporting and manufacturing forest products. While current technologies have substantially improved the value and volume of products manufactured from each log, future developments are expected to concentrate on improving efficiencies and reducing environmental impacts. Research into new products and new markets will complement these initiatives.

In years to come, all forest sector activities will become more environmentally sensitive. Where efforts to date have been focused at the local and provincial levels, these will expand to national programs. And Canada will play a leadership role in the management of its forests for global well-being through initiatives to reduce acid rain and carbon dioxide emissions, and to promote bioenergy.

Canada's forest industry is one of the most competitive in the world. However, as global competition rises, outdated segments of the industry will need restructuring, especially in the pulp and paper subsector. Fortunately, ample opportunities exist to update and integrate some outdated kraft pulp and newsprint machines into the production of specialty pulps and higher grades of paper.

The next twenty years will be a period of growth in all product sectors. New markets, new customers and new products will create many opportunities for further development. The United States presents a fast-growing market for higher value products, such as printing and writing papers and specialty wood products, while the Pacific Rim is expected to show growth in markets for specialty wood products.

Bolstered by extensive softwood and hardwood timber supplies and access to relatively low-cost energy, Canada's forest products industry will continue to thrive, provided it remains competitive in its technologies and conversant with changing consumer demands.

In positioning itself for the future, Canada must protect and enhance its forest resource base, continue to develop its industrial infrastructure and improve the processes by which forests are planned and managed.

Key issues to be addressed include:
- improving Canada's understanding of the dynamics and interrelationships of forest ecosystems;
- developing better means by which to integrate and manage forests for a multiplicity of values;
- undertaking appropriate forest management activities to maintain a healthy and productive forest land base to support future growth;
- strengthening the forest products industry through research and development into new processes, products and markets;
- ensuring that all forest sector activities are environmentally friendly and maintain ecosystem integrity.

Canada has the resource base, the technological strengths and the reputation to maintain a successful forest industry while supporting the development of other forest resources and values.

CANADA
A FOREST NATION

Forests are a major component of the Canadian identity. They characterize its landscapes, underwrite its economy and enrich the lives of every Canadian. Forests are critical elements in Canada's future development as a society and as a nation.

Few countries rely more heavily on their forest resources. The Canadian forest industry contributes substantially to the wealth of every province and territory. Close to 900,000 Canadians work either directly in the industry or for companies that support it, and almost 350 Canadian communities are forestry-dependent. In 1989, forestry contributed $19.5 billion to Canada's balance of trade — more than agriculture, fishing, mining and energy combined.

Fully half the Canadian landscape is forest, and these forests are as diverse as they are extensive. They offer a mosaic of products and values and, as a result, represent a substantial management challenge.

The majority of Canada's forests share a common feature: they are publicly owned. The federal government, provincial governments and private landowners share the responsibilities of their administration.

The federal government's role is multifaceted. It includes responsibility for trade relations, market development, regulation of pesticides, monitoring of atmospheric pollution, scientific exchange and technology transfer. Although many federal departments are involved in forestry, Forestry Canada is the only one which focuses solely on the forest sector. Through cost-sharing agreements and programs with the provinces, and several joint councils, Forestry Canada plays a leadership role in encouraging the sustainable development and multiple use of Canadian forests.

CANADA - A FOREST NATION

The Department also supports a first-class forest research organization, internationally respected for its work in areas such as biotechnology and fire management. Detailed information on Forestry Canada's activities and programs is available in the Department's 1989-1990 Annual Report.

With its national perspective, Forestry Canada works across the country to build a consensus of how Canada's forest resources can best be managed. For example, since 1985, under the auspices of the Canadian Council of Forest Ministers (CCFM), the federal Minister of Forestry has met with his counterparts in the provinces and territories to pursue common goals.

Among the CCFM's more recent accomplishments has been the establishment of the National Forest Database Program to support informed forest management and decision-making.

Over the next two years the CCFM will lead the development of a new National Forest Sector Strategy that will guide forestry in Canada into the next century.

CANADA IS THE CUSTODIAN OF 10% OF THE WORLD'S FORESTS.

Over 10 percent, or 25.7 million hectares, of Canada's productive forest land is federally controlled; most of this is in the Yukon and Northwest Territories. In the Yukon the federal government, through the Department of Indian Affairs and Northern Development, plays the dominant role in the management of forest land, while the government of the Northwest Territories manages the forests within its boundaries. The remaining federal Crown forest is held in national parks, research areas, Indian lands and lands administered by the Department of National Defence.

Most of Canada's productive forest land (about 80%) is controlled by the provinces.

Traditionally, the provincial governments have assumed the responsibility for managing provincial forests, while harvesting rights for timber have been conferred to the private sector through a variety of timber leases. However, provincial forest policies have been changing to keep pace with changing demands.

More of the responsibility for regenerating and managing forests has been assigned to the private companies that harvest them.

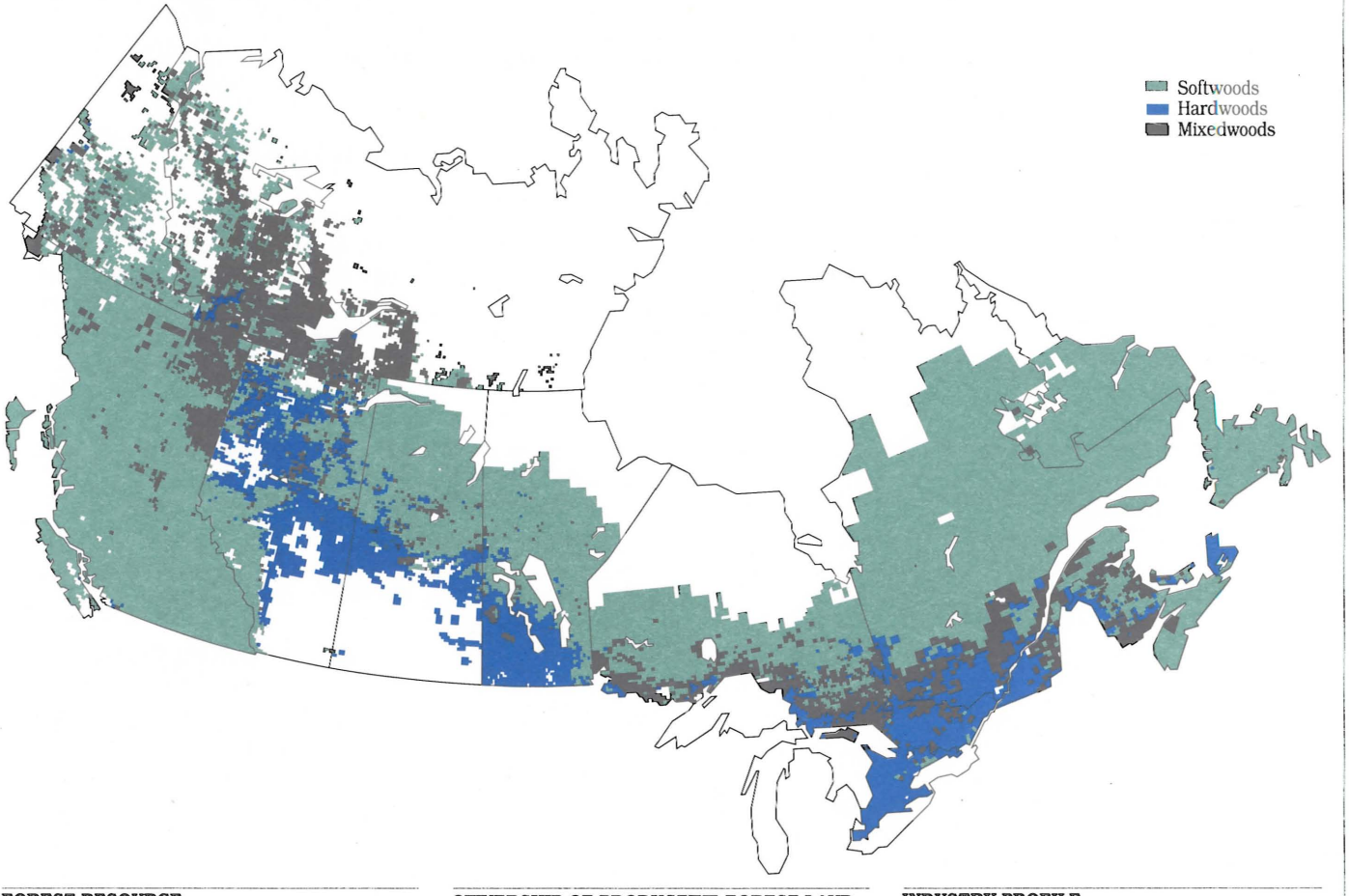
There is also a general trend to manage forests for recreation, wildlife and ecological values, in addition to the supply of commercial timber.

THERE ARE 430,000 PRIVATE WOODLOT OWNERS IN CANADA.

The remaining 9 percent of Canada's productive forest land is held by private woodlot owners, including both individual private landowners and large corporations. There are close to half a million private forest owners in Canada, mainly in Eastern Canada. Most eastern woodlot owners are members of various organizations, such as cooperatives, group ventures, marketing boards and federations, which provide them with expertise, advice and other management and marketing services. Private woodlots are among the most productive of Canada's forest lands, making them a valuable source of commercial wood supply. In addition, as sources of fuelwood, Christmas trees, maple syrup, recreation and aesthetic values, private woodlots contribute significantly to the local economy, especially in terms of employment in many of the poorest regions of Canada.

Profiles of the forest sector in each of the provincial and territorial economies are presented in the following pages. An illustration of the official tree species designated or adopted as an emblem by individual provinces is included in the provincial profiles.

CANADA



FOREST RESOURCE	
TOTAL AREA	997 million ha
FOREST LAND	453 million ha
RESERVED FOREST LAND	12.5 million ha
PRODUCTIVE FOREST LAND	244 million ha
AREA REGENERATED (1988)	823 thousand ha
AREA HARVESTED (1988)	1 million ha
DEFOLIATION BY INSECTS (1989)	19 million ha
AREA BURNED (1989)	7.3 million ha

OWNERSHIP OF PRODUCTIVE FOREST LAND
80% PROVINCIAL
11% FEDERAL
9% PRIVATE WITH 430 000 WOODLOT OWNERS

TRADE (1989)	
VALUE OF EXPORTS	$22.8 billion
17% of all Canadian exports,	
21% of world trade in forest products	
MAJOR VALUE OF PRODUCTS EXPORTED	
wood pulp (30%), newsprint (25%),	
softwood lumber (24%)	
MAJOR EXPORT MARKETS	
United States (65%), EEC (15%),	
Japan (11%), others (9%)	
BALANCE OF TRADE	$+19.5 billion

INDUSTRY PROFILE	
TOTAL VALUE OF SHIPMENTS (1988)	$49 billion
54% sold domestically, 46% exported	
CONTRIBUTION TO ECONOMY (1989)	$20 billion
NUMBER OF ESTABLISHMENTS (1988)	14 944
Logging: 10 587, wood industries: 3 639,	
paper and allied industries: 718	
FORESTRY-DEPENDENT COMMUNITIES	348
EMPLOYMENT (1989)	888 000 jobs
348 000 direct jobs, 540 000 indirect jobs,	
1 job in 14	
WAGES AND SALARIES (1988)	$9.6 billion
NEW INVESTMENT (1989)	$8.9 billion

NOTES

NOTES TO NATIONAL AND PROVINCIAL PROFILES

SOURCES:

The main sources of data are Statistics Canada and Forestry Canada.

MAP:

The map of Canada presents an overview of the composition of Canada's forests according to forest type. The three forest types as recognized in Canada's Forest Inventory are: softwood, hardwood and mixedwood.

FOREST RESOURCE:

Canada's Forest Inventory 1986 is the source for the land base data.

The figure of 12.5 million hectares for *reserved forest land* is based on Canada's total forest land.

The data for *area regenerated* refers to the area successfully regenerated as described in the table on page 25. It refers to Canada's productive forest land.

The *insect defoliation* data is based on Canada's total forest land, and refers to moderate to severe defoliation. No such defoliation is reported by Prince Edward Island and Nova Scotia.

The figure for *area burned* is also based on the total forest land area.

INDUSTRY PROFILE:

The national *employment* figure presents both total direct jobs in the forest sector and the total indirect jobs outside of the forest sector which are supported by these direct jobs. The total indirect jobs in each province will not add up to the national total because the provincial figures only include indirect jobs created in the particular province and not those created outside of the province. No employment figure is provided for Prince Edward Island because of the reporting methodology used by Statistics Canada.

Some of the provincial industry data is not available for reasons of confidentiality e.g. *wages and salaries* for Newfoundland.

NEWFOUNDLAND

OWNERSHIP OF PRODUCTIVE FOREST LAND
96% PROVINCIAL
4% PRIVATE WITH 4 500 WOODLOT OWNERS

Black spruce

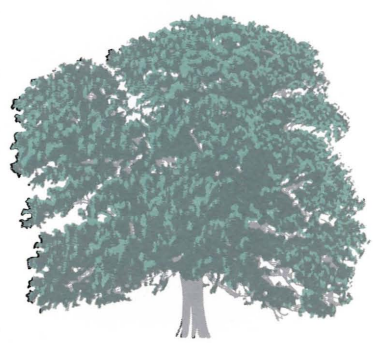
FOREST RESOURCE	
TOTAL AREA	40.6 million ha
FOREST LAND	22.5 million ha
RESERVED FOREST LAND	120.5 thousand ha
PRODUCTIVE FOREST LAND	11.2 million ha
AREA REGENERATED (1988)	17.5 thousand ha
AREA HARVESTED (1988)	17 thousand ha
DEFOLIATION BY INSECTS (1989)	10 thousand ha
AREA BURNED (1989)	68.2 thousand ha

TRADE (1989)	
VALUE OF EXPORTS	$377 million
MAJOR VALUE OF PRODUCTS EXPORTED	
newsprint (67%), book and writing paper (32%)	
MAJOR EXPORT MARKETS	
EEC (36%), United States (29%),	
South and Central America (22%)	
BALANCE OF TRADE	$+371 million

INDUSTRY PROFILE	
TOTAL VALUE OF SHIPMENTS (1988)	not available
NUMBER OF ESTABLISHMENTS (1988)	193
Logging: 130, wood industries: 56,	
paper and allied industries: 7	
FORESTRY-DEPENDENT COMMUNITIES	15
EMPLOYMENT (1989)	10 000 jobs
6 000 direct jobs, 4 000 indirect jobs,	
1 job in 20	
WAGES AND SALARIES (1988)	not available
NEW INVESTMENT (1989)	not available

PRINCE EDWARD ISLAND

OWNERSHIP OF PRODUCTIVE FOREST LAND
7% PROVINCIAL
93% PRIVATE WITH
16 000 WOODLOT OWNERS



Red oak

FOREST RESOURCE	
TOTAL AREA	570 thousand ha
FOREST LAND	290 thousand ha
RESERVED FOREST LAND	not available
PRODUCTIVE FOREST LAND	278 thousand ha
AREA REGENERATED (1988)	2.1 thousand ha
AREA HARVESTED (1988)	3.9 thousand ha
DEFOLIATION BY INSECTS (1989)	not available
AREA BURNED (1989)	215 ha

TRADE (1989)	
VALUE OF EXPORTS	$1.6 million
MAJOR VALUE OF PRODUCTS EXPORTED	
softwood lumber(47%),	
other paper and paperboard (43%)	
MAJOR EXPORT MARKETS	
North Africa (50%), United States (49%)	
BALANCE OF TRADE	$+1.5 million

INDUSTRY PROFILE	
TOTAL VALUE OF SHIPMENTS (1988)	not available
NUMBER OF ESTABLISHMENTS (1988)	29
Logging: 9, wood industries: 19,	
paper and allied industries: 1	
FORESTRY-DEPENDENT COMMUNITIES	not available
EMPLOYMENT (1989)	not available
WAGES AND SALARIES (1988)	not available
NEW INVESTMENT (1989)	not available

NOVA SCOTIA

OWNERSHIP OF PRODUCTIVE FOREST LAND
27% PROVINCIAL
3% FEDERAL
70% PRIVATE WITH 31 000 WOODLOT OWNERS

Red spruce

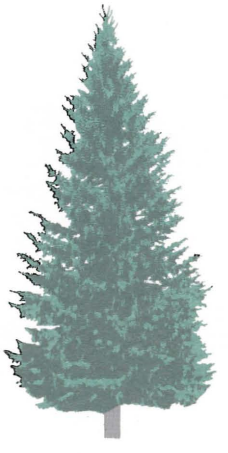
FOREST RESOURCE	
TOTAL AREA	5.6 million ha
FOREST LAND	4.0 million ha
RESERVED FOREST LAND	96.4 thousand ha
PRODUCTIVE FOREST LAND	3.9 million ha
AREA REGENERATED (1988)	32.7 thousand ha
AREA HARVESTED (1988)	42 thousand ha
DEFOLIATION BY INSECTS (1989)	not available
AREA BURNED (1989)	462 ha

TRADE (1989)	
VALUE OF EXPORTS	$524 million
MAJOR VALUE OF PRODUCTS EXPORTED	
newsprint (44%), wood pulp (44%)	
MAJOR EXPORT MARKETS	
United States (68%), EEC (19%)	
BALANCE OF TRADE	$+499 million

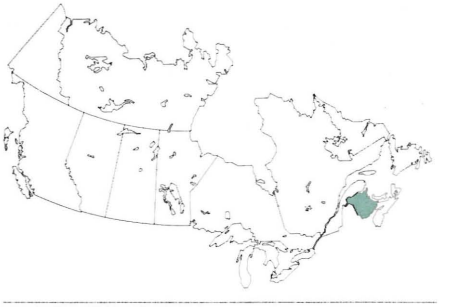
INDUSTRY PROFILE	
TOTAL VALUE OF SHIPMENTS (1988)	$1.0 billion
NUMBER OF ESTABLISHMENTS (1988)	516
Logging: 389, wood industries: 112,	
paper and allied industries: 15	
FORESTRY-DEPENDENT COMMUNITY	1
EMPLOYMENT (1989)	15 000 jobs
9 000 direct jobs, 6 000 indirect jobs,	
1 job in 25	
WAGES AND SALARIES (1988)	$198 million
NEW INVESTMENT (1989)	not available

NEW BRUNSWICK

OWNERSHIP OF PRODUCTIVE FOREST LAND
49% PROVINCIAL
2% FEDERAL
49% PRIVATE WITH 35 000 WOODLOT OWNERS



Balsam fir



FOREST RESOURCE	
TOTAL AREA	7.3 million ha
FOREST LAND	6.3 million ha
RESERVED FOREST LAND	31.6 thousand ha
PRODUCTIVE FOREST LAND	6.1 million ha
AREA REGENERATED (1988)	61.8 thousand ha
AREA HARVESTED (1988)	87.2 thousand ha
DEFOLIATION BY INSECTS (1989)	398 thousand ha
AREA BURNED (1989)	343 ha

TRADE (1989)	
VALUE OF EXPORTS	$1.5 billion
MAJOR VALUE OF PRODUCTS EXPORTED	
wood pulp (48%), newsprint (16%),	
other paper and paper board (24%)	
MAJOR EXPORT MARKETS	
United States (55%), EEC (23%), Japan (12%)	
BALANCE OF TRADE	$+1.4 billion

INDUSTRY PROFILE	
TOTAL VALUE OF SHIPMENTS (1988)	$2.7 billion
NUMBER OF ESTABLISHMENTS (1988)	1 124
Logging: 948, wood industries: 154,	
paper and allied industries: 22	
FORESTRY-DEPENDENT COMMUNITIES	41
EMPLOYMENT (1989)	30 000 jobs
18 000 direct jobs, 12 000 indirect jobs,	
1 job in 9	
WAGES AND SALARIES (1988)	$458 million
NEW INVESTMENT (1989)	not available

QUÉBEC

OWNERSHIP OF PRODUCTIVE FOREST LAND
87.6% PROVINCIAL
0.4% FEDERAL
12% PRIVATE WITH 120 000 WOODLOT OWNERS

White elm

FOREST RESOURCE	
TOTAL AREA	154 million ha
FOREST LAND	94 million ha
RESERVED FOREST LAND	378 thousand ha
PRODUCTIVE FOREST LAND	54.8 million ha
AREA REGENERATED (1988)	256 thousand ha
AREA HARVESTED (1988)	315 thousand ha
DEFOLIATION BY INSECTS (1989)	1.1 million ha
AREA BURNED (1989)	2.1 million ha

TRADE (1989)	
VALUE OF EXPORTS	$5.1 billion
MAJOR VALUE OF PRODUCTS EXPORTED	
newsprint (49%), wood pulp (15%), other paper and paperboard (18%)	
MAJOR EXPORT MARKETS	
United States (80%), EEC (13%)	
BALANCE OF TRADE	$+4.4 billion

INDUSTRY PROFILE	
TOTAL VALUE OF SHIPMENTS (1988)	$13.3 billion
NUMBER OF ESTABLISHMENTS (1988)	4 171
Logging: 2 735, wood industries:1 218, paper and allied industries: 218	
FORESTRY-DEPENDENT COMMUNITIES	126
EMPLOYMENT (1989)	210 000 jobs
110 000 direct jobs, 100 000 indirect jobs, 1 job in 14	
WAGES AND SALARIES (1988)	$2.7 billion
NEW INVESTMENT (1989)	$2.2 billion

ONTARIO

OWNERSHIP OF PRODUCTIVE FOREST LAND
84% PROVINCIAL
1% FEDERAL
15% PRIVATE WITH 169000 WOODLOT OWNERS

Eastern white pine

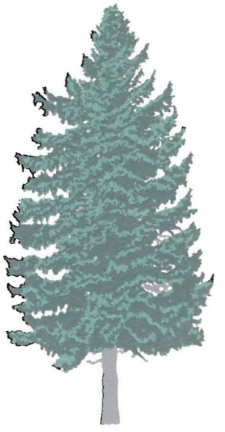
FOREST RESOURCE	
TOTAL AREA	107 million ha
FOREST LAND	80.7 million ha
RESERVED FOREST LAND	1.7 million ha
PRODUCTIVE FOREST LAND	38.3 million ha
AREA REGENERATED (1988)	181 thousand ha
AREA HARVESTED (1988)	237 thousand ha
DEFOLIATION BY INSECTS (1989)	14.5 million ha
AREA BURNED (1989)	404 thousand ha

TRADE (1989)	
VALUE OF EXPORTS	$3.9 billion
MAJOR VALUE OF PRODUCTS EXPORTED	
newsprint (37%), wood pulp (24%), other paper and paperboard (21%)	
MAJOR EXPORT MARKET	
United States (95%)	
BALANCE OF TRADE	$+2.0 billion

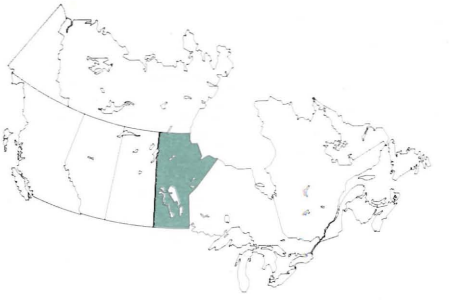
INDUSTRY PROFILE	
TOTAL VALUE OF SHIPMENTS (1988)	$12 billion
NUMBER OF ESTABLISHMENTS (1988)	2 983
Logging : 1 727, wood industries: 926, paper and allied industries: 330	
FORESTRY-DEPENDENT COMMUNITIES	41
EMPLOYMENT (1989)	169 000 jobs
84 000 direct jobs, 85 000 indirect jobs, 1 job in 29	
WAGES AND SALARIES (1988)	$2.4 billion
NEW INVESTMENT (1989)	$1.7 billion

MANITOBA

OWNERSHIP OF PRODUCTIVE FOREST LAND
90% PROVINCIAL
2% FEDERAL
7% PRIVATE WITH 3 500 WOODLOT OWNERS



White spruce



FOREST RESOURCE	
TOTAL AREA	65.0 million ha
FOREST LAND	34.9 million ha
RESERVED FOREST LAND	863 thousand ha
PRODUCTIVE FOREST LAND	14.9 million ha
AREA REGENERATED (1988)	5.6 thousand ha
AREA HARVESTED (1988)	12.4 thousand ha
DEFOLIATION BY INSECTS (1989)	383 thousand ha
AREA BURNED (1989)	3.3 million ha

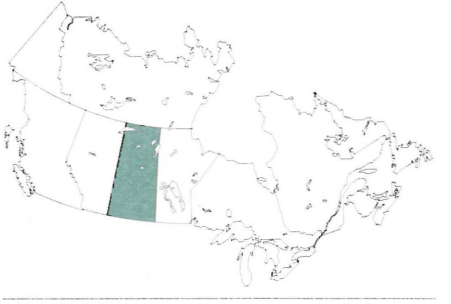
TRADE (1989)	
VALUE OF EXPORTS	$221 million
MAJOR VALUE OF PRODUCTS EXPORTED	
wrapping paper (32%), softwood lumber (30%), newsprint (29%)	
MAJOR EXPORT MARKET	
United States (73%)	
BALANCE OF TRADE	$+99 million

INDUSTRY PROFILE	
TOTAL VALUE OF SHIPMENTS (1988)	$613 million
NUMBER OF ESTABLISHMENTS (1988)	241
Logging: 117, wood industries: 99, paper and allied industries: 25	
FORESTRY-DEPENDENT COMMUNITIES	4
EMPLOYMENT (1989)	10 000 jobs
6 000 direct jobs, 4 000 indirect jobs, 1 job in 50	
WAGES AND SALARIES (1988)	$123 million
NEW INVESTMENT (1989)	not available

SASKATCHEWAN

OWNERSHIP OF PRODUCTIVE FOREST LAND
95% PROVINCIAL
3% FEDERAL
2% PRIVATE WITH 15 000 WOODLOT OWNERS

White birch



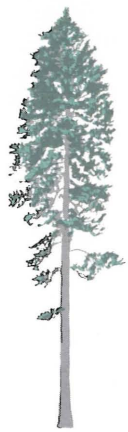
FOREST RESOURCE	
TOTAL AREA	65.2 million ha
FOREST LAND	23.7 million ha
RESERVED FOREST LAND	1.3 million ha
PRODUCTIVE FOREST LAND	15.9 million ha
AREA REGENERATED (1988)	10.9 thousand ha
AREA HARVESTED (1988)	22 thousand ha
DEFOLIATION BY INSECTS (1989)	826 thousand ha
AREA BURNED (1989)	471 thousand ha

TRADE (1989)	
VALUE OF EXPORTS	$275 million
MAJOR VALUE OF PRODUCTS EXPORTED	
wood pulp (52%), other paper and paperboard (37%)	
MAJOR EXPORT MARKETS	
United States (79%), Japan (18%)	
BALANCE OF TRADE	$+257 million

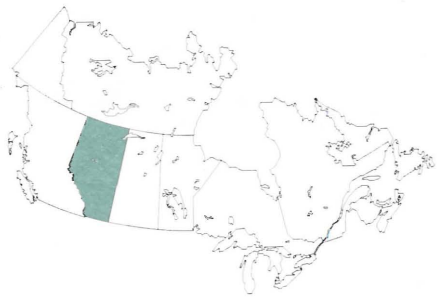
INDUSTRY PROFILE	
TOTAL VALUE OF SHIPMENTS (1988)	not available
NUMBER OF ESTABLISHMENTS (1988)	214
Logging: 143, wood industries: 65, paper and allied industries: 6	
FORESTRY-DEPENDENT COMMUNITIES	7
EMPLOYMENT (1989)	8 000 jobs
5 000 direct jobs, 3 000 indirect jobs, 1 job in 56	
WAGES AND SALARIES (1988)	not available
NEW INVESTMENT (1989)	not available

ALBERTA

OWNERSHIP OF PRODUCTIVE FOREST LAND
89% PROVINCIAL
7% FEDERAL
4% PRIVATE WITH 7 500 WOODLOT OWNERS



Lodgepole pine



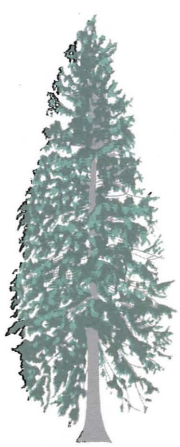
FOREST RESOURCE	
TOTAL AREA	66.1 million ha
FOREST LAND	37.8 million ha
RESERVED FOREST LAND	4.4 million ha
PRODUCTIVE FOREST LAND	25.4 million ha
AREA REGENERATED (1988)	39.1 thousand ha
AREA HARVESTED (1988)	40 thousand ha
DEFOLIATION BY INSECTS (1989)	1.3 million ha
AREA BURNED (1989)	6.4 thousand ha

TRADE (1989)	
VALUE OF EXPORTS	$731 million
MAJOR VALUE OF PRODUCTS EXPORTED	
wood pulp (59%), softwood lumber (23%)	
MAJOR EXPORT MARKET	
United States (92%)	
BALANCE OF TRADE	$+683 million

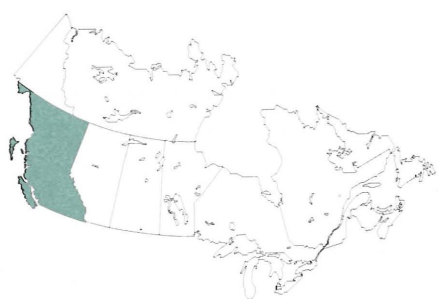
INDUSTRY PROFILE	
TOTAL VALUE OF SHIPMENTS (1988)	$1.6 billion
NUMBER OF ESTABLISHMENTS (1988)	602
Logging: 346, wood industries: 227,	
paper and allied industries: 29	
FORESTRY-DEPENDENT COMMUNITIES	10
EMPLOYMENT (1989)	18 000 jobs
10 000 direct jobs, 8 000 indirect jobs,	
1 job in 67	
WAGES AND SALARIES (1988)	$326 million
NEW INVESTMENT (1989)	not available

BRITISH COLUMBIA

OWNERSHIP OF PRODUCTIVE FOREST LAND
95% PROVINCIAL
1% FEDERAL
4% PRIVATE WITH 21 000 WOODLOT OWNERS



Western red cedar



FOREST RESOURCE	
TOTAL AREA	94.8 million ha
FOREST LAND	60.3 million ha
RESERVED FOREST LAND	2.4 million ha
PRODUCTIVE FOREST LAND	51.1 million ha
AREA REGENERATED (1988)	209 thousand ha
AREA HARVESTED (1988)	244 thousand ha
DEFOLIATION BY INSECTS (1989)	299 thousand ha
AREA BURNED (1989)	25.4 thousand ha

TRADE (1989)	
VALUE OF EXPORTS	$10.2 billion
MAJOR VALUE OF PRODUCTS EXPORTED	
softwood lumber (40%),	
wood pulp (36%), newsprint (10%)	
MAJOR EXPORT MARKETS	
United States (45%), Japan (22%), EEC (21%)	
BALANCE OF TRADE	$+9.7 billion

INDUSTRY PROFILE	
TOTAL VALUE OF SHIPMENTS (1988)	$16.8 billion
NUMBER OF ESTABLISHMENTS (1988)	4 864
Logging: 4 036, wood industries: 763,	
paper and allied industries: 65	
FORESTRY-DEPENDENT COMMUNITIES	103
EMPLOYMENT (1989)	194 000 jobs
99 000 direct jobs, 95 000 indirect jobs,	
1 job in 7	
WAGES AND SALARIES (1988)	$3.1 billion
NEW INVESTMENT (1989)	$3.0 billion

YUKON

OWNERSHIP OF PRODUCTIVE FOREST LAND
100% FEDERAL

FOREST RESOURCE	
TOTAL AREA	48.4 million ha
FOREST LAND	27.4 million ha
RESERVED FOREST LAND	118 thousand ha
PRODUCTIVE FOREST LAND	7.6 million ha
AREA REGENERATED (1988)	233 ha
AREA HARVESTED (1988)	465 ha
DEFOLIATION BY INSECTS (1989)	not available
AREA BURNED (1989)	328 thousand ha

NORTHWEST TERRITORIES

OWNERSHIP OF PRODUCTIVE FOREST LAND
100% FEDERAL

FOREST RESOURCE	
TOTAL AREA	343 million ha
FOREST LAND	61.4 million ha
RESERVED FOREST LAND	1.1 million ha
PRODUCTIVE FOREST LAND	14.3 million ha
AREA REGENERATED (1988)	200 ha
AREA HARVESTED (1988)	399 ha
DEFOLIATION BY INSECTS (1989)	99 thousand ha
AREA BURNED (1989)	578 thousand ha

CANADA'S FOREST RESOURCES

Canada's relationship with its forests has undergone marked change since European settlement in the mid-1500s. Forests were seen first as a source of fur, then as an impediment to transportation and settlement and, finally, in the nineteenth century, as a commercial timber crop. In the last 150 years, the Canadian forest industry has flourished to produce a myriad of solid wood and wood fibre products for markets around the world.

While Canadians have historically viewed their forests as endless, in recent years they have become concerned with forest stewardship and renewal. The perception that Canada's abundant forests may not be without limit has led to the realization that forest management activities must integrate demands for forest products with safeguards for the forest ecosystem, if the benefits of Canada's forests are to be sustained.

In the midst of the continued expansion of industrial development, Canada is experiencing another shift in its relationship with its forests. The Canadian public is looking beyond the trees to other forest values, including recreation, wildlife and fisheries habitat, water supply and wilderness. Forests are becoming valued as places of learning, for the maintenance of biodiversity and for their role in the global ecosystem, as well as for the products and experiences they offer.

The emerging demands on Canada's forest lands pose a significant challenge to forest managers. Planning and administering the forest to satisfy the many different and sometimes competing uses will require all their attention and skill in the years ahead. And the success of Canada's efforts relies heavily on informed decision-making. To plan Canada's forests to meet current and future needs, we must first know what we have to work with. Since at this time most of the knowledge about Canada's forests relates to their ability to grow wood for harvesting, this is where we will begin.

CANADA'S FOREST RESOURCES

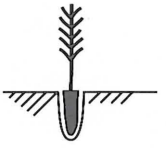
The discussion of Canada's timber resources found in this chapter is based mainly on phase I of Forestry Canada's national timber supply study, entitled "Canada's Timber Supply: Current Status and Outlook", to be published in the spring of 1991. Broader issues relating to the protection and maintenance of the forest environment, including non-timber values, are discussed in Chapter 3: Forestry and the Environment.

The purpose of this chapter is to describe Canada's timber resources, their extent and diversity, how they have been shaped by past development and how they will be shaped in the future by new demands for products and other forest-based values and experiences. We outline the process by which the amount of viable forest land for commercial timber production is determined and the major policies by which this land is managed for sustainable development. As part of this discussion, we introduce specific factors that affect the amount of commercial timber Canada is able to harvest and the means by which we can maintain or enhance this timber supply. Finally, we summarize Canada's timber supply and the challenges that must be addressed to ensure a reliable supply in the future.

Included in this chapter are highlights of a 1990 national survey of professional foresters, regarding their views of forest management and issues facing the Canadian forest sector. A detailed report of the survey findings is available from Forestry Canada.

CANADA'S FORESTS: AN EVOLVING MOSAIC

A forest is the expression of the physical and biological characteristics of a land base, shaped by external forces such as climate and people. The Canadian landscape is vast and biologically complex. The forest topography of the east coast, the Canadian Shield, the dry western prairies and the rainforests of the British Columbia coast all support different species of trees, which grow at different rates and attain different sizes. The result is a rich and diverse forest mosaic.



CANADA HAS 16% OF THE WORLD'S SOFTWOOD RESOURCES

Superimposed on this biological mosaic is a historical/cultural one. Canada's forests have evolved as a result of changes in the ways they have been valued and used.

Prior to the "discovery" of North America by Europeans, native peoples used the forests to meet their needs for shelter, food, clothing, technology and spiritual fulfillment. While their connection to the forest was extensive, their populations were relatively small and their impact on the forest landscape was minimal.

The early Europeans changed the landscape by clearing forests for settlement — mainly housing and agriculture. Preoccupied with fishing, colonizing and the fur trade, the early settlers made little effort to exploit the wood, other than for making furniture, syrup from sugar maples, or potash from hardwood ashes to manufacture into soap.

Not until the nineteenth century were forests viewed as a base for a large-scale commercial enterprise. Napoleon's blockade of Britain's timber supplies from the Baltic led to the first intensive commercial exploitation of Canada's forests. White pine for the masts of British ships and oak for their hulls were the principal uses made of species from the eastern and central Canadian forests.The forest mosaic began to change rapidly once the Europeans developed markets for Canada's timber. When familiar species became scarce in particular regions, the forest industry focused its attention on new ones. Often this meant the development of new technology and even new industries to utilize these species. For example, Canada's pulp and paper industry began with the manufacture of newsprint from balsam fir and black spruce, two eastern species that were plentiful and particularly suitable for the production of paper. In British Columbia and Alberta, lodgepole pine was ignored until sawmill technologies made it profitable to mill a high volume of relatively uniform, small stems.

The development of new uses for forest resources continues to shape Canada's forest mosaic.

This includes the use of under-utilized species, such as poplar and other hardwoods formerly considered "weeds."

As harvesting has fragmented the mosaic, subsequent timber management activities have further modified it. In a number of cases, natural forests have

given way to managed plantations. Species are selected for regeneration based on management objectives and the ecology of the site. Stands are thinned and sometimes pruned. Growing periods are shortened. And forests are protected from fire and pests.

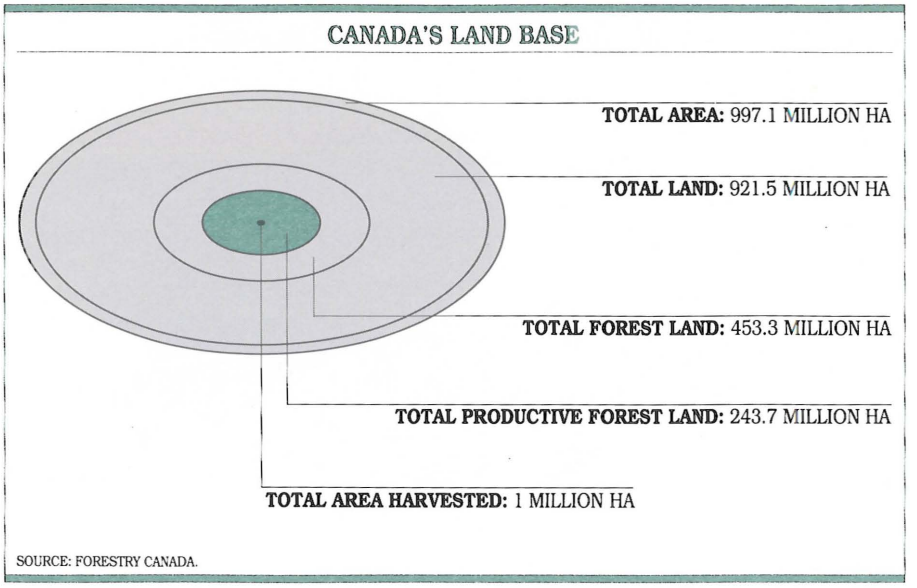
In the future, the forest mosaic will be shaped increasingly by non-timber demands on the forest environment. More natural areas will be managed for wildlife, wilderness and forest recreation. At the same time, it is likely that forest management on specific areas will become more intensive.

The forests in our future will be more planned, managed and regulated in the conscious effort to maintain biological diversity and support a range of forest values.

THE TIMBER RESOURCE BASE

Canada is a vast land, spanning 7 000 km from Newfoundland to Vancouver Island, and an equally large distance from the 49th parallel to the zenith of the arctic tundra. In total, Canada occupies about ten million square kilometres, or about one billion hectares, of which 93 percent is land. Forests grow on half this area — about 453 million hectares, or three times the total land area of Europe.

Canada's 1986 Forest Inventory figures reveal that not all of this land supports trees that can be used commercially. On 154 million hectares, only sparse and stunted trees grow in bogs, swamps and on barren soil; 55 million hectares have not even been inventoried. In total, 209 million hectares of forest land is not considered for harvesting as most of this forest is classified as unproductive i.e. incapable of producing a commercial crop of trees.



Slightly over half of Canada's forest land — 244 million hectares — is designated as "productive forest" in Canada's Forest Inventory. A productive forest is defined as capable of producing a merchantable stand of timber in a reasonable length of time. Of this productive forest land, 8.9 million hectares is reserved and includes parks and other areas where no harvesting is permitted; an additional 1.6 million hectares of this productive forest land is unclassified i.e. not classified as reserved or non-reserved productive forest land. This leaves about 233 million hectares of productive forest that potentially can be harvested. Therefore, of Canada's one billion hectares of land, only about one-quarter supports a productive, growing forest that is available for harvesting.

Of Canada's available productive forest area (233 million hectares), about half is currently estimated to be commercially viable.

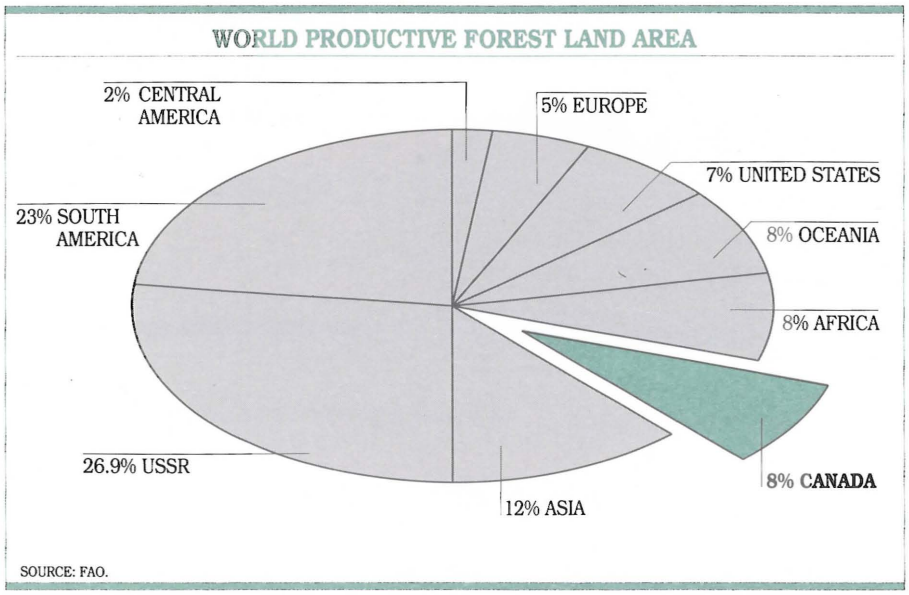
Some forests are in isolated areas without roads or rail links, making labour and transportation costs to mills prohibitive. Much is located on harsh terrain where access is extremely difficult and harvesting is too expensive. For these reasons, in this report we differentiate between the "physical" and "economic" supply of timber within Canada's productive forest land.

The physical supply of timber is related to the growing capacity of the available, productive forest; the economic supply is that portion of the growing capacity that can be profitably harvested and is, therefore, "commercially operable."

The economic timber supply is the portion of the forest that industry is currently using and is likely to continue to use in the immediate future for the production of timber.

The commercially operable portion of the productive forest varies considerably by province, depending on such things as quality of timber, road networks, labour availability, terrain and distance to mills.

CANADA'S FOREST RESOURCES



In the Atlantic provinces, virtually all of the productive forest is commercially viable. In British Columbia, currently only about half is viable, largely due to terrain, and in the Prairie provinces, less than half, due to the characteristics of the timber and the lack of existing infrastructure.

Both the cost of recovery and the market value of timber varies widely across the country.

This is the reason that high value timber in some remote areas may be economically feasible to harvest by helicopter, whereas other species in other regions may not be economically recoverable, except where mechanical harvesting/loading operations can be used.

The economic and biological diversity of our forests means that national inventory figures cannot tell the full story of Canada's timber supply.

FOREST POLICY AND ADMINISTRATION

Timber supply is not determined solely by the availability, productive capacity and economics of the forest land base. It is also influenced by elements of public policy, patterns of ownership and timber pricing.

As indicated earlier, about 80 percent of Canada's productive forest is administered by the provinces. The federal government administers slightly more than 10 percent, and the rest is privately owned. The proportion of private land is much higher in the Maritime provinces than in the rest of the country. In Prince Edward Island, about 93 percent is privately owned; in Nova Scotia, more than 70 percent is private lands, and in New Brunswick, private ownership is about 50 percent.

Quebec has the most privately owned forest land, from which 20 percent of the province's harvest is taken. Conversely, in British Columbia, Alberta, Saskatchewan and Manitoba, only about 4 percent of the provincial productive forest is privately owned. Despite the small percentage of forest land owned privately in British Columbia, the annual volume of private timber harvested is considerably larger than in any other province.

Of the productive forest administered by the federal government, approximately 85 percent is in the Yukon and Northwest Territories, where much of the productive forest land is too remote for large-scale commercial harvesting. Little harvesting takes place on the remaining federal forest lands. Only about 1 percent of the total volume harvested in Canada each year comes from federally administered land, mostly from Indian lands and those managed by the Department of National Defence.

TENURE AND TIMBER PRICING

Harvesting on provincial Crown lands is done almost exclusively by private forest companies under lease agreements with individual provinces. These agreements grant companies the right to cut timber, but provide no rights to the forest's land, water, wildlife or recreation resources. Although there are at least 24 distinct types of forest leases used in Canada, with major differences among the provinces, these can be grouped into three general classes of lease: long-term leases of land area, medium-term leases based on a volume allotment of timber and short-term agreements to harvest small amounts of timber.

Long-term, "area-based" leases (e.g. Tree Farm Licences in British Columbia, Forest Management Agreements in Alberta and Ontario) are commonly granted for 20 to 25 years and can be renewed indefinitely provided the company satisfies the terms of the agreement. The lease provides exclusive cutting rights to the timber and is generally available only to companies with manufacturing facilities that require large volumes of wood annually.

OWNERSHIP OF PRODUCTIVE FOREST LAND

PROVINCE (million ha)	FEDERAL CROWN	PROVINCIAL CROWN [1]	PRIVATE [2]	TOTAL
British Columbia	0.47	48.65	1.98	51.10
Alberta	1.75	22.75	0.94	25.44
Saskatchewan	0.46	15.03	0.39	15.89
Manitoba	0.34	13.49	1.09	14.92
Ontario	0.25	32.39	5.66	38.29
Quebec	0.22	47.97	6.61	54.79
New Brunswick	0.15	2.96	2.98	6.09
Nova Scotia	0.11	1.02	2.71	3.85
Prince Edward Island	-	0.02	0.26	0.28
Newfoundland	0.06	10.71	0.40	11.18
Yukon & North West Territories	21.88	-	-	21.88
CANADA	**25.71**	**194.99**	**23.02**	**243.70**

[1] Includes unclassified land.
[2] Includes municipal land.
Totals may not add exactly due to rounding.
Source: Forestry Canada.

The agreement carries with it many conditions, which may include responsibility for regenerating and tending the area harvested, for protecting the area from fire and pests, and for building roads.

The medium-term, "volume allotment" leases (e.g. Forest Licences in British Columbia, Timber Quotas in Alberta) often extend for a period of 15 or 20 years and may or may not be renewed, depending on the province and the lease. Generally, less forest management responsibility is delegated by the province to the companies holding these types of leases.

The short-term agreements (e.g. Crown Timber Permits in New Brunswick, Letters of Authority in Nova Scotia) carry no management responsibility and are used to allocate small amounts of timber and/or forest land for such purposes as Christmas tree operations, the harvesting of fuelwood and the operation of small sawmills.

In all types of forest leases, the holder of the lease pays a fee to the province for harvesting the timber. This is generally referred to as the stumpage charge.

In a few instances, it may take the form of a ground rent (e.g. Newfoundland) or a royalty on specific types of tenure (e.g. British Columbia). Methods of calculating stumpage differ greatly among provinces. Except in British Columbia, stumpage is generally set by regulations on the long-term leases. The rates may vary according to what has been negotiated, the location of the lease and the value of the end products (e.g. lumber, pulp), but the rate established holds for a specified period of time. Smaller tenures based on volume are usually sold to the highest bidder, although the province may set a minimum price.

Within British Columbia, stumpage prices are determined by what is called the "comparative value pricing system." Annually, the province sets a target for revenue from the sale of all timber harvested. Each lease holder pays a share of this revenue in proportion to the appraised value of the timber to be harvested under the particular lease.

ALLOWABLE ANNUAL CUT AND HARVEST LEVELS

The harvest of timber from Canada's productive forest lands is regulated according to various provincial sustained yield policies whereby the rate at which a forest is harvested is linked to the growth rate of the forest, so that harvesting can continue in perpetuity, although not necessarily at an even-flow level.

The allowable annual cut (AAC) is the mechanism through which harvesting is regulated.

An AAC is determined for each forest management unit, and prescribes the amount of timber that a forest company is permitted to cut annually for a specified period of time. The objective of the AAC is to regulate the harvest to the level at which the forest can produce and sustain an assured annual supply of timber.

A consequence of the sustained yield policy has been the desire to "restructure" Canada's productive forests into forests composed of a range of age classes. In this balanced age class structure, younger stands grow to maturity as older stands are cut. As a result, harvesting can take place on an ongoing basis without depleting the standing stock of timber. In some cases, harvesting may occur at levels above the long-term sustained yield level to capture the portion of mature timber that would otherwise be lost to fire, insects and disease.

There is no "correct" harvest level for a forest.

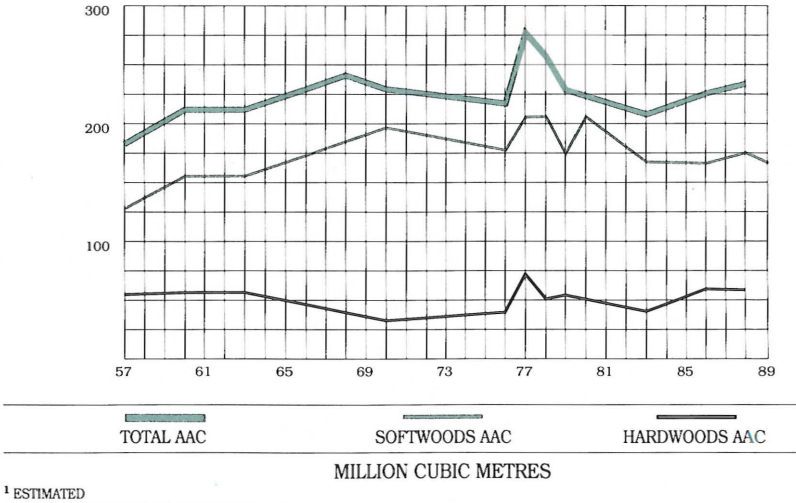
Allowable annual cuts are decided within a policy framework of social, economic and biological factors which reflect the social values prevalent at the time of the development of the policy. These social values include how we value the various resources that the forest offers, how much of those resources we wish to consume now, what we might leave for future generations, and our general feelings about future economic conditions. Setting the AAC for a forest region is a complex decision of crucial importance to the forest industry and forestry-dependent communities. It often requires difficult choices between economic, environmental and aesthetic values.

An AAC is determined by the provincial forestry service for each forest management unit over which it exerts regulatory control.

Each province determines its AACs based on its view of what proportion of the productive forest is considered commercially operable.

For example, in British Columbia, the AAC is based on only about 50 percent of the productive forest land, whereas in Atlantic Canada, virtually all of the productive forest is included when establishing the AAC. In some provinces (Nova Scotia, New Brunswick and Quebec), a quasi-AAC figure is also calculated for non-regulated private forest lands. The total provincial AAC is the sum of the management unit AACs, and the national AAC is the sum of the provincial AACs.

ALLOWABLE ANNUAL CUT (AAC) [1]



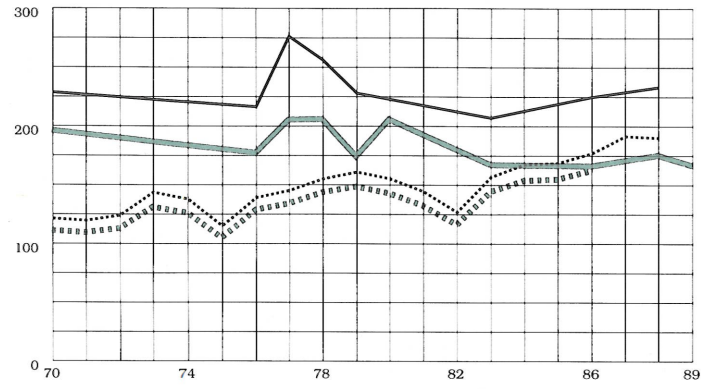
[1] ESTIMATED
SOURCES: FORESTRY CANADA/STATISTICS CANADA.

National allowable annual cut figures provide a general indication of the annual available timber supply in Canada.

The figure above shows that in 1957, Canada's AAC was estimated to be 180 million m^3. This estimate increased gradually through the 1960s and peaked in the mid-to-late 1970s at about 260 million m^3. Estimates since 1980 have levelled off at about 225 million m^3. The current estimate of Canadian softwood AAC amounts to about 170 million m^3, or about 75 percent of the total AAC, and hardwood AAC amounts to approximately 55 million m^3. It must be emphasized that this estimate of Canada's AAC includes only those lands for which AACs are calculated, and thus excludes some private lands. The harvest from private lands excluded from the AAC calculation is significant. In 1986, it is estimated that these lands supplied 20.3 million m^3 of softwoods and 3.1 million m^3 of hardwoods. Little is known about the long-term timber production objectives and capabilities of private landowners. However, it is likely that these lands will continue to produce a significant volume of timber in the future. It is difficult to clearly determine the extent to which the changes in Canada's AAC over the last 30 years are a result of differences in calculation methodologies by the provinces, as opposed to changes in biological, economic or regulatory factors. However, it is likely that Canada's AAC has increased over time as a result of changes in species utilization, silviculture, access, technological developments, etc., and that the levelling off in the early 1980s reflected the growing awareness of the differences between economic and physical timber supply.

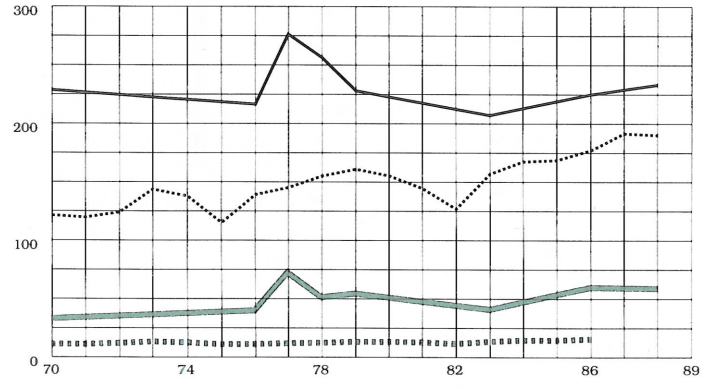
Furthermore, although provincial figures may indicate a surplus, timber supply shortages are known to exist for particular mills or regions.

SOFTWOOD AAC VS HARVEST 1970-1989



SOURCES: FORESTRY CANADA/STATISTICS CANADA.

HARDWOOD AAC VS HARVEST 1970-1989



SOURCES: FORESTRY CANADA/STATISTICS CANADA.

AACs for individual provinces have, until recently, always exceeded actual harvests, leaving a substantial reserve of timber on Crown land for which there had been "no demand."

However, as the above figure demonstrates softwood harvest levels and AACs are now converging primarily as a result of increased softwood harvests. Between 1970 and 1986, the softwood AAC declined from 196 million m^3 to 170 million m^3, while the softwood harvest volume increased from 110 million m^3 to 162 million m^3.

The hardwood situation is quite different. AAC for hardwoods has remained at about 50 million m^3 over the past 30 years, while harvest volumes have increased from 11 million m^3 to 15 million m^3.

FUTURE TIMBER SUPPLIES

Canada's softwood timber supply (as measured by provincial AACs) is nearly fully utilized.

While the national timber supply appears sustainable within the context of the next 30 to 60 years, the adequacy of regional timber supplies will vary considerably over this period, and local supply problems will not easily be overcome.

Canada's healthy supply situation in the short term is, in part, due to the large amount of forest land in Canada which supports forests that are mature and available for harvesting. It also reflects forest management programs that are in place to reduce losses from fire and pests and to enhance the timber supply, such as efforts undertaken to rapidly regenerate cut-over forests.

In the longer term, the supply outlook is less clear. As the demand for fibre continues to increase, Canada's timber supply will have to depend more on intensively managed forests.

MATURITY OF CANADA'S PRODUCTIVE FORESTS

MATURITY CLASS	AREA (million ha)	AREA %	VOLUME (million m³)	VOLUME %
Regeneration	19.8	8.1	140	0.6
Immature	77.8	31.9	5 625	24.3
Mature	83.3	34.2	13 619	58.8
Overmature	13.1	5.4	2 117	9.1
Uneven-aged	0.4	0.2	34	0.1
Unclassified	49.3	20.2	1 618	7.0
TOTAL	**243.7**	**100.0**	**23 154**	**100.0**

Totals may not add exactly due to rounding.
Source: Forestry Canada.

For Canada to increase its softwood harvest rates, substantial enhancements of the resource would be needed. On the other hand, hardwood harvest levels (other than those pertaining to quality hardwoods such as oak, maple, etc.) could be increased substantially without noticeably affecting the supply. Given this situation, what are Canada's options with regard to future timber supplies? An analysis of the factors which affect timber supply (i.e. age class and rate of harvest, silviculture programs, protection efforts, technology, recycling, and land use) may provide some insights.

Although these factors work simultaneously, for clarity we will look at their individual effects on Canada's future timber supply.

AGE CLASS AND RATE OF HARVEST

After many years of commercial harvesting, Canada's productive forests are still predominantly composed of stands of mature and overmature timber.

Many of these stands are more susceptible to fire and insects. Canada's forest industry will remain dependent on this mature stock of timber for the next 30 to 60 years until the regenerated, managed forests are ready for harvesting.

In the short term, there is a lot of timber available for harvest now, and a case could be made for increasing current harvest levels.

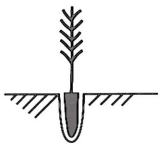
As discussed in the earlier section on AACs, instead of losing the mature and overmature timber to fire, insects and disease, in some cases harvesting is occurring at levels above the long-term sustained yield level. However, if the rate of harvest of mature timber stock becomes too high, then Canada will run out of mature timber before the next crop is ready for harvesting and be forced, at some point in the future, to substantially curtail harvesting or harvest immature trees. Harvesting immature trees diminishes the productive capacity of the forest and reduces the long-term sustained yield harvest level.

The current softwood harvest rate is almost at its maximum on the forest area currently viewed as commercially operable. If the level of cut were increased significantly on this area, reductions in future harvest levels would be required to prevent the reduction of the long term sustained yield capacity of the softwood forest. As indicated earlier, Canada has a considerable surplus of hardwoods and can thus sustain a large increase in their harvest.

SILVICULTURE PROGRAMS

Generally speaking, the sooner productive forests regenerate after harvest (or depletion from other causes), and the faster they grow once established, the greater will be the volume of timber available for harvest and the allowable annual cut.

Historically, Canada's productive forests were cut-over and left to regenerate on their own. Natural regeneration, however, is not always timely, and some cut-over forests may take a long time to regenerate to commercial species. They may be effectively out of production for several decades, resulting in diminished overall crop production levels.



CANADA WILL PLANT CLOSE TO 1 BILLION TREES IN 1990.

AREA OF RENEWAL COMPARED TO HARVEST

YEAR	AREA HARVESTED	AREA PLANTED	AREA OF DIRECT SEEDING	AREA OF SUCCESSFUL NATURAL REGENERATION*	TOTAL AREA SUCCESSFULLY REGENERATED	SUCCESSFUL RENEWAL AS A % OF HARVEST
			(000 hectares)			
1975	682.6	128.0	34.3	341.3	451.4	66.1%
1976	703.7	120.4	35.9	351.9	457.5	65.0%
1977	735.2	121.7	42.7	367.6	478.2	65.0%
1978	823.0	128.0	37.0	411.5	523.2	63.6%
1979	876.4	143.0	39.4	438.2	561.8	64.1%
1980	881.4	152.0	65.0	440.7	585.7	66.5%
1981	802.6	169.6	42.6	401.3	545.4	68.0%
1982	762.9	185.4	50.3	381.5	541.2	70.9%
1983	830.0	215.7	37.3	415.0	588.3	70.9%
1984	898.1	240.0	33.7	449.0	637.2	71.0%
1985	901.6	261.0	26.2	450.8	649.3	72.0%
1986	1 018.7	299.5	26.0	509.4	734.7	72.1%
1987	1 012.9	370.2	37.3	506.4	788.1	77.8%
1988	1 021.6	413.3	37.7	510.8	822.9	80.5%

*Success rates for planting, direct seeding and natural regeneration refer to spruce, pine, and true fir species. These species account for approximately 80% of Canada's coniferous harvest. It was estimated that 50% of all harvested lands became satisfactorily stocked to spruce, pine and true fir through natural regeneration. It was also established that 70.1% of the total planted area became satisfactorily stocked without re-treatment, and an estimated 59.2% of the total direct seeded area became satisfactorily stocked without re-treatment.

Source: Forestry Canada.

In the late 1960s and 1970s, Canadian forest managers began to appreciate that, given the large demand for forest products, Canada's natural productive forests would not sustain production at the levels desired without investment in silviculture (the practice of growing and tending forests).

Over the past 10 to 15 years, Canada has made impressive gains in its silviculture programs, and expenditures on regeneration have increased dramatically.

Between 1975 and 1988, the area treated almost tripled. In 1988 alone, over 413 thousand hectares were planted with over 731 million seedlings. Currently, it is estimated that over 80 percent of cut-over forests are regenerating promptly, either naturally or artificially, a rise of 22 percent from the early 1970s.

The above table shows the increase in silviculture efforts since 1975. These silviculture programs will affect the timber supply in 30 to 60 years, depending upon the nature and location of the particular stand.

There is no doubt that increased silviculture activity will help to sustain Canada's wood supply. However, forest regeneration and tending, as currently practiced in Canada, is expensive, and ways must be found to make it more cost effective. One way is to make it a responsibility of the industry and to depend on their entrepreneurial skills to minimize the costs. It is noteworthy that all of the major forest provinces, including British Columbia, Alberta, Ontario, Quebec and New Brunswick, require the lease holders to ensure timely regeneration following harvesting. British Columbia and Alberta require most lease holders to do this at their own expense. While the lessees are not equity holders in the new crops, this arrangement ensures that they have a continuing vested interest in growing trees as effectively and efficiently as possible.

In the past Canada has been able to depend on "extensive" forestry practices to supply its harvest requirements; it could rely on natural regeneration from a massive productive land base with low operating and investment costs.

In these circumstances, it did not matter that regeneration took a long time, growth rates were mediocre and losses to natural hazards extensive; a larger forested land base could be substituted for intensive crop production.

However, as increasing demands on the forest land base are shrinking the area of productive forest on which timber supply depends, Canada must become more intensive in its management practices.

Canada cannot expect to expand its annual softwood production beyond current levels without substantial investments to raise crop yields.

FOREST PROTECTION

Each year, Canada loses to fire, insects and disease an amount (in cubic metres) of timber nearly equivalent to what it harvests.

In effect, the forest industry is competing with these other agents for available timber. The degree to which Canada can protect its forests from these forces will directly influence its timber supply.

Although forest fire protection programs have become highly efficient and effective, and Canada's ability to deal with insect pests has improved dramatically, the large area of vulnerable forest in Canada makes protection difficult. The frequency and severity of fire and pest damage is strongly influenced by weather patterns, making it difficult to assess the degree of effectiveness of specific control techniques over a given time period. Nevertheless, it is clear that advances in pest control have helped reduce timber losses.

Sizeable gains have been made in protecting Canada's forests against some harmful insects, such as the spruce budworm — the most damaging pest in Canada.

As pointed out earlier, Canada's mature and overmature forests, which represent the major portion of Canada's timber supply, are much more susceptible to fire and pests. The continued ability to protect these forests for commercial use will be particularly important in the next few decades as Canada makes the transition to second growth. Improved protection would seem to be the fastest route to maintaining or even expanding the timber supply, although not necessarily the least expensive.

TECHNOLOGICAL CHANGE

Advances in technology can increase Canada's timber supply by enhancing the productivity of the land base, changing the economics of access and utilization of stands, and improving the manufacture and transport of forest products.

Techniques such as mechanized planting, site preparation and stand tending, and the development of tree improvement and biotechnology programs could increase Canada's wood supply by accelerating regeneration after harvesting and by producing a superior quality tree crop.

Meanwhile, continued improvements in the efficiency and cost effectiveness of access development, logging, manufacturing and transporting roundwood and forest products will effectively increase the operable portion of the commercial forest land base.

Technological advances have already led to the commercial use of species once considered weeds, the production of more lumber and value from each log, and the use of logging by-products (e.g. log ends, cores, trimmed wood and even sawdust) as raw material for pulp and paper. In 1970, chips and residue made up about one quarter of the input for the pulp and paper industry; in 1990, they represent almost 60 percent. The use of computer scanning devices and thinner saws can potentially increase lumber output by 5 to 10 percent without increasing the amount of wood harvested. Each of these improvements serves to increase timber supply by increasing the volume recovered from each tree. Similar gains are being made in the pulp sector, where advances in pulping technologies are resulting in a greater yield of pulp per unit of wood input. Pulp is produced by three methods: chemical, semi-chemical and mechanical.

Today, it takes 2.5 cubic metres of wood to produce one tonne of mechanical pulp, compared with 5.5 cubic metres to produce one tonne of chemical pulp.

Historically, the Canadian industry has been very successful at developing technological innovations to reduce costs and expand utilization. Such innovation must continue in the future if Canada is to sustain its timber supply and industrial base.

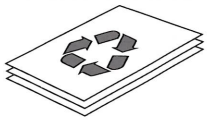
RECYCLING

Canada exports 85 percent of its newsprint (84 percent of it to the United States).

Recent regulations in the United States requiring greater recycled content in their newsprint will have a significant impact on Canadian producers and, ultimately, on timber supply.

Given the cost of collecting and transporting recycled paper to the mills and of building de-inking plants, recycling in Canada is likely to be expensive. Remaining competitive will be an ongoing challenge.

While some promote recycling as a means of decreasing Canada's need for virgin fibre, the argument is not quite that simple. Currently, 60 percent of the wood input to produce Canadian pulp is in the form of wood chips and other sawmill by-products. Whole logs comprise only 40 percent of the pulp and paper industry's raw material, and much of this timber is unsuited to other uses. While few would dispute the benefits to be gained from recycling paper products, the advantages in Canada are more likely to be related to decreasing landfill volumes than to reduced harvesting. The industrial implications of recycling will be discussed more fully in Chapter 4: Canada's Forest Industry.



IN CANADA, WASTE PAPER ACCOUNTS FOR OVER ONE-THIRD OF THE MATERIAL HANDLED BY MUNICIPAL DISPOSAL SYSTEMS.

LAND USE

As Canada enters the 1990s, demands on its forest lands are growing. Wood products, wildlife habitat, water quality, ecological reserves, Indian land claims, wilderness, recreation — all compete for the same forest land base; some compete for the same forests. The key question these demands pose for Canada's timber supply is how much of Canada's productive forest land is to be used for commercial timber production?

The reservation of forests for purposes other than timber production could have a large and immediate constraining effect on Canada's timber supply, with attendant reductions in allowable cuts. Reduction in the commercial forest land base is likely to have significant negative economic impacts, especially since Canada's softwood stocks are already almost fully committed.

To offset the effects of land withdrawals, it will be necessary to continue to invest in intensive forestry practices to enhance the timber supply on the land available. This could include such measures as artificial regeneration with improved seedlings; thinning and fertilizing stands; improving protection measures to reduce annual losses to fire and pests; improving access to currently inaccessible forests; improving utilization of timber supply (species and logs); and allocating surplus AAC.

In some cases the competing demands for forests are sufficiently compatible to be combined with commercial timber production.

In some situations, this integrated, multiple-use approach to forest management can offer greater benefits to Canada's citizens than allocating forest land to single uses.

Integrated forest management has achieved some positive results and warrants considerable attention in the years ahead.

While the economic costs of sharing the commercial forest have yet to be determined, it is almost certain that integrated forest management will be the way of the future. The successful integration of timber production with other objectives in the forest landscape will be required to sustain Canada's timber supply. This topic will be addressed more thoroughly in subsequent reports in this series.

SUMMARY AND CONCLUSIONS

This review of Canada's timber supply raises a number of questions that Canadians will need to grapple with as they consider the future of their forests and forest industry.

In the medium term (30-60 years) Forestry Canada's study suggests that there are adequate timber supplies to support the current level of industrial activity.

At the same time, industrial growth based on softwoods appears to be limited within the context of the economically available timber supply. This raises the question as to whether, through technological development, Canada can move the economic margin to take advantage of those timber resources which are apparently available physically but not economically.

The removal of forests from timber production for other reasons may have a serious impact on the existing level of industrial activity. The overall softwood supply and utilization situation suggests that there may be real risks to Canada's industrial economy if timber resources are removed from the commercial forest. These risks will need to be assessed carefully when dealing with conflicting forest-use issues.

Undoubtedly the overall view of the supply and demand situation masks local timber supply shortages and/or shortages of particular quality material for specific product uses. Where this is the case, the results on local industry and particular communities can be devastating.

At the same time, there is potential for growth in some areas, based on under-utilized hardwood stocks and softwood supplies that are currently uneconomic to harvest. Again, whether Canada can take advantage of this timber supply will depend on its ability to continue to find new markets and make products as efficiently as its competitors.

In the longer term, Canada's timber supply prospects are less clear.

Significant reductions in allowable cuts may be required if the current over-supply of mature forests is used up before the new forest is ready to be harvested. Silviculture and technological development may minimize these supply problems. However, in planning expenditures for the development and management of new forests, Canada must ensure that the most productive and accessible sites receive the highest investment priority. This is essential for meeting both productivity and economic efficiency goals.

There are also questions about the quality of the new forests in the longer term. For instance in some regions, such as coastal British Columbia, a significant stock of forests are particularly valuable for the manufacture of high-value solid wood products. Whether the managed forests that replace them will offer the same quality of product is uncertain.

Assessing the state of Canada's commercial forest resource is a difficult and dynamic exercise. In considering the future of Canada's commercial forest and the industry that depends upon it, it is important to remember that Canada has a large available resource base, a growing commitment and capability to manage the forest, and a tradition of being able to adapt to changing circumstances in the forest. This is not meant to minimize the problems associated with complex forest resource issues. But it is clear that with good management, Canada can look forward to a continuing flow of economic benefits from its forest resources.

The sustainability of Canada's forest sector will be determined by its success in maintaining the productivity of its forests and reconciling competing demands.

RESULTS OF SURVEY

OF PROFESSIONAL FORESTERS

INTRODUCTION

Professional foresters play a critical role in the management of Canada's forests. They provide expertise and advice to governments and the forest industry on most aspects of forest management, as well as research, education and policy development. They also provide important perspectives on forestry issues to the Canadian public. According to a 1989 national survey conducted for Forestry Canada, Canadians consider these professionals to be among the most credible sources of information on forestry matters.

To acquire the foresters' perspective on issues facing the sector, Forestry Canada commissioned a cross-Canada survey of 4 500 professional foresters in September of 1990. The survey was conducted by Omnifacts Research Limited in conjunction with Environics Research Group Limited and CROP Incorporated. Highlights of this survey are presented in the following pages. While the survey findings may not concur with the information provided elsewhere in this report, and while the views expressed are not necessarily those of Forestry Canada, the survey results have been included in this document because of Forestry Canada's desire to promote debate and discussion on the country's most important resource sector.

SURVEY HIGHLIGHTS

The survey findings are presented by topic, and results are expressed in percentages. The responses do not always total 100 percent, since not every forester responded to every question. A more detailed report of this research is available from Forestry Canada.

CURRENT FOREST CONDITIONS

Less than three in ten Canadian foresters rate the current condition of forests in their province as excellent (1%) or good (27%). A majority (56%) say their forests are in fair condition, while another 14 percent rate them in poor condition. Forest conditions are assessed most positively in British Columbia and Alberta, while negative ratings are most evident in Quebec and Newfoundland. Foresters are most likely to identify forest management practices as the single most important factor affecting forest conditions.

FOREST PROBLEMS

Among the various problems currently affecting forests in their province today, foresters are most likely to rate as very or somewhat serious the level of funding for forest management (88%, with 50% indicating the problem is very serious), funding levels for research and development (81%) and disease and insect damage (77%).

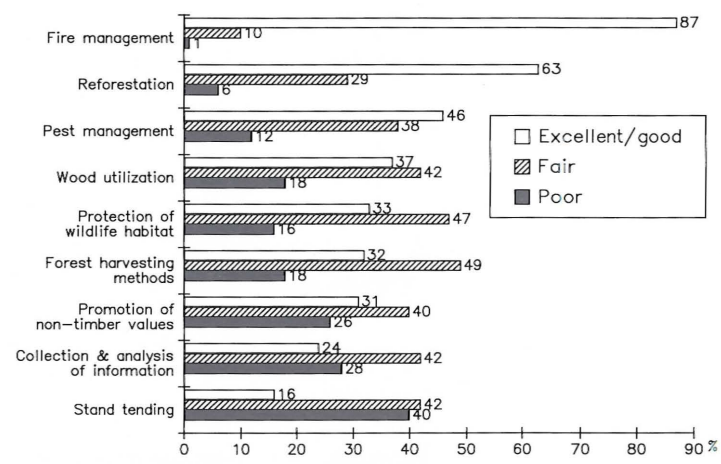
Other problems viewed to be very or somewhat serious by a majority of foresters include the rate of forest harvesting (67%), harvest practices (66%), the administration of forest lands (64%), and the conversion of forest lands to other uses (53%). Fewer than half express such concern about atmospheric pollution (40%), forest fires (38%), the number of trees planted (37%), wildlife management (33%) and climate change (17%). Foresters across the country differ somewhat in the problems they view as serious.

CURRENT FOREST MANAGEMENT PRACTICES

One quarter of Canadian foresters believe that an excellent (1%) or good (24%) job is currently being done in managing the forests in their province.

A majority (55%) indicate that a fair job is being done, while one in five (19%) says forest management is being poorly done. Positive assessments of forest management practices are most widespread in Alberta (46%), New Brunswick (43%) and Manitoba (39%), while least evident in Quebec (13%), Newfoundland (11%) and Saskatchewan (10%). Foresters also rated nine specific areas of forest management (FIGURE 1).

1. CURRENT FOREST MANAGEMENT PRACTICES IN PROVINCE



FORESTRY CANADA / SURVEY OF PROFESSIONAL FORESTERS IN CANADA

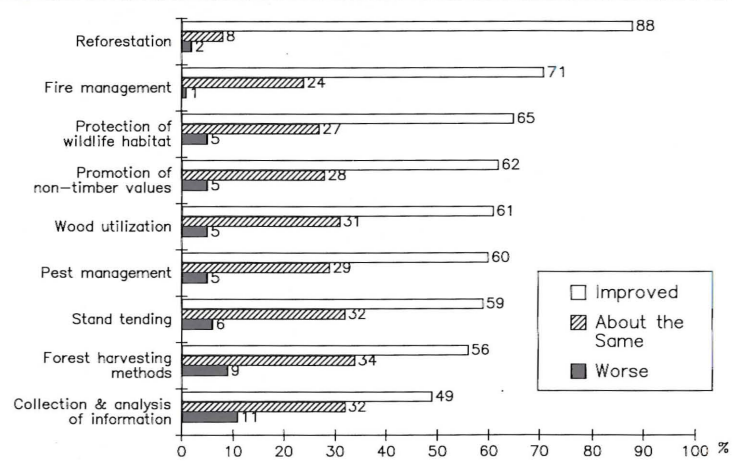
CHANGES IN FOREST MANAGEMENT PRACTICES

Foresters were also asked to identify those areas in which they feel such practices have changed for the better and for the worse over the past 10 years. Improvements were most likely to be mentioned in the areas of reforestation (regeneration, planting) (40%) and harvest planning and practices (35%).

Other improvements mentioned include a higher priority on integrated management, non-timber values and environmental protection (24%), more active and positive government involvement (e.g. legislation, standards, funding) (24%) and better overall forest management planning and inventory (15%).

Seven in ten (70%) also identified areas in which they believe forest management practices are now worse than they were 10 years ago. One in three mentions issues related to harvesting practices, while a similar proportion identify inadequate government commitment in terms of inadequate policy and enforcement, reductions in funding and programs, or excessive bureaucracy and politics. Overall, however, foresters are more likely than not to see forest management practices as having improved over the past 10 years (FIGURE 2).

2. CHANGES IN FOREST MANAGEMENT PRACTICES OVER PAST 10 YEARS



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PROVINCIAL GOVERNMENT PERFORMANCE

A third (33%) of foresters across the country say their provincial government is doing an excellent or good job in managing forest lands, while half (50%) give a fair rating and another 17 percent believe they are doing a poor job. Canadian foresters are most positive about the job being done by their provincial governments in the areas of fire management (87% excellent or good) and reforestation (56%), while least positive in terms of stand tending (19%) and public information and education (18%).

More than half express the view that provincial enforcement of regulations and guidelines is generally much (17%) or somewhat (36%) too lenient, compared to only 14 percent who consider such enforcement to be too strict. Not surprisingly, most (73%) foresters employed by government consider enforcement to be too lenient, compared to only a fifth (21%) of those working for the forest industry.

FEDERAL GOVERNMENT PERFORMANCE

Only in the area of research does a plurality (39%) of foresters believe the federal government is doing an excellent or good job. Areas least likely to receive this assessment include public information and education (15%), funding for forest management (13%), trade and market development (10%) and policy development and legislation (8%). Significantly, a third or more of foresters did not feel they were sufficiently informed to rate federal government activity in the areas of forest lands management, support to private woodlot owners, economic analysis and trade and market development.

Foresters do believe progress has been made through the federal-provincial Forest Resource Development Agreements (FRDAs) that have been in place over the past several years, with most saying these agreements have had a major (47%) or moderate (33%) impact on forest management in their province.

FOREST INDUSTRY PERFORMANCE

Three in ten (31%) foresters believe the forest industry is doing an excellent or good job of managing forests in their province, compared to 46 percent who give a fair rating and 23 percent who say the industry is doing a poor job.

Foresters are most likely to say the industry is doing an excellent or good job in fire management (58%) and reforestation (53%), while less than one in five gives such ratings in the areas of pest management (19%), stand tending (19%), consideration of non-timber values (14%), public information and education (12%), and research (5%).

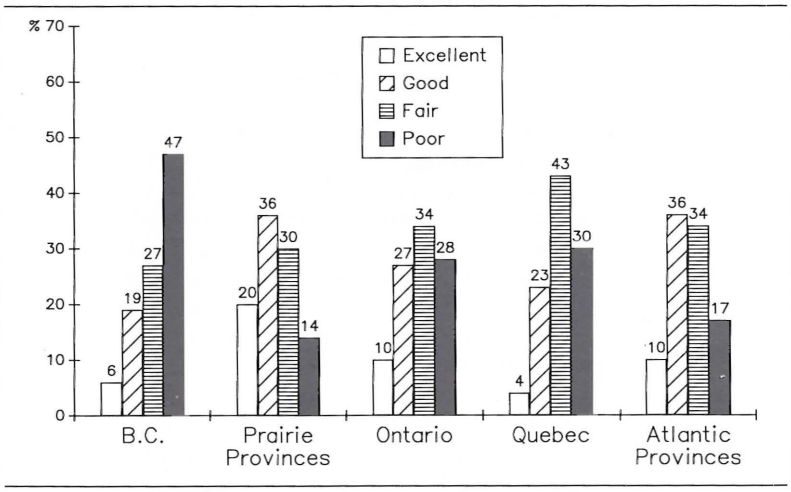
One in five (22%) believes that private woodlot owners are doing an excellent or good job of managing forest lands in their province. Another third (34%) give woodlot owners a fair rating, while 28 percent say they are doing a poor job.

WOOD SUPPLY

While foresters generally agree that forest management practices have improved, they also express concern about the long-term availability of forest resources. Most foresters strongly (34%) or somewhat (42%) agree that there is a growing scarcity of timber in Canada today. This view is most widely held in Quebec (86%, with 44% in strong agreement), Saskatchewan (97%) and Newfoundland (86%).

Only three in ten rate the prospects of sustaining the current supply of harvestable wood in their province as excellent (7%) or good (24%), with the majority rating such prospects as either fair (33%) or poor (34%). Concerns about long term forest sustainability are most pronounced in B.C., where close to half (47%) rate the prospects as poor (FIGURE 3).

3. PROSPECTS FOR SUSTAINING CURRENT SUPPLY OF HARVESTABLE WOOD IN PROVINCE



FORESTRY CANADA / SURVEY OF PROFESSIONAL FORESTERS IN CANADA

ALLOWABLE ANNUAL CUT

Across Canada, six in ten foresters say the current Allowable Annual Cut (AAC) in their province is either definitely (17%) or likely (44%) too high, while half as many (31%) consider the provincial AAC to be about right and only three percent believe it is too low. Foresters in B.C. (72%) and Quebec (62%) are particularly likely to say that AAC levels are too high.

STUMPAGE FEES

As well, foresters are more likely than not to be critical of the stumpage fees and costs currently charged to timber producers in their province. Less than four in ten (38%) consider these charges to be appropriate, while 40 percent say they are too low and another 13 percent believe they are too high. Foresters in Ontario (49%) and Quebec (43%) are among those most likely to say stumpage fees and costs are too low, whereas B.C. foresters are evenly divided between those who say they are too high (25%) and those who consider them too low (26%).

NSR LANDS

Foresters' generally positive views about improvements in reforestation are reflected in the finding that half (49%) say the amount of "not satisfactorily restocked" or NSR land in their province is decreasing, twice the proportion who indicate such land is increasing (25%) or who say it is remaining stable (22%). Most (68%) B.C. foresters say NSR lands are decreasing, but this view is shared by less than half in Quebec (43%) and Atlantic Canada (44%), while pluralities in Ontario (42%) and the Prairie provinces (46%) say that NSR lands are on the increase.

FOREST PRESERVATION AND OLD GROWTH FORESTS

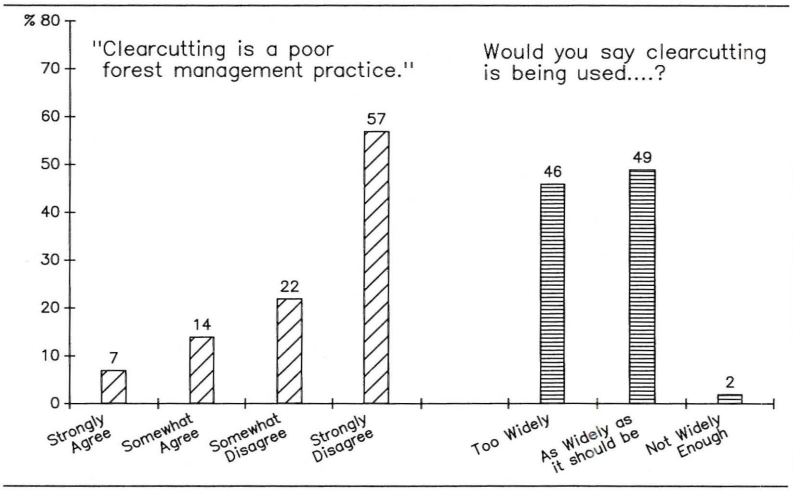
Despite concerns about the long-term wood supply, half (52%) of Canadian foresters believe that the right amount of "reserved" forest land is currently set aside in their province. Three in ten (31%) say this amount of land is too little, while another 12 percent say it is too much.

More than seven in ten foresters across Canada strongly (39%) or somewhat (34%) disagree with the view that "most old growth forests in Canada should be protected." Most (66%), however, also believe that the current controversy over old growth forests in Canada is primarily a function of conflicting values and priorities concerning the role old growth forests should play in society and ecosystems, while one in four (25%) attributes the controversy to misunderstanding and confusion about such forests.

CLEARCUTTING

Most foresters in Canada strongly (56%) or somewhat (22%) disagree with the view that "clearcutting is a poor forest management practice", while only one in four is strongly (7%) or somewhat (14%) in agreement. Rejection of this view is almost universal in B.C. (90%) and strongly held everywhere else, except in Québec where 40 percent of foresters agree that clearcutting is a poor practice.

4. VIEWS ON CLEARCUTTING



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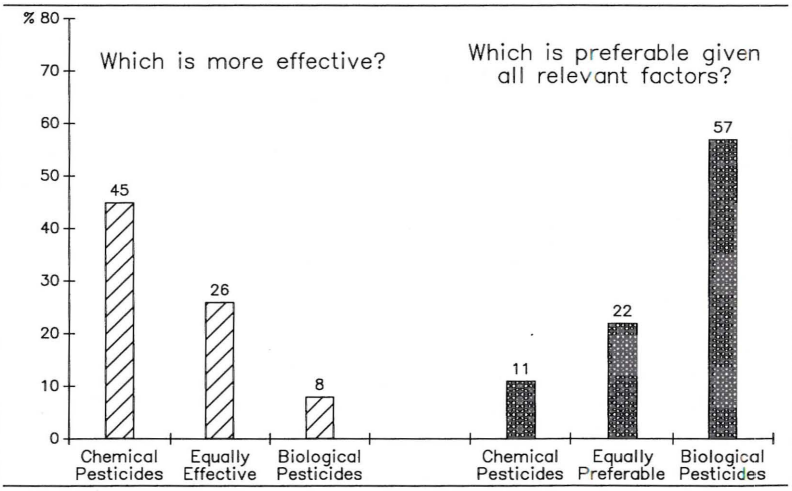
5. CHEMICAL VERSUS BIOLOGICAL PESTICIDES



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Québec foresters are also more likely than those elsewhere to express reservations about clearcutting, with 61 percent saying this harvest method is too widely used in Canada. This view is least evident among foresters in Ontario (39%) and B.C. (40%), as well as among those employed in the forest industry (25%) (FIGURE 4).

PESTICIDE USE

Foresters are more likely than not to consider biological pesticides to be less effective than chemical pesticides a view most strongly held in New Brunswick (72%) and Newfoundland (68%). However, when asked to indicate a preference "given all relevant factors", a majority (57%) of foresters across the country choose biological pesticides over chemical ones (FIGURE 5).

FORESTERS' VIEW OF PUBLIC OPINION

Foresters perceive a significant gap between their own views and what they see to be the public's opinion on key issues involving clearcutting, chemical hazards in forest management and old growth preservation. Given this discrepancy, it is not surprising that most (77%) consider the public to have a poor understanding of forest issues (FIGURE 6).

PUBLIC INVOLVEMENT IN FOREST MANAGEMENT

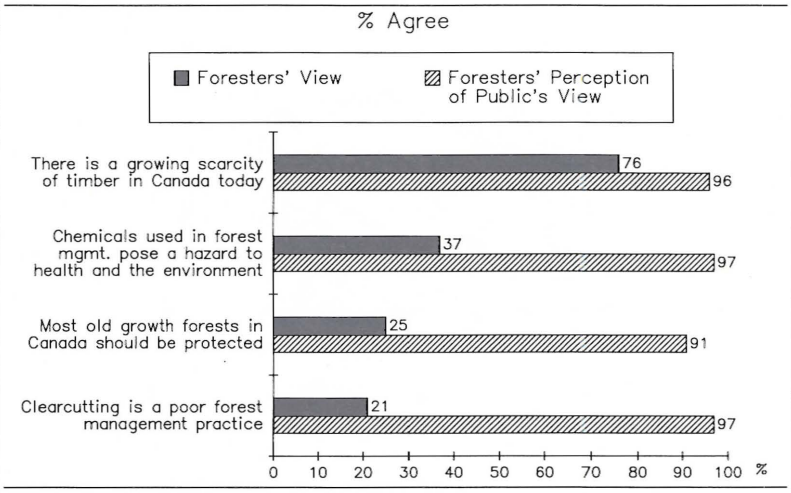
While most foresters consider Canadians are not well informed about forestry, most believe the public has a legitimate role to play in forest management decisions. Only one in five (22%) believes the public currently has too much influence on such decisions, compared to a majority who say they have either the right amount (40%) or too little (34%) influence.

Current opportunities for public involvement are most widely seen as excellent or good by foresters in Ontario (45%) and B.C. (40%), while this assessment is least evident in the Atlantic provinces (15%) and Quebec (11%, where 59% rate the opportunities as poor) (FIGURE 7).

FORESTERS INFLUENCE ON PUBLIC OPINION

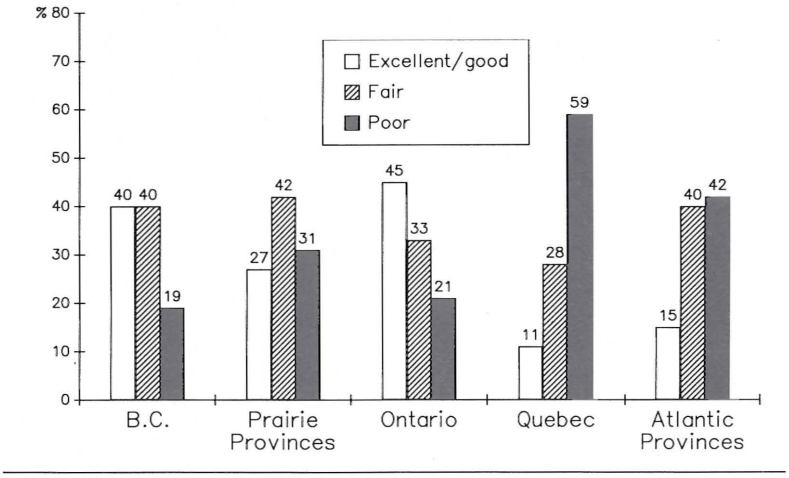
Foresters appear to share the public's view that they are a highly credible source of information on forest issues, with a plurality (42%) identifying their profession as the group that could be the most effective in influencing the public. Considerably fewer believe the public would be most influenced by media personalities (19%), environmental and wilderness groups (15%), government and industry scientists (12%) and government (2%) or industry (1%) officials.

6. FORESTERS' VIEW VERSUS PUBLIC'S OPINION



FORESTRY CANADA / SURVEY OF PROFESSIONAL FORESTERS IN CANADA

7. OPPORTUNITIES FOR PUBLIC INVOLVEMENT IN FOREST MANAGEMENT DECISIONS IN PROVINCE



FORESTRY CANADA / SURVEY OF PROFESSIONAL FORESTERS IN CANADA

STUDY CONCLUSIONS

The survey provides an assessment of forest management across Canada from the perspective of those professionals who possess the most expertise and direct involvement in this activity. Foresters are distinctly positive about some aspects of forest land management as it is practiced today, particularly in the areas of fire management and reforestation. Moreover, there is broad agreement that forest management practices have improved over the past 10 years, with many citing advances in integrated forest management and planning, attention to non-timber values and new government initiatives.

But foresters express criticism as well. There is widespread concern about the long-term sustainability of forest resources across the country, and a majority of foresters are lukewarm to negative about many areas of forest management in their province (particularly in the area of stand tending). Governments come under widespread criticism, notably in terms of inadequate funding for forest management and research, overly lenient enforcement of regulations and too little public education and information. Foresters are most critical of the federal government, an opinion which appears to be based partly on a lack of awareness of its role in the forest sector. As for the Canadian public, foresters consider it to be largely ill-informed about forestry issues, but at the same time they accept the public as having a legitimate role in forest management decisions.

Quebec foresters stand out from their colleagues elsewhere in expressing a perspective that is closer to that of the general public on such issues as clearcutting, pesticide use, old growth preservation, public involvement, and criticism of the forest industry. In B.C., the perspective is more in line with that of the industry itself, with greater criticism of governments and opposition to public sentiment on such issues as clearcutting and old growth preservation.

Considered as a whole, the foresters' perspective on forest management in Canada is neither the bright one portrayed by the industry nor the gloomy one espoused by environmental and conservation interests, but shares elements of both. As experts with direct involvement in the sector who also command the public's trust, foresters occupy a unique position from which they can make a constructive contribution to addressing the issues and challenges confronting the future management and protection of Canada's forests.

FORESTRY AND THE ENVIRONMENT

To a large extent, forests characterize Canada's environment and in many ways symbolize the health of the nation. To maintain its prosperity and preserve future options, Canada must safeguard the character and well-being of its forest lands.

There are many issues facing Canada with respect to forestry and the environment. Issues range from macro-level topics such as climate change and the carbon balance, to national issues of land-use allocation and protection, to regional issues of integrated resource management and to local, micro issues regarding specific management standards and practices. All have an influence on the health and long-term productivity of Canada's forests.

In this inaugural report on the State of Forestry in Canada, we focus on the larger of these environmental issues and review Canada's status with respect to the carbon balance, acid rain, climate change and biological diversity. Forest management practices are addressed only in general terms, to provide an indication of the topics that will be covered in subsequent reports. Discussions of Canada's efforts to address specific environmental issues regarding timber production and manufacturing are found in other chapters, and these too will be examined in more detail in the future.

We begin this chapter with a look at the process by which matters relating to the environment are being pursued in Canada. We reflect on the need to grow beyond the industrial perspective that has historically coloured our evaluation of forest resource use, and on the need to develop new systems to manage forests for changing objectives and to monitor our progress towards achieving them. Following discussions of the environmental issues noted above, we conclude with a summary of Canada's agenda to improve its future performance with respect to environmental issues.

EXAMINING VALUES AND MEASURING PERFORMANCE

While forest management in Canada has historically focused on timber and fibre production for industrial use, in recent years forest managers have recognized more non-timber values such as wilderness, wildlife, water and fish resources, recreation, cultural and aesthetic values.

More recently, ecosystem stability and biodiversity have been added to the list of forest management objectives.

Realizing these objectives will necessitate vast changes in the ways Canadians have traditionally perceived, described and evaluated their forests. Having identified new objectives for its forests, Canada must now develop the language and other mechanisms necessary to incorporate them into forest planning and management processes.

Current forestry terminology is geared towards timber production. "Non-productive forest lands" mean not productive for growing commercial crops of timber, "NSR" means not suitably restocked with commercial tree species. If we are to successfully adopt a more broad-based view of our forests, we must include in our vocabulary terms that acknowledge forest values beyond timber. We must become more explicit in our management objectives with respect to these values to enable the development of management systems by which to achieve them; and we must establish appropriate mechanisms by which to monitor our progress towards these objectives.

To address the first of these issues, The Canadian Council of Forest Ministers will sponsor a program this year to revise and refine the Canadian Forest Sector Strategy. The current Strategy, completed in 1987, represented the views of all stakeholders in Canada's forests at that time. In a series of regional and national forums in 1991, this Strategy will be reviewed to identify current forest values and to refine forest management priorities for the 1990s. The next State of Forestry report will present the values coming out of these forums and some suggestions of how Canada might begin to measure its performance with respect to these values.

Monitoring provides the feedback necesary for Canada to continuously evaluate its progress towards its goals. Though Canada has developed a relatively sophisticated set of performance indicators for the industrial sector, as yet there are no comparable means with which to measure performance in the non-industrial sector. Additional work is required to assess the effectiveness of current forestry practices in meeting a broad range of forest values , and to modify current practices or develop new ones to achieve non-timber objectives.

ONE ACRE OF HEALTHY FOREST PRODUCES ABOUT 4 TONNES OF OXYGEN PER YEAR.

More comprehensive information is also needed on the implications of development for the environment. While environmental impact research studies and the national forest health monitoring system provide some measure of the effects and implications of development on the environment, they are not sufficient. To address this need, Canada will be developing a more comprehensive program of environmental monitoring.

THE CARBON CYCLE

One of the major issues facing Canada and the world is the prospect of climate change.

Concern is focused on the build-up of atmospheric greenhouse gases, primarily carbon dioxide, which can lead to major changes in global temperature.

Much of the current debate centres on the expected magnitude of that change and the speed at which it might occur. In normal concentrations, carbon dioxide acts something like the glass of a greenhouse; it allows the sun's rays to penetrate and warm the earth, but then traps the longer-wave heat rays that would otherwise radiate back into space.

The increases in temperature and changes in precipitation that are part of the projected climate change are likely to affect Canada's forests in several ways. These include:

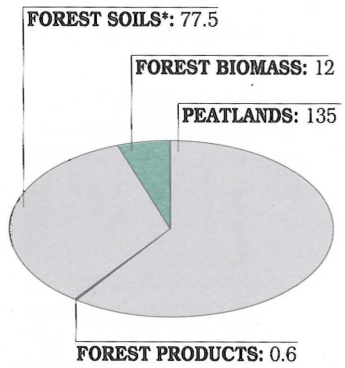
- a change in growth rates as the atmospheric environment changes
- a northward movement of forest boundaries
- differing sensitivities to change among various species in the forest, with some insect pests and diseases being affected initially
- increases in the number and severity of fires
- changing opportunities for land use.

While there is potential for significant impacts from climate change, forests also form critical elements in the carbon cycle, which is the genesis of climate change.

The main sources of increases of carbon dioxide in the atmosphere are energy consumption and deforestation. Each year, 5 to 6 billion tonnes of carbon are released as carbon dioxide by the combustion of fossil fuels (oil, gas and coal); up to 2 billion tonnes are released in the clearing of tropical forests. If the trend is to be reversed, humans must control their appetite for energy, and they must maintain the world's forests.

PRELIMINARY ESTIMATES OF CURRENT CANADIAN FOREST SECTOR CARBON INVENTORY

BILLION TONNES



Forest biomass includes carbon in living forest vegetation; soils include carbon in forest floor litter and decomposing material accumulated over many years; forest products include materials harvested over the last 40 years.
*There is an unknown overlap between forest soils and peatlands.

SOURCE: FORESTRY CANADA.

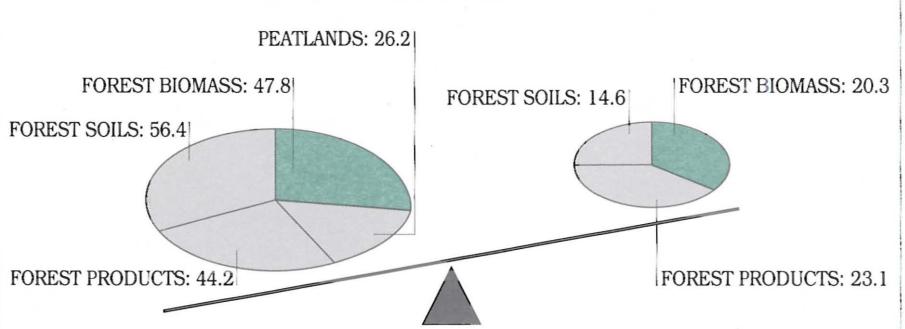
Forest ecosystems are by far the largest terrestrial photosynthetic systems.

During photosynthesis, trees remove carbon dioxide from the atmosphere and store the carbon for decades or centuries in woody biomass - trunks, branches and roots.

The management of these ecosystems presents a major opportunity to intentionally remove carbon dioxide from the atmosphere. Consequently, the world's forests have a major influence on both the removal of carbon from the atmosphere as they grow, and the release of stored carbon into the atmosphere through the natural processes of wildfire or decay, or through forestry activities such as harvesting or the burning of slash. When forest lands cleared by harvesting, fire or other disturbances are not reforested, the environment's capacity for "fixing" atmospheric carbon is greatly reduced.

CANADIAN FOREST SECTOR CARBON BUDGET 1986 [1]

MILLION TONNES



The net accumulation of carbon in Canada's forests is estimated to be 116.4 million tonnes. The accumulation of carbon in forest biomass is the net increase in forest vegetation before releases due to current-year disturbances other than harvesting. (The 44.2 million tonnes transferred to forest products is shown.) Disturbances, including fire, mortality caused by insects, and releases associated with harvesting (including slashburning), are represented in the release from forest soils and biomass. Releases from 40 years of carbon accumulated in forest products (including land fills) are included in the forest products release estimate. Peatland release of an estimated 0.6 million tonnes of carbon as methane is accounted for in the accumulation figure.

SOURCE: FORESTRY CANADA. 1. PRELIMINARY ESTIMATES. (ESTIMATES FOR FOREST SOILS ARE UNDER REVIEW).

Half the dry weight of a tree is carbon. Canada's trees contain an estimated 12 billion tonnes of carbon, yet this is only slightly more than the amount the world pours into the atmosphere every 2 years as fossil fuels are burned. In addition, a large quantity of carbon resides in forest soils and peatlands. Forest products also contain a small but manageable amount, bringing the Canadian carbon total to an estimated 225 billion tonnes.

A recent study by Forestry Canada indicates that in 1986, Canada's forests may have removed as much carbon from the atmosphere as Canada produced. After allowing for losses from decomposition and burning, a net 116 million tonnes of carbon were added to Canada's forests and peatlands. This is remarkably close to the estimated 114 million tonnes of carbon released from fossil fuels in the same year. Current data indicate the same positive trend in carbon accumulation in every region of the country, except the most northerly areas.

Canadian forests clearly play a positive role in addressing the global problem of atmospheric carbon dioxide. Preliminary estimates indicate that in 1986, Canada's forests sequestered as much carbon as emitted by Canada's industrial activities.

This contribution could be enhanced through aggressive reforestation programs, fire suppression and reduced slashburning, recycling forest products

(which also contain stored carbon), as well as alternative harvesting and silvicultural practices that improve forest growth.

Carbon sequestering is greater in young, fast growing trees whose biomass growth is larger than in mature, slow growing trees.

By ensuring adequate regeneration, Canada's forests can continue to act as an important sink for atmospheric carbon.

ENVIRONMENTAL ISSUES

While many of the factors that affect the vitality of forest ecosystems are largely beyond our control, many others can be influenced by or are a direct result of human activities.

Some of the factors that affect the well-being of our forests are themselves influenced by forest dynamics. Thus, while air pollution leading to global warming will affect the growth and vitality of our forests - these forests, by absorbing carbon dioxide from the atmosphere, can help maintain the carbon balance and help to prevent climate change.

Bioenergy

In addition to their role as a carbon sink, forests can contribute to the carbon budget by reducing the use of fossil fuels.

Forest biomass can be converted to various forms of energy either directly through burning or indirectly through chemical and biological conversion to fuels such as ethanol and methanol. The use of forests for this purpose may allow significant quantities of fossil fuels to be replaced by a renewable fuel that, if managed properly, is carbon neutral. Provided that forests are replaced, they will continue to withdraw carbon dioxide from the atmosphere through photosynthesis, and this may offset the carbon added to the atmosphere through their use as fuel.

Canada's ENFOR (ENergy from the FORest) Program was established in 1978 with the objective of generating sufficient information and technology to enable a significant increase in the contribution of forest biomass to the country's energy supply. When it was initiated, the contribution of forest biomass to Canada's energy supply was about 4%; today, at least partly as a result of ENFOR, this has risen to 7%. Through this program, Canada has been able to determine the quantities of forest biomass that are available nationally and develop efficient ways of harvesting and transporting them. It has also supported the development of techniques for establishing and managing short-rotation forests of species such as poplar and willow for energy purposes.

Acid Rain

Like carbon dioxide, the problem of acid rain is attributed to the impact of industry on the atmosphere. Concern about the effects of acid rain on forests reached a peak in Europe in the 1970s; shortly thereafter, similar symptoms, including reduced growth, loss of vigour and even mortality, were recognized in both Canada and the United States.

Much has been learned about the nature and effects of acid rain during the past decade, including the fact that the phenomenon is caused by a wide variety of air pollutants.

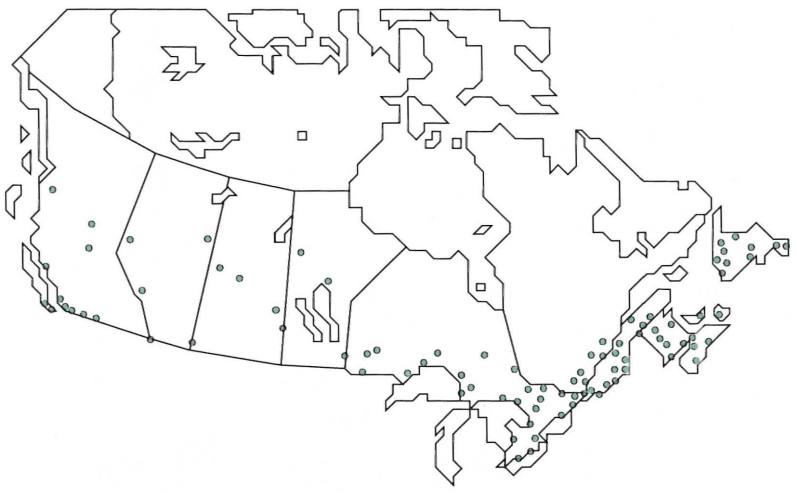
In addition to the increased acidity of precipitation, indirect or secondary effects include increased levels of pollutants such as sulphates, nitrates, volatile organic compounds, heavy metals and ozone. These can seriously affect the health, growth and physiological functioning of ecosystems. The greatest pollution load occurs in eastern North America, and so it is important to implement effective pollution control regulations on both sides of the Canada - United States border.

To assist in this task, a national forest health monitoring system (the Acid Rain National Early Warning System, or ARNEWS) was put in place in 1984. This system originally focused specifically on acid rain and its possible impact on the forest. It has since been broadened to a more comprehensive network for monitoring changes in the health and vitality of a representative series of forest ecosystems in response to acid rain, and other pollutants and forms of stress from both natural and human sources. There are now over 100 sampling sites established within the network, primarily in the more southern parts of the country, where pollution levels are highest. The map on the next page shows the locations of the ARNEWS plots.

The ARNEWS network is a long-term undertaking, and it has thus far provided no evidence of large-scale, catastrophic forest decline. However, local and regional declines have been observed; these include damage to maple forests in Quebec, leaf browning on birch believed to be caused by "acid fog" and possibly ozone in the Bay of Fundy region of New Brunswick, and foliar damage to Douglas-fir in parts of British Columbia.

The monitoring system, fully developed and implemented in Canada, has attracted much attention in other countries, and monitoring networks

ARNEWS NETWORK



SOURCE: FORESTRY CANADA.

modelled in part on ARNEWS are now in place or will soon be established in the United States, Mexico and parts of Europe.

Under the federal government's Green Plan announced in December 1990, ARNEWS will be expanded to extend the network in Canada and to include more forest types and tree species. The objectives will also be broadened to include monitoring of responses to possible climate change.

Programs are now underway in Canada to assess and monitor the possible effects of climate change on forest ecosystems, to develop computer models for predicting the probable impact on forest resources and the forest sector, and to develop appropriate options for action.

Maintaining Biological Diversity

The world's forests are a rich web of soils, plants, animals, insects and fungi that comprise a multitude of diverse ecosystems. The wealth of genetic material each ecosystem contains provides a buffer against changing circumstances and enables species to survive where individuals cannot.

In our use of these systems we have relied, often unthinkingly, on this inherent resilience and ability to withstand external pressures and continuously supply our needs. However, the rapid increase in recent years in the extinction of plant and animal species, particularly in the tropical forests, and the destruction of many unique forest habitats, has forced us to realize that natural resilience has its limits and that we have already reached or exceeded those limits in many parts of the world. By damaging or destroying some ecosystems, we lose habitat, species and, potentially, all the genetic material contained therein.

MORE THAN 70 SPECIES OF MAMMALS LIVE IN CANADA'S FORESTS.

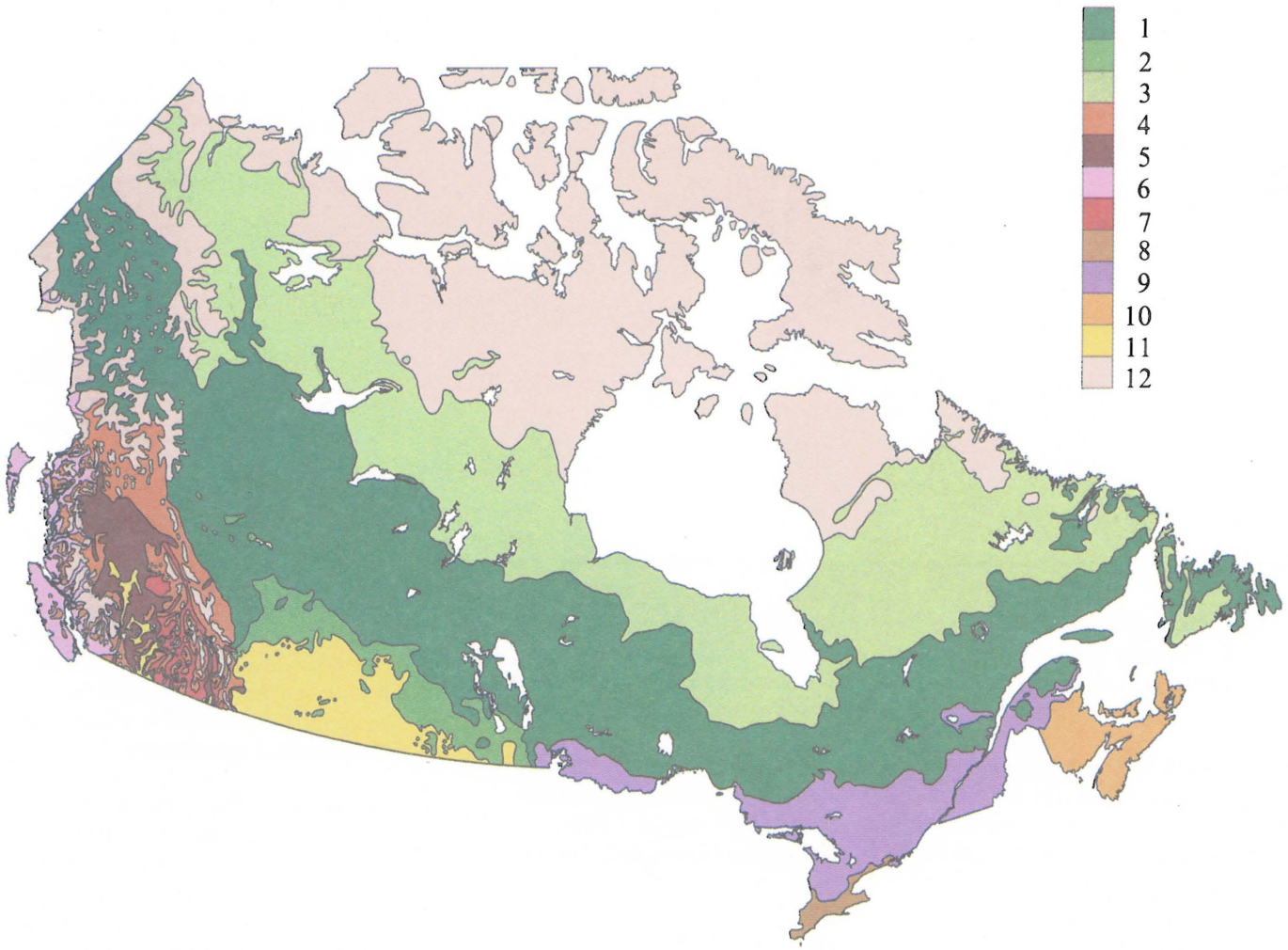
During the Green Plan consultations, Canadians expressed concern over the loss of biodiversity in Canada's forests.

Canada has endorsed the objectives and recommendations of the World Conservation Strategy (1980) and the Brundtland Commission Report (1987) aimed at ensuring the preservation, maintenance and sustainable use of species and ecosystems. Implementation of these recommendations by the forest sector as a whole will take time and will require the full cooperation of industry and all levels of government.

As one of the Green Plan initiatives, Canada will establish a National Seed and Gene Bank to conserve the existing genetic variation within our native tree species and to promote and coordinate, with provincial governments and the private sector, research into genetic resources conservation and use. It is hoped that the centre will eventually have an international scope and thus provide an avenue for assisting developing nations in preserving their forest germplasm resources.

In response to the acknowledged concern for maintaining genetic diversity, Canada is starting work to protect its forest ecosystems so that species can evolve and adapt within changing environments. Biodiversity must be addressed in a number of ways to ensure that species diversity is maintained throughout the world.

"HIGHLY PROTECTED" CONSERVATION AREAS BY FOREST REGION



Forest Region Number	Forest Region Name	Number of Conservation Areas	Conservation Area (ha)	Forest Region Coverage (%)
1	Boreal - Predominantly Forest	188	5,983,337	2.31
2	Boreal - Forest and Grassland	16	342,298	1.71
3	Boreal - Forest and Barren	28	1,649,879	0.81
4	Subalpine	31	1,542,772	6.65
5	Montane	24	273,566	1.98
6	Coast	62	307,915	2.84
7	Columbia	5	5,249	0.12
8	Deciduous	29	8,588	0.49
9	Great Lakes - St. Lawrence	281	225,531	0.67
10	Acadian	47	194,625	1.67
11	Grassland	21	135,328	0.55
12	Tundra	44	21,033,992	6.89
TOTAL		**776**	**31,703,080**	

Sources: Environment Canada/Forestry Canada.

The global forest community faces many challenges to maintain the world's biological diversity.

Ecological Reserves

While Canada needs managed forests to achieve specific objectives, it also needs unmanaged forests to keep learning about the dynamics of natural forest ecosystems and to incorporate this growing knowledge into its management strategies. As well, these original ecosystems serve as benchmarks against which we can assess the effects of various land-use practices and monitor changes in the atmosphere.

Ecological reserves provide areas for the study of how natural forests function in the absence of human intervention and provide habitat for scarce species associated with particular forest ecosystems.

While Canada has recognized the importance of retaining examples of its original ecosystems, progress in establishing a national network of ecological reserves has been rather slow. The Canadian Council on Ecological Areas, established in 1982, has done much to encourage the selection, protection and maintenance of reserves, and to promote cooperation among member agencies. In the Council's National Registry of "highly protected" reserves, there are now 776 national parks, provincial ecological reserves, and other federal and provincial protected areas.

The Canadian government has expressed a strong commitment towards the preservation and protection of the great variety of complex biological systems found in Canada's forests.

Through the Green Plan, the federal government will seek the cooperation of provincial governments to complete the national network of ecological reserves to maintain the genetic stock of Canadian forest ecosystems in their natural state.

THERE ARE 34 NATIONAL PARKS IN CANADA COVERING 18.2 MILLION HECTARES, AND OVER 1 000 PROVINCIAL PARKS WITH AN AREA OF 15.6 MILLION HECTARES.

Forest Management Practices

To achieve multiple resource goals within Canada's forest landscapes, we must perpetuate the ecological systems in which they exist. As a result, forest management must continue to progress towards the management of systems rather than the management of single resources or products.

Forests must be planned and managed at the landscape or "big picture" level in order to coordinate events, monitor the cumulative effects of forest activities, and prevent fragmentation of the forest environment. They must also be managed at the forest stand or "small picture" level to determine management objectives, integrate uses, and safeguard forest ecosystems.

Today, Canadian forest managers must strive to integrate timber production techniques with the maintenance or enhancement of non-timber values while undertaking actions to protect the forest from the ravages of fire, insects and disease. The inventory and assessment of these values, and the development of management systems to integrate them, are major themes that Canada will pursue through the 1990s, along with the maintenance of environmental stability and health.

Knowledge of the complexities and dynamics of forest ecosystems must be incorporated into planning and management regimes. Forest management decisions must take into account the potential impact of actions on the long-term productivity of forest soils, on unique and irreplaceable fisheries and wildlife habitats, and on the diversity of genetic material presently stored within our forests. They must also take into account the danger of creating artificial habitats and forests that may be more susceptible to hazards such as disease, insect epidemics or changes in climate. To this end, work is taking place across Canada to improve information, analytical capabilities, management and monitoring systems. A few of these are noted below; others will be addressed in future reports.

Integrated Forest Pest Management

At present, insects and disease claim nearly the equivalent of two-thirds of Canada's annual harvest. In addition, the successful regeneration and growth of forest plantations is often hampered by competition from other plant species. While Canadians continue to recognize the need to protect forest resources, they are also demanding that pests be managed in more environmentally

sensitive ways. Consequently, forest scientists have focused their attention on developing Integrated Forest Pest Management (IFPM) practices that take a more ecological approach to the problem.

One such approach involves the use of biological rather than chemical methods of controlling forest pests. Both at the national and the international levels, a major effort is under way to develop new biological controls for insects and diseases. The biological insecticide *Bacillus thuringiensis (B.t.)*, and a number of other viruses used in insect control have been developed by Forestry Canada and other forest research agencies. In addition, important research in biotechnology is being carried out to increase the effectiveness of a variety of natural products used to control major insect pests such as the spruce budworm, hemlock looper and gypsy moth. Disease-causing organisms such as fungi are being studied as well to determine if they can be used to control insect pests or reduce the effect of certain weeds that compete with tree growth.

THE DEVELOPMENT OF *B.T. (BACILLUS THURINGIENSIS)*, AND A NUMBER OF OTHER VIRUSES AS BIOLOGICAL CONTROL AGENTS HAS GREATLY ENHANCED CANADA'S CAPABILITY TO PROTECT ITS FORESTS WITH MORE ENVIRONMENTALLY BENIGN PRODUCTS.

Central to the development of pest control strategies is the federal requirement for registration of pest control products. The federal pesticide registration process has been the subject of a thorough review in 1990. Although only two percent of all pesticides applied in Canada are used in forest management, the use of chemical insecticides continues to be viewed with concern, and as part of Canada's Green Plan, research in IFPM will be accelerated to develop alternative strategies. New developments will be discussed in future reports.

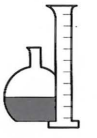
Fire and the Environment

Annual fire occurrence in Canada has increased steadily over the last 60 years, from approximately 6,000 fires a year between 1930 and 1960, to almost 10,000 fires during the 1980s. This is largely a reflection of a growing population, increased forest use and improved methods of fire detection. In 1989, Canada experienced the most severe fire season on record, with 7.3 million hectares of forest land being burned. The figure on the next page shows the number of fires and hectares burned from 1980 to 1990. Although these losses are severe, substantially greater losses would have occurred without Canada's advanced fire management technology.

Although fire threatens life and forest values, it is also important to recognize that fire is a natural and functional part of the forest ecosystem. It contributes to pest control, vigorous regeneration and the maintenance of a diversity of forest habitats. Some forest ecosystems, such as the boreal forests, depend on fire to regenerate and to maintain their species diversity.

Fire is also used as a forest management tool to clear post-harvest debris in preparation for planting, to destroy pests such as dwarf mistletoe in logging slash and, in some ecosystems such as lodgepole pine, as a means of stimulating natural regeneration.

In recent years, growing environmental concerns have emerged over the impact of smoke from wildfires and operational prescribed burns on both local air quality and atmospheric chemistry. As a result, smoke control programs have been instituted across the country and prescribed burning has been reduced as forest managers have searched for other ways to prepare forest sites for planting.



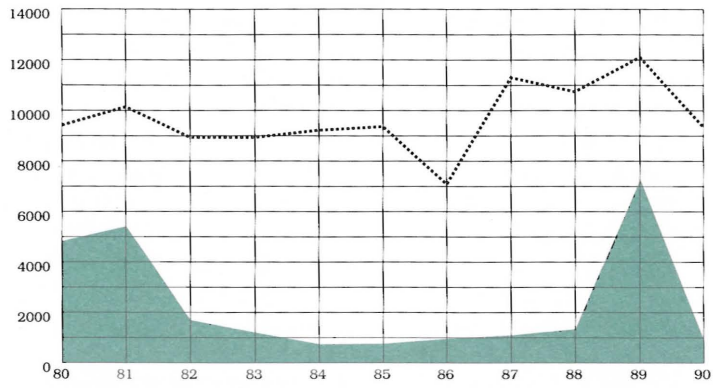
CANADA IS RENOWNED FOR ITS WORLD-CLASS RESEARCH AND DEVELOPMENT OF FOREST FIRE MANAGEMENT AND PREDICTION SYSTEMS.

Elsewhere in the world, there has been a dramatic increase in biomass burning, especially in tropical forests. This has caused the level of greenhouse gases in the atmosphere to rise substantially, contributing to ozone depletion and climate warming. Through the International Global Atmospheric Chemistry Project, a study involving scientists from Canada and many other countries has been undertaken to evaluate the effect of biomass burning on the atmosphere. These scientists are attempting to determine the flow of gases into the atmosphere as a result of biomass burning and the ultimate effect this will have on the earth's climate.

Harvesting and Silvicultural Practices

A shift in public sentiment has reduced the value of the timber resource relative to the values of other forest

FOREST FIRES 1980 - 1990



SOURCE: FORESTRY CANADA.

resources such as recreation, wildlife habitat, viewscapes and wilderness. With this increase in non-timber values, the extent and methods of timber harvesting have become the subject of considerable professional and public debate.

In addition to those resources that can be extracted from or enjoyed within the forest, Canadians have also begun to value forest ecosystems as repositories of natural forest processes that can be studied to increase our knowledge of forest science. Much research is under way to develop resource management strategies that maintain the genetic and species diversity of forests to ensure ecosystem stability.

Silvicultural systems designed primarily to achieve timber production goals are being modified to achieve new management objectives, including those for protection, wildlife, fisheries, recreation and other values. Timber production goals must also be re-evaluated with respect to current issues such as old-growth forests.

Research into new methods to minimize environmental impacts (e.g. longline yarding) must also continue. And new practices, such as increased wood utilization on cutover areas, increased use of a range of partial cutting systems, and greater mechanization in forestry operations will require continued monitoring and research into their potential impact on forest soils and water. Regulations and guidelines to control almost all aspects of timber production and minimize the impacts on other resources and the environment have been in place in all jurisdictions across Canada for a number of years.

IN 1989, 12 105 FOREST FIRES BURNED 7.3 MILLION HECTARES OF FOREST LAND.

Much progress has been made over the past 10 years in Canada's harvesting and silvicultural practices. Canada must continue to upgrade its knowledge and skills in forest management techniques.

CONCLUSION

Sustainable Development

There is now broad concensus in Canadian society that sustainability must be the goal in the use and development of natural resources.

> Canada must plan and manage forest lands in a manner that will sustain ecosystems, perpetuate socioeconomic activity and maintain the quality of life.

To achieve this objective, Canada must integrate environmental, economic and social values.

The Canadian Council of Forest Ministers, at a meeting in Halifax in 1990, strongly endorsed the principle of sustainable development with respect to Canada's forests. This commitment was confirmed by the federal government in its Partners for Sustainable Development program within the Green Plan. Through legislation and the national Green Plan, Canada has made commitments to broaden the knowledge base for a spectrum of resource values and to develop the analytical capability to determine which management systems and techniques can be employed to achieve the desired management goals in each of the country's diverse ecosystems.

The Partners for Sustainable Development program contains four objectives which will form the core of Forestry Canada's efforts through the 1990s.

1. To establish large-scale exemplary models of " best forest management practices" within Canada's productive forest lands. This will be accomplished through effective working partnerships with industry, provinces and other stakeholders with federal leadership through the provision of science, technological expertise and support.

2. To accelerate and expand forestry research leading to the development of a new array of environmentally sound management technologies and strategies by:

- better defining values to be sustained for maintaining the health of forest ecosystems
- developing methods and systems to conserve and protect biodiversity of forest ecosystems
- developing and implementing a new generation of forest pest management strategies to respond to public concern regarding the use of insecticides and herbicides
- putting in place advanced forest fire management information systems
- developing more environmentally acceptable processes for the production of wood-based products.

3. To enhance environmental databases and to expand existing forest-health monitoring networks to obtain relevant, timely and authoritative information on the state of Canada's forest ecosystems and on the multiple values of the forest estate.

4. To develop data management and decision-support systems for holistic decision-making that takes into account all forest values.

Canada is not alone in grappling with issues of sustainable development. Today, environmental considerations occupy a central position on the agenda of most national governments. For instance, plans are being currently formulated for the 1992 United Nations Conference on Environment and Development to be held in Brazil. International conventions on climate change, biodiversity and the sustainable development of the world's forests are expected to be debated for future adoption by the United Nations. Among the issues to be addressed are those of shrinking forest cover and subsequent watershed degradation (particularly in the tropics), the effects of air pollution on forest growth, and loss of genetic and species diversity, wildlife habitat and soil productivity.

As the world's principal trader of forest products and custodian of 10% of its forests, Canada is a major participant in the development of these conventions, and is expected to assume an international leadership role.

The sustainable development of Canada's forest resources will require a more holistic approach to forest management.

Forest management decisions will inevitably become increasingly complex and interrelated; there will be many more courses of action and consequences to be considered.

A number of tools have been developed to assist resource managers in their interactions with the public and in analysing the implications of different resource management scenarios. Ecological classification schemes that indicate appropriate silvicultural treatments for various ecosystems have been developed in many provinces. Computer models have been constructed that indicate the potential course of insect infestations and show how IFPM strategies can be implemented quickly. Geographic information systems create a planning environment in which managers can take all forest values into consideration in their decisions. Other new technologies, such as expert systems and remote sensing, permit managers to look at social, economic and ecological issues that could have a bearing on their management plans.

While these tools can assist us in identifying options and analysing their economic, environmental and social implications, technology alone will not achieve better resource management or sustainability.

To achieve sustainable development of all its forest resources, Canada must build on its research strengths, improve its understanding and abilities with respect to managing ecosystems, develop a current perspective on the major values of its forests and put the systems in place to achieve these objectives. Progress in these areas will be the focus of future reports.

CANADA'S FOREST INDUSTRY

The forest industry is a major engine of Canada's economy, and its future development affects all Canadians, particularly those in communities which are forestry-dependent.

Many factors shape the setting in which Canada produces and sells forest products. Among them, the advent of new competitors, changing consumer preferences and concerns for the environment present major challenges. The industry's ability to invest and restructure to meet these challenges will affect Canada's ability to take advantage of future market opportunities. This chapter provides an overview of Canada's forest industry, focusing on the current market situation, key issues facing the industry and its prospects in the future.

Canada holds a significant place in the global market for forest products. It is the largest producer of newsprint (31%), second largest producer of pulp (16%) and ranks third in the world production of softwood lumber (16%).

Canada exports more manufactured forest products than any other nation. The United States is Canada's largest customer, purchasing 65 percent of its exports, followed by the European Economic Community (15%) and Japan (11%).

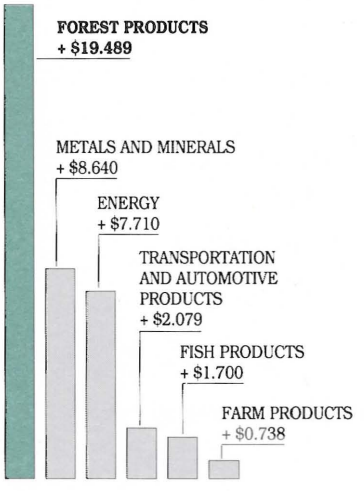
In 1988, Canada's manufactured forest products shipments were valued at $49 billion. Forest sector exports in 1989 were valued at $23 billion, representing 17 percent of all Canadian exports. Since Canada is a major producer of forest products and imports very little, the forest industry has a large surplus in its balance of trade; greater than the combined trade surplus of agriculture, fishing, mining and energy.

CANADA'S FOREST INDUSTRY

Almost 50 percent of Canada's forest products are exported to other countries, predominantly the United States, and mainly in the form of wood pulp, newsprint and softwood lumber.

FOREST PRODUCTS CONTRIBUTION TO BALANCE OF TRADE 1989.

BILLIONS OF DOLLARS



SOURCE: STATISTICS CANADA.

Directly and indirectly, the forest industry provides 888,000 jobs or 1 out of every 14 jobs in Canada, and employs 7 percent of our labour force. About 135,000 workers are employed in the solid wood products sector, 145,000 workers in the paper and allied sector, 56,000 workers in the logging industry and another 13,000 in the forestry services industries. The forest industry also supports a growing equipment manufacturing sector, and has a strong forestry consulting community that is respected world-wide.

FOREST INDUSTRY SUBSECTORS AND PRODUCTS

INDUSTRY CLASSIFICATION	COMMODITY CLASSIFICATION
Forestry services	
Reforestation services	
Forest protection services	
Forestry nursery services	
Logging	**Primary wood products**
Firms harvesting logs and pulpwood	Logs and bolts
Firms delivering logs and pulpwood	Pulpwood
to mills	Poles, pilings, fence posts
	Fuelwood
	Wood chips
Wood industries	**Wood-fabricated materials**
Sawmills and planing mills	Lumber
Shingles and shakes mills	Shingles and shakes
Veneer and plywood mills	Veneer
Sash, door and other millwork	Plywood
Wooden boxes and pallets	Particleboard
Coffins and caskets	Waferboard
Other wood industries	Other:
	Sash, door,
	Kitchen cabinet,
	Bathroom vanity,
	Box, pallet,
	Coffins
Paper and allied industries	**Wood pulp and paper products**
Pulp mills	Wood pulp
Newsprint mills	Newsprint
Paperboard mills	Other paper and paperboard:
Other paper mills	Book and writing,
Asphalt roofing	Fine tissue and sanitary,
Paper box and bag	Wrapping,
Other converted paper	Paperboard,
	Converted paper,
	Building paper and board

SOURCE: STATISTICS CANADA.

While the total number of forestry related jobs is likely to remain stable, there will be a continuing shift from low-skill to high-skill occupations accompanying the industry's increasing automation and adoption of new electronic and other processing technologies. Training and re-training will continue to be important manpower issues in the forest industry.

INDUSTRY STRUCTURE

The Canadian forest industry can be classified into four major subsectors: forestry services, logging, wood industries, paper and allied industries. Together, these subsectors make a substantial contribution to Canada's economic and social development, balance of trade and employment.

CANADA'S FOREST INDUSTRY

Forestry is the life-blood of many regional economies and nationally contributes about 3.4 percent or $19.7 billion, to our gross domestic product (GDP). Of this, about 1 percent comes from the solid wood products industry, 1.6 percent from paper and allied industries and about 0.8 percent from forestry services and logging.

From its start in eastern Canada in the early 1800s, Canada's forest industry has diversified into a variety of products and services. Of these, the solid wood products and pulp and paper sectors provide the backbone of the industry.

Over time, forest companies have become increasingly integrated. Most paper and all newsprint is now manufactured in integrated mills where the pulp is both produced and converted into paper products.

Less integration exists between primary and secondary processing in the solid wood products sector, where smaller secondary wood manufacturers, such as those making sashes and doors, tend to buy lumber from the larger primary producers.

The industry has also progressively improved its utilization and economic return from each log. The highest grade logs are used to produce veneer and plywood, while the lowest grade logs become pulp. As well, each portion of the log is allocated to its highest value end-use. Through the use of scanners, bucking and sawing optimizers, and high-precision saws, each log is cut to maximize its value. Further efficiencies are realized as the solid wood products and pulp and paper sectors become more integrated. Chips, shavings and sawdust produced as by-products of lumber production are important raw material for pulp and panelboards, while lower-grade wood residues are used for energy. And formerly undesirable "weed species" such as poplar are now used to produce waferboard, oriented strand board and some pulps.

Virtually all of Canada's harvest is processed by domestic mills; exports of unprocessed wood, including logs, pulpwood and chips, comprise less than 6 percent of the total timber harvest.

STATE OF THE INDUSTRY

As a major exporter, Canada's forest industry is extremely sensitive to fluctuations in world demand, product prices and the value of the Canadian dollar.

Slumping world-wide demand and lower prices for commodity products such as lumber and pulp, together with high interest costs and a strong Canadian dollar relative to the United States dollar, have led to an overall decline in profitability in the Canadian forest industry in the last year. Profits over the first half of 1990 were down more than 50 percent relative to the same time period in 1989.

IN 1989 CANADA'S FOREST INDUSTRY CONTRIBUTED $20 BILLION TO THE CANADIAN ECONOMY; NEW INVESTMENTS WERE WORTH $8.9 BILLION.

The forest industry is strongly tied to the business cycles of the economy. Economic slowdowns and high interest rates affect housing starts and expenditures on renovation, which have an impact on the lumber and panel industries. Similar repercussions occur in the pulp and paper sector, where business lows mean reduced advertising which, in turn, affects paper sales.

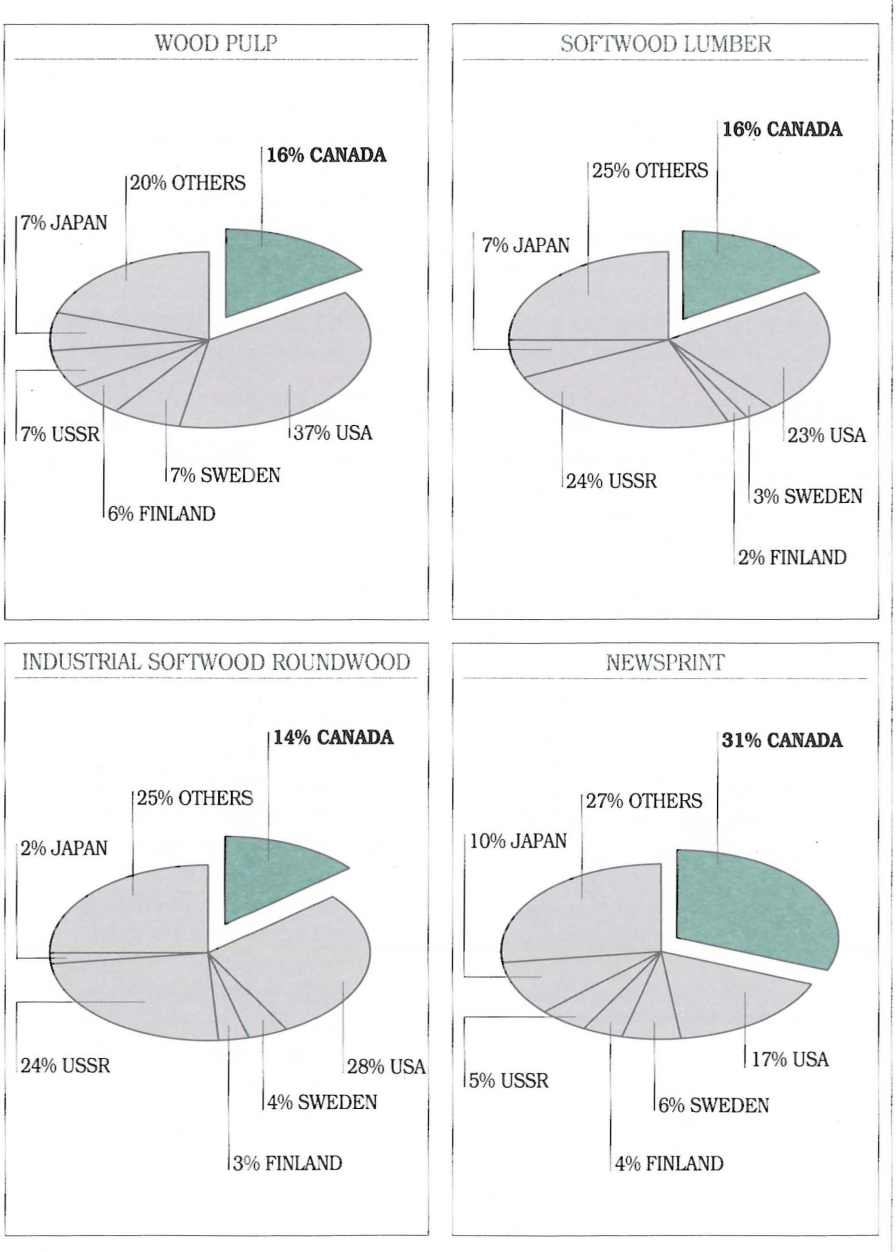
The Canadian pulp and paper industry is currently on the downward side of a cycle, following five years of solid growth.

Record profits in 1987, 1988 and part of 1989, led to heavy investments in increased capacity, technological updating and the implementation of environmental safeguards. Increases in capacity as a result of these investments are only now coming onstream — at the very time when demand is declining — thus exacerbating profitability problems. For example, five new newsprint machines came online in North America in 1990, and an additional six machines are scheduled for operation in 1991. These new production facilities, in combination with other factors, have contributed to a drop in newsprint prices. The price drop, the high Canadian dollar, and increased production costs have essentially eliminated the profit margin for newsprint in Canada over the short term.

Softwood kraft producers also faced a 5 percent price drop in 1990. Lower operating rates and lower earnings have resulted as production is curtailed to prevent further price decreases. Overall,

CANADA'S FOREST INDUSTRY

CANADA'S SHARE OF WORLD PRODUCTION OF FOREST PRODUCTS
1988



SOURCE: FAO.

earnings after taxes in the pulp and paper industry in the first half of 1990 were down 65 percent compared to the same period in 1989.

Canada's solid wood products industry is in a similar downswing. Profits for the lumber industry peaked in 1987 and have deteriorated since. Changing demographics have resulted in decreased demand for residential housing, and growth in repairs and remodelling, as well as non-residential and industrial construction. Relatively high interest rates in Canada and the United States over the last few years have further dampened demand both for new construction and renovation. Strong lumber demand through the mid-to-late 1980s was offset by major capacity expansions in North America from plant modernizations and improvements in productivity. As a result, the lumber sector has experienced relatively flat prices, despite the closure of several hundred mills in Canada and the United States. The potential growth in new composite wood products such as Parallam, veneer laminated lumber and oriented strand board will make further inroads into traditional lumber and plywood markets.

While 1990 was a slow year for both lumber and pulp and paper products, the prospects for 1991 and 1992 appear somewhat better.

Lumber sales are projected to increase slightly by the end of 1991. Declining interest rates in Canada and the United States should encourage more industrial and house construction and remodelling, while a reduced timber harvest in the U.S. northwest should expand United States markets for Canadian products. By 1992, as the economies of the major importing nations strengthen, offshore exports of lumber are expected to regain their 1989 levels. The short-term prospects in Europe are less certain, since trees damaged by exceptionally high winds in the spring of 1990 will likely be salvaged, creating a glut in the market for the next 2 to 5 years. The implications of a freer market in Eastern Europe are also uncertain, although the Canadian industry is watching developments with interest.

As the world economy picks up in 1992, the Canadian pulp and paper industry's profits should improve accordingly. Although pulp producers likely face another year of lower prices due to excess capacity in Canadian,

EACH CANADIAN CONSUMES AN AVERAGE 248.3 KG OF PAPER AND PAPERBOARD EACH YEAR.

American and Scandinavian mills, shipments of newsprint are expected to increase by 1992. However, increased newsprint capacity coming onstream in 1991 will limit the opportunity for existing plants to increase sales. Rapidly increasing U.S. and overseas demand for printing and writing papers should provide an opportunity for Canadian paper producers to increase sales.

ISSUES AND UNCERTAINTIES

The economic outlook for Canada's forest industry is clouded by uncertainty associated with issues relating to the industry's competitiveness, to trade and to the environment. How these issues are handled will have a major impact on Canada's ability to take advantage of future market opportunities.

COMPETITIVENESS

The forest industry's long-term competitiveness is largely determined by the nature of its raw material, the costs of labour and capital, and Canadian productivity levels and product quality relative to other competitors in world markets.

Canada's competitive edge has historically been tied to natural endowments of abundant energy and large tracts of high quality, low cost wood. As discussed in Chapter 2: Canada's Forest Resources, Canada is reaching the limits of its commercially viable softwood supply at current production costs and product prices. The character of the raw resource is changing as well, as trees of smaller diameter and different species are harvested. There is uncertainty regarding the effects of withdrawals of forest land for non-timber uses on the commercially available timber supply, and the effects of environmental regulations on the costs of production. Thus, while the advantage in relatively low cost energy remains, Canada will have to be innovative to make the best use of its available timber resources.

Major productivity gains have been achieved in Canadian sawmills over the past decade.

As a result of investments totalling over $9 billion since 1980, Canada's sawmills are among the most productive in the world.

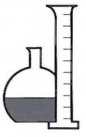
Increased mechanization and modern processing methods to better utilize small logs have substantially improved Canada's competitive position in world markets for commodity grades of lumber. The production of custom cut and specialty grades for niche markets abroad has further strengthened Canada's solid wood products industry. Despite capital and repair expenditures of over $35 billion in paper and allied industries and the construction of a number of world-scale, modern mills during the same period, this sector is not in a uniformly strong competitive position. Many older, less productive machines remain, and much of Canada's kraft pulp capacity, which came onstream in the 1970s, is outdated relative to current technology. Numerous newsprint machines are also dated and of low productivity relative to those of our competitors.

However, improvements have been made in the use of raw materials and the recovery of pulp from wood. The use of lumber industry by-products and waste as the raw material for pulp mills has increased substantially. Low grade material that was formerly discarded or burned is increasingly being substituted for logs as input for pulping.

Advances in pulping technology have also improved the quality of mechanical pulp that can be produced. Through a new process known as chemi-thermo-mechanical pulping (CTMP), wood chips are separated into fibres between metal disks, using heat, pressure and chemicals. This process uses fewer chemicals and produces more pulp per volume of wood than the more common "kraft" chemical pulping process. Furthermore, the product is of high enough quality that it can be substituted for kraft pulp in some paper products. The CTMP process can also be used for both softwoods and hardwoods — a major advantage over the traditional mechanical pulping process.

New product development is another way to maintain competitiveness. The paper industry is restructuring towards value-added products, such as improved grades of printing and specialty papers, particularly from mechanical pulp. These products are of higher value than traditional mechanical grades such as newsprint, and make effective use of paper machines that would not otherwise be economically viable.

Likewise, in the solid wood products industry, value-added products are being developed for specific markets. Pre-cut components that are used for products such as doors and windows are being offered. Specialty lumber mills that tailor orders to specific customer demands are making an appearance. The industry has also begun to define end-uses tailored to unique species characteristics; for example, a large promotional initiative has targeted the use of western hemlock for high value mouldings, doors and windows in European markets.



CANADIAN SCIENTISTS RECEIVED INTERNATIONAL RECOGNITION FOR THE INVENTION AND DEVELOPMENT OF PARALLAM, A NEW STRUCTURAL WOOD PRODUCT.

To fill the demand for long structural timbers while utilizing existing wood supplies, new composite wood products have been developed.

New markets for forest products are also being sought in non-traditional areas, such as industrial construction.

This market is worth about $93 billion per year, of which wood currently comprises only about 7 percent. The Canadian government is working jointly with industry to develop the technical data that will enable traditional and new wood products to find new applications in industrial structures and other areas customarily using steel and concrete. In 1990, the National Building Code of Canada was modified to permit the expanded use of wood in more complex structures than was previously allowed; a similar action has now been undertaken in the United States. The light frame construction, institutional and industrial markets present major opportunities for Canadian forest products, but making inroads into these markets will require a major new marketing effort by the industry.

Such innovations in products and processing reflect the efforts and ability of the forest industry to adapt to market demands, and the importance of technological innovation in keeping the industry competitive.

Current research and development expenditures by forest product companies in Canada are low relative to other countries, and this must change if Canada is to maintain its position in markets.

TRADE

Canada's solid wood products and pulp and paper industries face stiff competition in world markets. New competitors are appearing on the scene, some with significant advantages in labour and raw materials. Brazil has extensive hardwood forests and low labour costs. Chile, New Zealand and other countries in the southern hemisphere have plantation forests that can provide fibre for new pulp mills and supply competitive grades of lumber to Pacific Rim countries in the near future. Other competitors, such as Sweden and Finland, have modern pulp and paper mills and are closer to European markets. Many of Canada's competitors are also investing heavily in research to develop new equipment and products.

Canada's markets for its major commodity products of lumber, newsprint and pulp have traditionally been focused on the United States, but the growth of U.S. sales in these product areas is slowing. While the industry has made a substantial effort to develop new markets, especially in the Pacific Rim and Europe, the proximity and size of the U.S. market will ensure its continued importance and influence on the Canadian forest industry. It is one of the fastest growing markets for higher value products such as printing and writing papers and specialty wood products, and therefore represents a large opportunity for Canadian producers.

To maintain or improve its position in world markets, the Canadian forest industry will need open access to existing markets and unrestricted opportunities to develop new markets.

While substantial inroads have been made in recent years, Canada's forest products industry still faces a number of trade barriers. In the past, tariffs posed the greatest barriers by making Canadian products less price-competitive in foreign markets. Recent international trade negotiations under the General Agreement on Tariffs and Trade (GATT) have generally reduced such barriers, however tariff escalation remains a problem for some forest products. Other non-tariff barriers are also faced by the industry, often in the form of technical constraints, such as meeting foreign building codes and product standards.

Canada is continuing to pursue more liberalized world trade by pushing for the elimination of both tariff and non-tariff barriers in multilateral trade negotiations.

Similar efforts in the bilateral arena have had some success. The recently negotiated Canada-U.S. Free Trade Agreement, which came into effect on January 1, 1989, provides more secure

and open access to Canada's largest and closest market. The agreement contains provisions to phase out tariffs on printing and writing papers and, of perhaps greatest importance to the forest products industry, mechanisms to deal with the settling of disputes.

However, a number of bilateral trade issues remain which restrict free and open access to the U.S. market. The memorandum of understanding (MOU) dealing with the export of Canadian softwood lumber remains a controversial trade irritant. There is also a tariff on shingles and shakes, imposed by the United States to protect its industry in the Pacific northwest. This tariff is expected to expire in mid-1991.

In Japan, Canada faces a discriminatory tariff on spruce, pine and fir lumber. Differences in building codes and product standards have been largely resolved. Discussions are currently underway to obtain official Japanese acceptance for construction of three-storey timber frame apartment buildings and for Canadian grades of machine stressed lumber and finger-jointed timber.

In Europe, Canada faces relatively high tariffs on exports of softwood plywood and newsprint above annual duty-free quotas. Europe is also currently pushing for the kiln-drying of all Canadian lumber imports, because of concerns that some shipments might contain a microscopic worm called the pinewood nematode. In response, Canada has established an inspection program that will minimize the risk of shipping infested wood, and has jointly undertaken a new research treatment program with the European community that could provide a more suitable alternative to kiln-drying for pinewood nematode eradication.

The establishment of the European Community (EC) as a unified market in 1992 could also have an impact on Canada's future trade in forest products.

The EC is revising all standards for forest products, and if the new codes and standards differ substantially from those in North America, they may result in non-tariff trade barriers to Canadian producers. By providing a steady input of Canadian technical information to the European Community, the Canadian government and industry are participating in the setting of these standards.

Canada has continued to successfully sell its products in world markets despite a number of trade barriers, the appearance of new players and the continued pressure of traditional competitors. This effort toward liberalized trade and direct market development initiatives must continue.

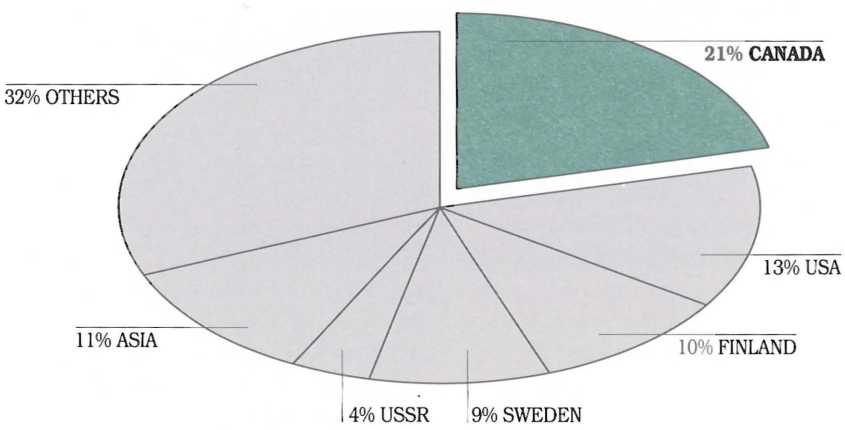
THE ENVIRONMENT

Canada's forest industry is working to ensure that its manufacturing processes and products are environmentally safe and support sustainable development.

These efforts include voluntary withdrawals or reductions in the use and production of toxic substances, the development of guidelines (often in cooperation with government and other interest groups) to minimize the impacts of forestry operations on other resources and forest values, and ongoing research into better ways of harvesting, manufacturing and renewing Canada's forests.

The pulp and paper industry combines wood with water, energy and chemicals to produce various products. In the process, waste by-products are produced — mostly water, but also air emissions, solids and chemical effluents that must be treated or recycled. Depending upon the process, between 50 and 90 percent of the solid wood input becomes pulp.

CANADA'S SHARE OF WORLD EXPORTS OF FOREST PRODUCTS
1988



SOURCE: FAO.

The effluent contains the remaining 10 to 50 percent in the form of suspended solids and chemical by-products. Major investments are being made to reduce both the amount of effluent and its environmental effects, and more will undoubtedly be required in the future.

Furans and dioxins are toxic by-products of the chemical pulping process, created when chlorine is used to bleach pulp and remove impurities. Recent advances in measurement technology now permit the identification of minute traces of these substances in the pulp, effluent and sludge of pulp mills. In response, the forest industry has invested in new processes and procedures to reduce the use of chemicals that produce these toxic by-products.

Changes in technological processes, such as the substitution of chlorine dioxide for chlorine, and improvements in monitoring chlorine use have already significantly reduced dioxin formation.

In addition to the voluntary actions of the industry, governments are enacting stricter legislation to control such contamination, which will result in further reductions of dioxin output. Over the next few years, the industry will have achieved an overall reduction of over 90 percent of dioxin output. In April 1990, the federal government proposed new federal regulations to virtually eliminate the discharge of furans and dioxins in pulp mill effluents.

The release of chlorinated organic compounds from bleaching operations will be strictly controlled, and all mills will be subject to strict regulations regarding the discharge of suspended solids, oxygen-using substances and toxicity levels. These regulations will be phased in during the next four years to meet full compliance by 1994.

Currently, most of Canada's 144 pulp and paper mills have restructured or are restructuring to use more environmentally sensitive pulping processes.

Since 1984, the forest industry has invested over $2 billion for pollution control. To meet new environmental guidelines, the industry expects to spend close to $5 billion by 1994.

The solid wood products industry also uses potentially harmful chemicals to protect wood from staining, fungus and mould. Recent concerns about toxins have resulted in the voluntary withdrawal of pentachloraphenols (PCPs) in anti-sapstain treatments for unseasoned lumber and their replacement by several alternative chemical compounds that are subject to an annual review process. Codes of practice have also been developed for the handling, distribution and use of chemicals in the production of treated wood products. The use of chemical preservatives for long term protection of wood (e.g. for utility poles) will be subject to a major review within the next few years, as part of the registration process for pesticides.

The ongoing capital cost of responding to environmental concerns will be substantial, and remaining competitive will pose a continuing challenge to Canada's forest industry.

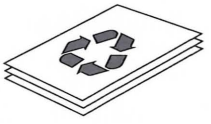
RECYCLING

Increased public demand for paper containing recycled fibres, and the subsequent impacts on paper producers provide another example of the considerable repercussions that environmental concerns will have on the forest industry. While the motivation behind the recycling issue in North America originally centred on the public desire to reduce the volume of used paper in landfill sites, forest conservation has become an increasingly important motivating factor.

In the newsprint sector, eight American states passed legislation in 1989-1990 stipulating that certain amounts of the fibre consumed in their pressrooms must consist of recycled material. Several other states are considering similar action. While these new regulations leave some flexibility in incorporating both recycled and virgin fibre newsprint, they will almost certainly necessitate changes in the production of Canadian newsprint.

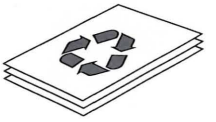
Forty-eight of the 110 mills that produce paper and paperboard in Canada presently use waste paper for some of their raw material inputs, though most of the material being recycled is unprinted and without fillers, coatings or ink, which require removal before the fibre can be re-used. Only six mills have de-inking facilities, and only two produce recycled newsprint. Eight expansions or new plants equipped with

de-inking facilities are planned in Canada: three in Ontario, four in Quebec and one in British Columbia. More will likely be needed in the future to satisfy Canada's domestic and foreign customers.



FORTY-THREE PERCENT LESS ENERGY IS NEEDED TO RECYCLE PAPER THAN TO PROCESS RAW WOOD FIBRE.

The incorporation of recycled fibre in Canadian pulp presents a major challenge for the forest industry — largely because Canada is a major exporter and has a relatively small population and consumption base. While provinces and municipalities have established curbside recycling programs, even the most efficient can collect only a relatively small portion of material. Approximately 1.5 million tonnes of the 10 million tonnes of newsprint Canada produces is consumed domestically. Of this, it is estimated that recycling programs can realistically recover only about 500,000 tonnes. Therefore, in order to produce recycled newsprint for the United States, Canada must import substantial volumes of old newspapers. The costs associated with collecting, transporting and recycling this material could push Canadian production costs higher than those of its American



CANADA IMPORTS 550 000 TO 650 000 TONNES OF WASTE PAPER PER YEAR FOR RECYCLING.

competitors. The alternative is to open new newsprint plants close to sources of waste paper — primarily large cities in the United States — which would mean a loss of Canadian employment and the revenues associated with production.

In addition to the waste paper supply problems, there are also high costs and some environmental risks associated with the production and treatment of recycled material. Construction of a de-inking plant can cost as much as $100 million. Effluent from its operation produces wastes amounting to about 10 to 30 percent of its input and requiring both primary and secondary treatment. This sludge contains clays, inks, carbon black and other chemicals, and must be incinerated or treated and disposed of in a sanitary landfill site. Though there is some indication that treated sludge may find use as a substitute for manure or as an ingredient in other products (e.g. cement, gypsum), it still represents additional treatment and handling costs.

Recycling presents a major dilemma for the Canadian forest industry at a time when profits are slipping and market expansion opportunities are limited.

Given the U.S. legislation for the use of recycled fibre, Canada is obliged to find ways to meet this requirement or lose market share with its major customer. On the other hand, importing significant amounts of used U.S. newspapers to produce recycled newsprint has major economic and environmental implications. Replacing some of the virgin wood fibre used in paper with recycled fibre could also have adverse impacts in other Canadian forest product sectors. For example, over 60 percent of the wood fibre used to manufacture pulp and paper in Canada is in the form of pulp chips, sawdust and other wood residues that have limited alternative uses. These waste by-products are currently a major revenue source for the solid wood products industry.

This is a challenging situation, and the industry is currently grappling with its strategic options.

OUTLOOK

Canada's forest industry is entering a new era. The markets it serves, the products it makes, and even the timber it uses are changing in ways that affect future opportunities within the sector. Despite the relatively gloomy short-term prospects, the next 20 years will be a period of tremendous opportunity.

While growth is projected for all forest product groups, the greatest opportunities lie in the higher value products.

According to studies undertaken by Forestry Canada in 1988, world demand for wood and paper products will continue to rise over the next 20 years, fueled by a growing global population and economy. The demand for pulp and paper products is likely to increase substantially, with the demand for wood pulp growing by nearly 1 percent per

year and the demand for paper products by about 2 percent annually. Demand for printing and writing papers is expected to increase by more than 4 percent annually to the year 2010, while newsprint and other papers could increase by 1.6 percent per year. The opportunities for solid wood products, though not as good as for pulp and paper, are still promising. The global demand for lumber will likely increase about 0.5 percent annually to the year 2010, while the demand for composite panelboards could increase by more than 3 percent per year.

To take advantage of these significant market opportunities, Canada must become more efficient in the production of commodity grade products such as lumber and pulp, and evolve into a higher value product mix. Across the industry there are common strategies to guide this development. These include a stronger emphasis on marketing, a focus on specialty products, a higher profile on product quality and consistency, and an increase in research and development.

The Canadian forest industry has been built on the production of softwood lumber, newsprint and pulp, and its future success will depend on the ability to maintain its competitive advantage.

Canada must build on its competitive strengths in fibre and energy resources and, at the same time, become less dependent on commodity products which face increasing competition.

IN 1989, CANADA PRODUCED ABOUT 70% OF THE WORLD'S SUPPLY OF MAPLE SYRUP, VALUED AT MORE THAN $77 MILLION.

This will involve updating technologies and improving products. Recent years have seen massive capital investments to make mills more efficient, meet environmental standards and manufacture new products. Despite this, many mills remain that are old and inefficient relative to those of our competitors. Many of these could profitably be converted to manufacture higher quality products for niche markets.

Major opportunities exist for Canada in the U.S. markets for printing and writing papers. A number of currently outdated newsprint machines could be converted to produce mechanical grades of paper (where Canada holds an advantage due to its relatively low energy costs) to capitalize on this opportunity. There are also opportunities for integrating some of our older kraft mills with the manufacture of chemical grade printing and writing papers. The Canadian forest industry faces many uncertainties. Barriers to markets in the United States, Europe and Japan, new emerging competitors in South America and Asia, regulations and public pressures for environmental and recycling measures, and exchange rate movements all will affect the future development of the industry. The current downturn in the economy and consequent outlook for lower profits and available cash for capital investments makes this all the harder. Despite these challenges, the industry must continue to restructure.

If Canada is to maintain its place in world markets, it must continue to invest in research to increase its productivity, to develop new products, and to protect the environment.

It must continue to evolve in keeping with changing customer demand. The industry's ability to deal with these structural investment problems will affect its future performance and its ability to take advantage of market opportunities.

NATIONAL ACCOUNT

Comprehensive and reliable statistical information about the forest resource and the forest industry is required to measure progress towards strategic targets. This chapter provides tabular summaries of key measures of Canada's forest resources and forest sector, as well as an historical perspective of some important performance indicators.

Many of these indicators are presented in an accounting format that provide a 10-year perspective of the sector, noting additions and depletions over the decade as well as the change that takes place in one year. The remaining sheets present a brief description of the Canadian forest industry's contribution in key sectors and forest management activities.

Individually, the tables and charts demonstrate the trends and the magnitude of changes over time. Taken together, they show the evolution of Canada's forest industry and indicate the improvements in forest management practices which will result in a more productive and sustainable forest.

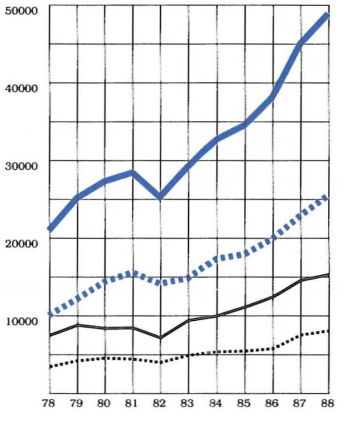
Since the information presented in various tables may vary by the time period of collection or the assumptions underlying data collection, the reader is cautioned from making direct comparisons between tables. To assist the reader in interpreting the information contained herein, brief introductions or explanatory notes accompany the tables. Unless otherwise noted, all figures and graphs are in current dollars.

In some cases, only estimates are provided, based on the best available data. Over the coming years, the initiative sponsored by the Canadian Council of Forest Ministers to develop a National Forest Database Program should improve Canada's ability to assess and depict the sector's performance.

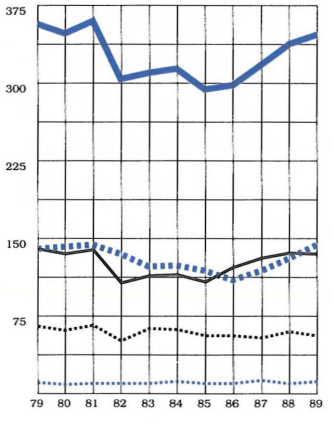
SUMMARY STATISTICS

	LATEST YEAR AVAILABLE	CURRENT YEAR	PREVIOUS YEAR	YEAR-TO-YEAR CHANGE	TREND RATE OF GROWTH[1]
HIGHLIGHTS					
Total productive forest land (000 000 ha)	1986	243.7	N/A	N/A	N/A
Total area harvested (000 000 ha)	1988	1.02	1.01	+0.9	+ 3.0
Total A.A.C. (000 000 m^3)	1986	225	N/A	N/A	N/A
Volume harvested (000 000 m^3)	1988	190.3	191.6	- 0.7	+ 2.4
Value of shipments ($000 000)	1988	49 045	45 133	+ 8.7	+ 9.2
Balance of trade ($000 000)	1989	19 489	19 434	+ 0.3	+ 7.4
Total employment (000)	1989	348	339	+ 2.7	- 0.2
Direct jobs per 1000 m^3 harvested	1988	1.78	1.66	+ 7.2	- 2.2
Value of shipments per job ($000)	1988	144.7	141.5	+ 2.3	+ 9.6
Value of shipments per m^3 harvested ($/$m^3$)	1988	257.7	235.6	+ 9.4	+ 6.6
R&D expenditures as a percent of sales	1988	0.6	0.5	+ 20.0	N/A

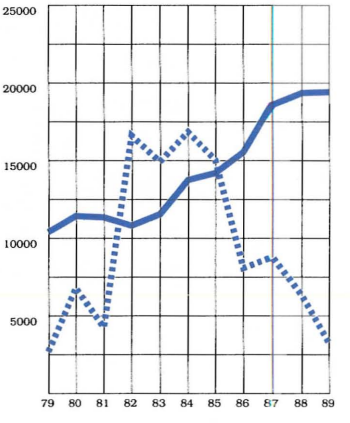
VALUE OF SHIPMENTS 1978-1988



EMPLOYMENT 1979-1989



BALANCE OF TRADE 1979-1989



[1] A ten-year compounded rate of growth using a three-year moving average of the series was chosen to minimize the variation of the data caused by a peak or trough.

Source: Forestry Canada.

NATIONAL FOREST ACCOUNT

CANADA'S FOREST INVENTORY 1986

Almost half of the total area of Canada (997.1 million hectares) is forest land (453.3 million hectares). However, when accounting for forest land that is not inventoried (55.4 million hectares) and forest land that is unproductive (154.2 million hectares), the productive forest land covers only 243.7 million hectares (or slightly more than half the total forest area). After excluding parks, wilderness areas and other land uses (8.9 million hectares) where harvesting is not permitted, and forest land of unclassified status (1.6 million hectares), the nonreserved productive forest land on which harvesting may take place in Canada is about 233.1 million hectares.

Canada's forest land classification	(Million hectares)
Total forest land	453.3
Not inventoried	55.4
Total inventoried forest land	**397.9**
Unproductive forest land	154.2
Total inventoried productive forest land	**243.7**
Reserved land	8.9
Unclassified	1.6
Total productive nonreserved forest land [1]	**233.1**

[1] Area of forest land which currently supports the economic supply of timber.

A NATIONAL FOREST ACCOUNT

Canada's Forest Inventory is a useful tool in presenting a picture of the state of Canada's forest resource. However, it presents only a static view of the forest at a given point in time, it does not measure change. To accurately report on the state of Canada's forests, we need to be able to describe and depict the various changes taking place.

In an attempt to address this need, Forestry Canada undertook a study and developed a model to assess the status of Canada's timber resource in 1986 and the change that took place during the ten year period, 1977-1986. An assessment of the volume and area depleted by fires, insects and disease, as well as an estimate of the growth that occurred, is an integral part of this modelling exercise.

The status of Canada's timber resource is presented as a "statement of account" showing the forest capital in 1986, the accruals and the withdrawals of capital from 1977 to 1986, and the net balance (surplus or deficit) for the period.

The forest capital is the productive nonreserved forest land base and the timber growing on it. The accruals are the "deposits" to forest capital, such as additions to the productive forest land base, and the "interest" on capital due to forest growth. The depletions are the withdrawals from the forest capital, such as harvesting, withdrawals from the productive land base, and the effects of mortality due to fire, insects and disease.

The Accrual - Depletion Balance is the ten-year difference of accruals less withdrawals for the reporting period.
Net Balance 1977-1986 = Accruals - Withdrawals
Capital 1986 = Capital 1976 + Balance

The model relies on data from Canada's Forest Inventory 1986, which is more comprehensive than the 1976 inventory. Where figures were missing, best estimates were derived so that a more complete description of the resource could be presented.

The major assumptions of the model include:

-the total productive nonreserved forest land base of 233.1 million hectares, described in Canada's Forest Inventory 1986, was accepted as being constant for 1976 and 1986;
-the estimates of the 1976 volume on the stocked productive nonreserved forest land were derived from the 1986 inventory database;
-the amount of land not stocked to commercial tree species was estimated as being 10.8 million hectares at year-end 1976.

Highlights of the model are as follows:

Land Capital

-the stocked productive nonreserved forest land was estimated to be 222.3 million ha, based on the 233.1 million ha of productive nonreserved forest land minus the 10.8 million ha estimated by the model as being non stocked at the end of 1976;
-depletions from the stocked land were 19.1 million ha; fire and pests accounted for about 56% and planned harvesting operations about 44%;
-additions to the stocked land were estimated to be 14.3 million ha;
-the net balance of the stocked productive nonreserved forest land on average declined by an estimated 474 000 ha per year.

Volume Capital

-the volume of growing stock in 1976 was about 23.9 billion m^3;
-the annual depletion from the growing stock was 294.1 million m^3, harvest volumes accounted for about 53%, and the rest was destroyed by fires (25%) and forest pests (22%);
-annual additions to the growing stock volume were estimated at about 363.4 million m^3;
-the 10-year periodic balance in the growing stock volume indicates a net increase of about 693 million m^3. This represents an annual increase in the growing stock of 0.3%.

Conclusions

In summary, for the period 1977-1986, the study estimated that additions to the timber volume surpassed the depletions on an average of 69 million m^3 annually, adding 0.3% to the standing growing stock (of timber). In terms of land area, the stocked productive nonreserved forest land base declined at an annual rate of 474 thousand hectares.

Source: Forestry Canada.

NATIONAL FOREST ACCOUNT

	AREA (MILLION HECTARES)	VOLUME (MILLION CUBIC METRES)
FOREST CAPITAL 1976		
Regeneration	29.0	282
Immature	91.9	6 982
Mature, overmature and uneven-aged	101.4	16 673
TOTAL	**222.3**	**23 937**
CHANGES 1977-1986		
DEPLETIONS		
Harvest	8.4	1 560
Fire	6.1	743
Pests	4.6	638
TOTAL	**19.1**	**2 941**
ADDITIONS		
Natural regeneration	12.0	102
Artificial regeneration	2.3	130
Growth in standing forest		3 402
TOTAL	**14.3**	**3 634**
FOREST CAPITAL 1986		
Regeneration	28.2	353
Immature	85.9	6 730
Mature, overmature and uneven-aged	103.5	17 547
TOTAL	**217.6**	**24 630**
NET CHANGE		
Net **decrease** in area stocked	4.7	
Net **increase** in growing stock		693

Source: Forestry Canada.

THE CANADIAN FOREST SECTOR CARBON BUDGET

There are approximately 450 million hectares of forest land in Canada, which represents an inventory of carbon of 225 billion tonnes stored in the soil, in the forest biomass and in forest products in use in Canada. The greatest proportion is stored in peatlands, which comprise about 60% of the stored carbon.

The carbon budget for the Canadian forest sector is composed of a series of carbon accumulations and carbon releases. The primary accumulations result from natural growth in the forest biomass (trees), soils and in the peatlands. Carbon release shows up in the emissions from forest fires and harvesting, which results in decay of the forest detritus, and in the processing of forest products such as paper and lumber. The net positive effect of these accumulations and emissions, about 116 million tonnes, is small compared to the carbon inventory of 225 billion tonnes, indicating that the system is very finely balanced between carbon emissions and accumulations.

CURRENT CANADIAN FOREST SECTOR CARBON INVENTORY[1]

	(billion tonnes)
Forest biomass	12.0
Soils	77.5
Forest products	0.6
Total forest sector	90.1
Peatlands	135.0
Total carbon inventory	**225.1**

CANADIAN FOREST SECTOR CARBON BUDGET 1986[1]

	(million tonnes)
CARBON RELEASE	
Forest biomass	20
Forest soils	15
Forest products	23
Total carbon release	**58**
CARBON ACCUMULATION	
Forest biomass	48
Forest soils	56
Forest products	44
Peatlands	26
Total carbon accumulation	**174**
Net sink 1986	**116**

[1] Preliminary estimates.

Source: Forestry Canada.

INDUSTRIAL ACCOUNT

The Industrial Account lists a number of measures of industrial activity, their current levels, their change over the most recent years available and their ten year growth rate. While all measures of industrial activity, including investment and public revenues, have increased over the decade, employment in the sector has dropped by 0.2% annually. Within the employment category, only Forestry Services showed a substantial increase of 0.3% annually over the decade and 18.2% in the last year.

	LATEST YEAR AVAILABLE	CURRENT YEAR	PREVIOUS YEAR	YEAR-TO-YEAR CHANGE	TREND RATE OF GROWTH[1]
VOLUME					
Production of Major Commodities					
Lumber[2] (000 m³)	1989	59 293	60 706	- 2.3	+ 3.2
Wood pulp (000 tonnes)	1989	23 562	23 697	- 0.6	+ 1.8
Newsprint (000 tonnes)	1989	9 678	9 969	- 2.9	+ 1.4
Apparent Domestic Consumption[3]					
Lumber[2] (000 m³)	1989	20 522	21 043	- 2.5	+ 3.5
Wood pulp (000 tonnes)	1989	15 505	15 417	+ 0.6	+ 1.5
Newsprint (000 tonnes)	1989	1 502	1 408	+ 6.7	+ 4.2
Exports					
Lumber[2] (000 m³)	1989	40 426	41 113	- 1.7	+ 2.8
Wood pulp (000 tonnes)	1989	8 241	8 465	- 2.6	+ 2.3
Newsprint (000 tonnes)	1989	8 185	8 566	- 4.4	+ 1.1
SALES					
Apparent Domestic Sales[4] ($000 000)					
Lumber[2]	1986	2 056	1 775	+ 15.8	+ 7.1
Wood pulp	1986	7 206	6 191	+ 16.4	+ 6.0
Newsprint	1986	406	387	+ 4.9	+ 7.2
Export Sales ($000 000)					
Lumber[2]	1989	5 509	5 415	+ 1.7	+ 5.8
Wood pulp	1989	6 939	6 496	+ 6.8	+ 9.8
Newsprint	1989	5 665	6 201	- 8.6	+ 7.7
Other forest products	1989	4 666	4 469	+ 4.4	+ 12.5
Total forest products	**1989**	**22 779**	**22 581**	**+ 0.9**	**+ 8.5**
Balance of trade of forest products ($000 000)					
United States	1989	11 961	12 368	- 3.3	+ 6.2
United Kingdom	1989	1 170	1 155	+ 1.3	+ 6.6
Other EEC	1989	2 115	1 846	+ 14.6	+ 7.5
Japan	1989	2 504	2 266	+ 10.5	+ 13.1
Other Asia	1989	826	955	- 13.5	+ 17.0
Total	**1989**	**19 489**	**19 434**	**+ 0.3**	**+ 7.4**

[1] A ten-year compounded rate of growth using a three-year moving average of the series was chosen to minimize the variation of the data caused by a peak or trough.
[2] Comprised of softwood and hardwood.
[3] Apparent domestic consumption = production + imports - exports.
[4] Apparent domestic sales: Obtained by multiplying apparent domestic consumption (production + imports - exports) by an implicit price (value of shipments ÷ quantity of shipments).

Sources: Statistics Canada/CPPA.

INDUSTRIAL ACCOUNT

	LATEST YEAR AVAILABLE	CURRENT YEAR	PREVIOUS YEAR	YEAR-TO-YEAR CHANGE	TREND RATE OF GROWTH[1]
LABOUR FORCE					
Employed persons (000)					
Logging Industry	1989	56	60	- 6.7	- 1.0
Forestry Services[2]	1989	13	11	+18.2	+ 0.3
Wood Industries	1989	135	136	- 0.7	+ 0.4
Sawmills	1989	66	64	+ 3.1	
Other Wood Industries	1989	69	72	- 4.2	
Paper and Allied Industries	1989	145	132	+ 9.8	- 0.3
Total employed	**1989**	**348**	**339**	**+ 2.7**	**- 0.2**
Unemployed persons (000)					
Logging Industry	1989	13	13	0.0	+ 0.5
Forestry Services[2]	1989	5	5	0.0	+ 4.9
Wood Industries	1989	14	14	0.0	+ 0.7
Sawmills	1989	7	7	0.0	
Other Wood Industries	1989	7	7	0.0	
Paper and Allied Industries	1989	6	5	+20.0	- 3.7
Total unemployed	**1989**	**38**	**38**	**0.0**	**- 0.1**
REVENUES					
Public revenues from the forest sector ($000 000)					
Stumpage and Fees					
- Provincial	1988	883.5	752.8	+17.4	+ 7.8
- Federal	1988	7.3	3.7	+97.3	N/A
Corporate Incomes Taxes					
- Provincial	1987	283.7	181.7	+56.1	+ 9.7
- Federal	1987	401.9	224.8	+78.8	+ 4.7
Personal Income Taxes[3]					
- Provincial	1988	700.5	644.2	+ 8.7	+10.9
- Federal	1988	1 666.6	1 563.5	+ 6.6	+10.5
Total revenues	**1987**	**3 649.8**	**2 614.5**	**+39.6**	**N/A**

[1] A ten-year compounded rate of growth using a three-year moving average of the series was chosen to minimize the variation of the data caused by a peak or trough.

[2] Forestry Services include: reforestation services, forest protection services and forestry nursery services. No national data is available for silvicultural employment only. Estimates from a variety of sources indicate that in 1989, as many as 40,000 workers (mainly seasonal) were involved in planting, site preparation, stand tending and nursery services. This could account for up to 12,000 person-years.

[3] Estimated.

Sources: Statistics Canada/Forestry Canada.

INDUSTRIAL ACCOUNT

	LATEST YEAR AVAILABLE	CURRENT YEAR	PREVIOUS YEAR	YEAR-TO-YEAR CHANGE	TREND RATE OF GROWTH[1]
CAPITAL AND REPAIR EXPENDITURES					
Capital Expenditures ($000 000)					
Logging Industry	1989	272.9	270.9	+ 0.7	+ 0.4
Wood Industries	1989	803.6	966.8	-16.9	+ 9.8
Paper and Allied Industries	1989	5 133.5	3 654.6	+40.5	+17.4
Total	**1989**	**6 210.0**	**4 892.3**	**+26.9**	**+13.8**
Repair Expenditures[2] ($000 000)					
Logging Industry	1989	339.3	331.1	+ 2.5	+ 2.5
Wood Industries	1989	521.6	531.8	- 1.9	+ 7.1
Paper and Allied Industries	1989	1 871.5	1 768.8	+ 5.8	+11.2
Total	**1989**	**2 732.4**	**2 631.7**	**+ 3.8**	**+ 8.7**
Total Capital and Repair Expenditures[2] ($000 000)					
Logging Industry	1989	612.2	602.0	+ 1.7	+ 1.5
Wood Industries	1989	1 325.2	1 498.6	-11.6	+ 8.6
Paper and Allied Industries	1989	7 005.0	5 423.4	+29.2	+15.0
Total	**1989**	**8 942.4**	**7 524.0**	**+18.9**	**+11.7**
CAPITAL STOCKS					
Net Capital Stocks[3] ($000 000)					
Logging Industry	1989	1 441.5	1 412.6	+ 2.0	- 0.6
Wood Industries	1989	4 847.6	4 448.2	+ 9.0	+ 5.7
Paper and Allied Industries	1989	27 302.6	22 845.0	+19.5	+ 9.1
Total	**1989**	**33 591.7**	**28 705.8**	**+17.0**	**+ 7.8**

[1] A ten-year compounded rate of growth using a three-year moving average of the series was chosen to minimize the variation of the data caused by a peak or trough.
[2] Repair expenditures also include maintenance expenditures.
[3] End-year net capital stock.

Sources: Statistics Canada/Forestry Canada.

RESEARCH AND DEVELOPMENT EXPENDITURES ACCOUNT

The R&D Expenditures Account records the total contribution to R&D in forestry in 1988. The estimated expenditures are provided both from the point of view of the *source of funds* (the total commitment of each reporting agency) and the *performers* (the total expenditures for work carried out within the reporting agencies).

Sources of funds	1988 ($000 000)	**Performers**[4]	1988 ($000 000)
Federal Government	105.7*[1]	Federal Government	59.4
Provincial Governments	43.8	Provincial Governments	30.2
Universities	7.0[1]	Universities	29.0[1]
Industry[2]	166.0[1]	Industry[2]	187.7[1]
Others[3]	28.1[1]	Industrial Research Institutes[5]	44.3
Total	**350.6**[1]	**Total**	**350.6**[1]

TOTAL CONTRIBUTION TO RESEARCH AND DEVELOPMENT IN FORESTRY 1988

PERFORMERS / SOURCES OF FUNDS	FEDERAL GOVERNMENT	PROVINCIAL GOVERNMENTS	UNIVERSITIES	INDUSTRY[2]	INDUSTRIAL RESEARCH INSTITUTES[5]	**TOTAL CONTRIBUTION BY REPORTING AGENCIES**
Federal Government	59.4	1.0	14.3[1]	21.3	9.7	**105.7***[1]
Provincial Governments	–	29.2	5.5[1]	5.6[1]	3.5	**43.8**
Universities	–	–	7.0[1]	–	–	**7.0**[1]
Industry[2]	–	–	1.0[1]	136.3[1]	28.7	**166.0**[1]
Others[3]	–	–	1.2[1]	24.5[1]	2.4	**28.1**[1]
Total intramural Research and Development	**59.4**	**30.2**	**29.0**[1]	**187.7**[1]	**44.3**	**350.6**[1]

1 Estimated.
2 Includes Research and Development expenditures by manufacturers of forestry equipment and forest fire fighting aircraft.
3 May include other Canadian and foreign sources, contracts and others.
4 Intramural expenditures: expenditures for Research and Development work performed within the reporting agency, including work financed by others.
5 Includes FERIC, FORINTEK and PAPRICAN.
– Nil.
* The total federal government contribution ($105.7 million) may be underestimated. The current reporting methodology does not allow us to clearly indicate the distribution of the federal portion of Research and Development funding ($9.6 million) under Forest Resource Development Agreements. Part of these funds may already be included under some of the performers.

Sources: Statistics Canada/Forestry Canada/Industrial Research Institutes.

FOREST MANAGEMENT

FOREST MANAGEMENT EXPENDITURES ACCOUNT

The Forest Management Expenditures Account records expenditure levels in 1985 and 1988, and the annual percent change between 1985 and 1988, and between 1979 and 1988. All aspects of forest management, including silviculture, forest protection, resource access and other forest management activities, increased expenditure levels over the ten-year period.

	1985	1988	% CHANGE PER YEAR[1] 1985-1988	% CHANGE PER YEAR[1] 1979-1988
FOREST MANAGEMENT EXPENDITURES ($000 000)				
Silviculture				
Provincial	349.8	452.1	+ 8.9	+16.4
Federal	63.5	105.6	+18.5	+16.4
Industry[2]	63.3	147.3	+32.5	+23.6
Total	**476.6**	**705.0**	**+13.9**	**+17.6**
Forest Protection				
Provincial	299.3	355.6	+ 5.9	+12.2
Federal[3]	20.4	1.9	-24.0	- 6.9
Industry[2]	39.4	39.4	0.0	+ 7.3
Total	**359.1**	**396.9**	**+ 3.4**	**+10.8**
Resource Access[4]				
Provincial	99.8	101.5	+ 1.7	+ 3.8
Federal	8.1	3.5	-16.2	- 6.9
Industry[2]	238.8	179.5	- 7.7	- 0.8
Total	**346.7**	**284.5**	**- 5.7**	**0.0**
Other Activities[5]				
Provincial	314.1	378.6	+ 6.4	+ 8.8
Federal	117.0	114.8	- 0.6	+10.7
Industry[2]	64.4	136.3	+28.4	+14.0
Total	**495.5**	**629.7**	**+ 8.3**	**+10.1**
TOTAL FOREST MANAGEMENT EXPENDITURES				
Provincial	1063.0	1287.8	+ 6.6	+11.3
Federal	209.0	225.8	+ 2.6	+ 9.1
Industry[2]	405.9	502.5	+ 7.4	+ 6.8
Total	**1677.9**	**2016.1**	**+ 6.3**	**+ 9.8**

[1] Annual compounded rate of growth over the period.
[2] 1988 industry figures are estimates.
[3] The drop since 1985 occurred as a result of the transfer of responsibilities for forest management activities from the federal government to the Northwest Territories. The federal expenditures on Forest Insect and Disease Survey (FIDS) of $3.56 million are included in the forest research component of "Other Activities".
[4] Resource access includes expenditures for permanent roads, bridges and other supporting infrastructure.
[5] Other Activities include forest management research, inventory, timber management, administration and other.

Sources: CPPA/Forestry Canada.

FOREST MANAGEMENT

FOREST MANAGEMENT ACTIVITIES ACCOUNT

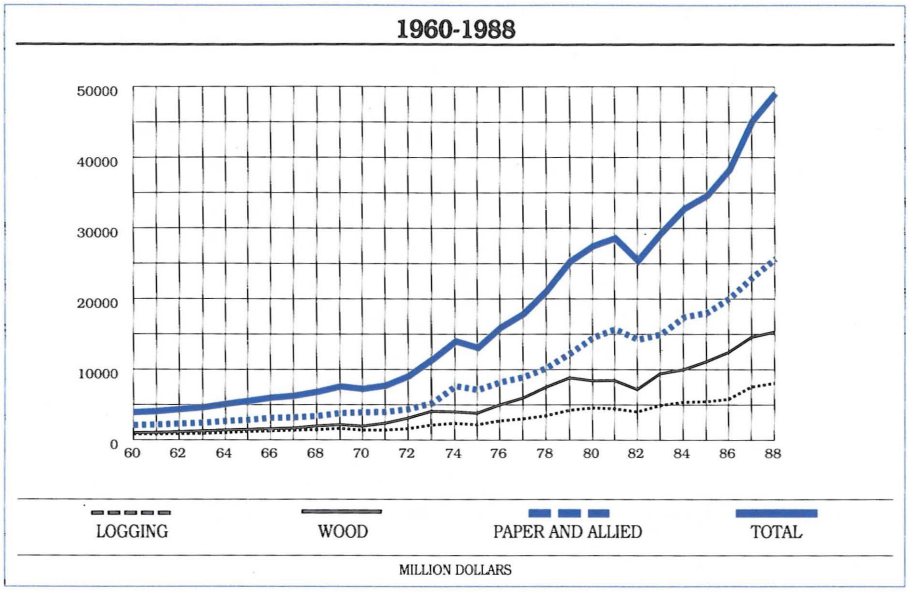
The Forest Management Activities Account presents silviculture statistics and records changes over a one-year period and between 1979 and 1988. While the area harvested has only increased by 3% annually over the ten-year period, forest management activities have increased markedly: the area prepared for planting has increased by 11.3% annually, the area planted by 11.3%, and the area tended by 13.9%. The number of seedlings established increased by 27% in one year.

	LATEST YEAR AVAILABLE	CURRENT YEAR	PREVIOUS YEAR	YEAR-TO-YEAR CHANGE	TREND RATE OF GROWTH[1]
FOREST MANAGEMENT ACTIVITIES					
Silviculture treatments (000 ha)					
Area of site preparation	1988	450.6	478.9	- 5.9	+ 11.3
Area planted	1988	413.3	370.2	+ 11.6	+ 11.3
Area seeded	1988	37.7	37.3	+ 1.1	- 1.4
Area of stand tending	1988	269.3	275.5	- 2.2	+ 13.9
Total area harvested (000 ha)	**1988**	**1 021.6**	**1 012.9**	**+ 0.9**	**+ 3.0**
Total area successfully regenerated[2] (000 ha)	**1988**	**822.9**	**788.1**	**+ 4.4**	**+ 4.9**
Total seedlings established[3] (000 000)	**1990**	**1 011**	**796.3**	**+ 27.0**	**N/A**
Total number of trees harvested[4] (000 000)	**1990**	**580**	**N/A**	**N/A**	**N/A**
FOREST DAMAGE (000 HECTARES)					
Fires					
- Total forest land	1989[5]	7 273	1 336	N/A	N/A
- Total productive forest land	1989[5]	3 992	640	N/A	N/A
Insect Defoliation[6]					
- Total forest land	1989	18 853	15 490	+21.7	N/A

[1] A ten-year compounded rate of growth using a three-year moving average of the series was chosen to minimize the variation of the data caused by a peak or trough.
[2] Using national success rates for planting, direct seeding, and natural regeneration of spruce, pine and true fir.
[3] This total includes the estimated number of trees planted (860 million which includes FRDA, provincial and industry planting) and an estimate of the equivalent number of trees planted through seeding and site preparation (151 million) to encourage natural regeneration.
[4] Based on an estimate of average stems per hectare and volume per tree.
[5] The reporting technique has changed in 1989, the data is no longer comparable to previously released data.
[6] Insects include spruce budworm, forest tent caterpillar, jack pine budworm, mountain pine beetle, hemlock looper and gypsy moth.

Source: Forestry Canada.

SHIPMENTS IN THE FOREST SECTOR



VALUE OF SHIPMENTS IN THE FOREST SECTOR

Total shipments by the forest sector have increased steadily over the years as a result of increasing domestic and foreign demand for Canadian forest products.

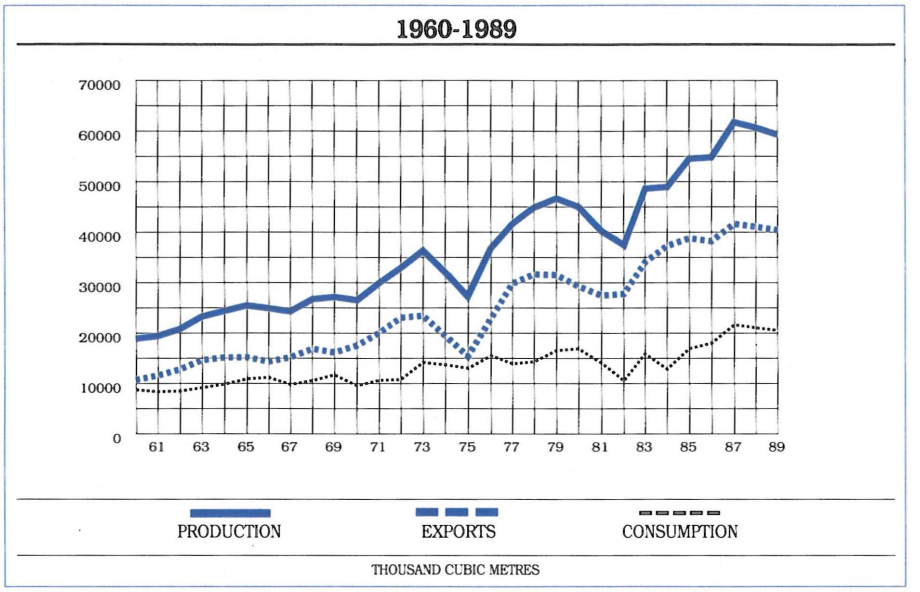
In 1988, shipments of forest products reached a record high of $49 billion. The paper and allied products industries accounted for $25.7 billion dollars worth of these shipments.

Since 1960, the value of forest products shipments has grown at a real compounded annual rate of 3.6%. Wood product industries have dominated this increase, followed by the paper and allied products industries and the logging industry. Based on conservative projections for world demand, Canada's real output of forest products could increase by 55% over the next 20 years.

YEAR	LOGGING	WOOD	PAPER AND ALLIED	TOTAL	LOGGING	WOOD	PAPER AND ALLIED	TOTAL
	CURRENT DOLLARS $000 000				CONSTANT 1986 DOLLARS $000 000			
1960	806	1 007	2 126	3 939	3 358	4 196	8 858	16 413
1965	1 185	1 488	2 882	5 555	4 472	5 615	10 875	20 962
1970	1 382	1 951	3 931	7 264	4 213	5 948	11 985	22 146
1975	2 175	3 803	7 132	13 110	4 439	7 761	14 555	26 755
1978	3 435	7 477	10 197	21 109	5 725	12 462	16 995	35 182
1979	4 222	8 808	12 287	25 317	6 397	13 345	18 617	38 359
1980	4 559	8 397	14 503	27 459	6 245	11 503	19 867	37 615
1981	4 430	8 442	15 729	28 601	5 476	10 435	19 443	35 354
1982	3 995	7 168	14 261	25 424	4 545	8 155	16 224	28 924
1983	4 909	9 406	15 011	29 326	5 319	10 191	16 263	31 772
1984	5 364	9 973	17 472	32 809	5 634	10 476	18 353	34 463
1985	5 462	11 122	18 075	34 659	5 591	11 384	18 501	35 475
1986	5 776	12 433	20 067	38 276	5 776	12 433	20 067	38 276
1987	7 538	14 583	23 012	45 133	7 193	13 915	21 958	43 066
1988	8 062	15 322	25 661	49 045	7 336	13 942	23 349	44 627

Source: Statistics Canada.

LUMBER



PRODUCTION, EXPORTS AND CONSUMPTION OF LUMBER

With the exception of the recessions of 1975 and 1982, both lumber production and lumber exports have followed a steep upward trend since 1960.

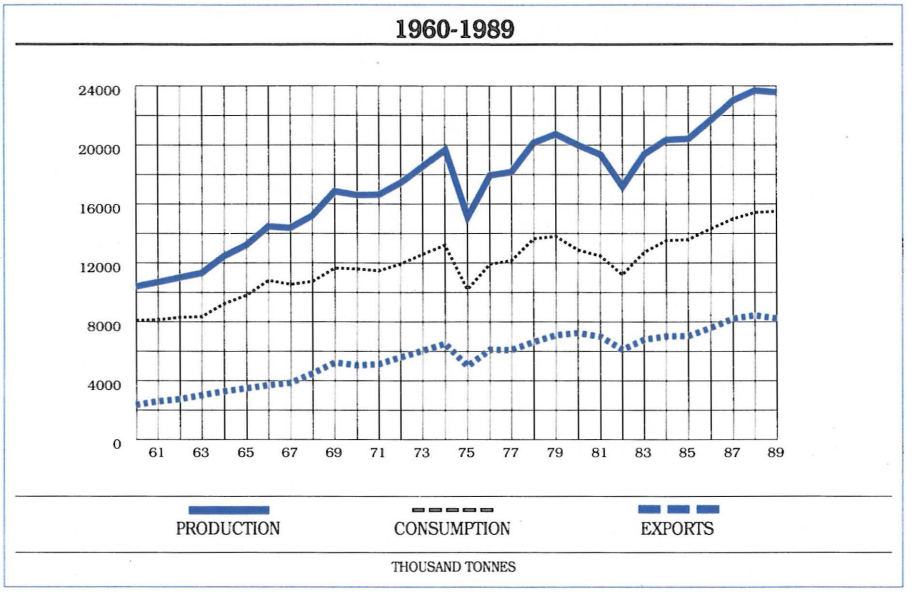
Production reached a high of 61.8 million m^3 in 1987, up by over 200% from 18.9 million m^3 in 1960. Housing starts soared during this period in response to favorable economic conditions and population growth, and domestic lumber consumption rose from 8.7 million m^3 in 1960 to 21.7 million m^3 in 1987. Lumber exports increased from 10.8 million m^3 to a record high of 41.7 million m^3 over this period.

Since then, the demand for Canadian lumber has softened due to a slowing in housing starts both in Canada and the United States. A strengthening of the Canadian dollar has also contributed to a reduction in lumber exports.

YEAR	PRODUCTION	EXPORTS	CONSUMPTION [1]
		(000 CUBIC METRES)	
1960	18 946	10 768	8 722
1965	25 525	15 277	10 909
1970	26 588	17 621	9 564
1975	27 305	15 466	13 026
1979	46 700	31 548	16 561
1980	44 995	29 290	16 903
1981	40 217	27 506	14 072
1982	37 452	27 807	10 540
1983	48 666	34 113	15 895
1984	48 989	37 335	12 857
1985	54 588	38 861	16 923
1986	54 853	38 274	17 998
1987	61 775	41 676	21 659
1988	60 706	41 113	21 043
1989	59 293	40 426	20 522

1. Apparent domestic consumption: Production + Imports - Exports.
Source: Statistics Canada.

WOOD PULP



PRODUCTION, EXPORTS AND CONSUMPTION OF WOOD PULP

Canada is the world's largest exporter of wood pulp. The high quality and competitive price of Canadian wood pulp makes it one of the most sought-after products on international pulp markets.

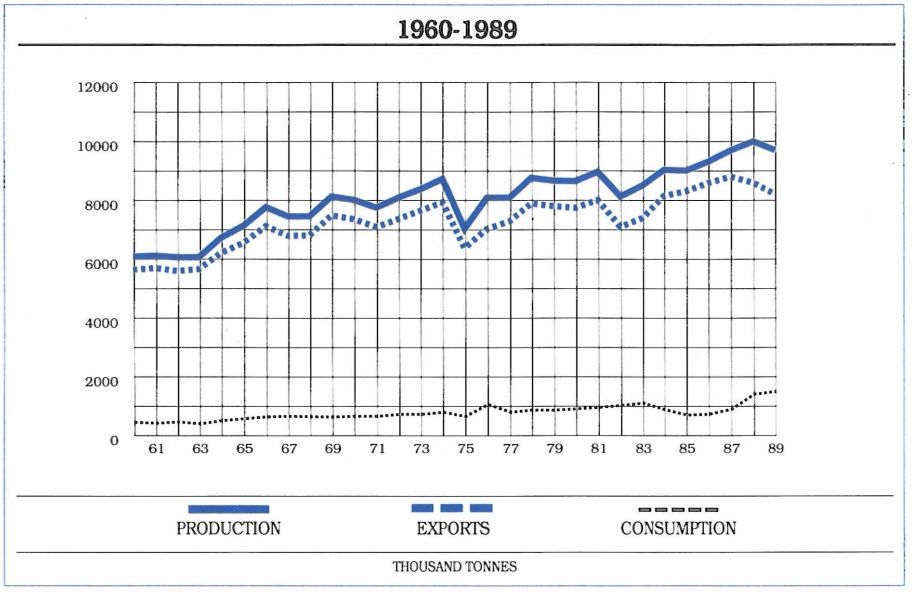
Annually, Canada exports almost one-third of all world pulp exports, with shipments valued at $6.9 billion. Canadian production of wood pulp has increased at an annual rate of 2.9% between 1960 and 1989, when it reached 23.6 million tonnes. In 1989, Canada exported 35% of its wood pulp production, mainly to the United States (45%), the European Economic Community (27%) and to Japan (15%).

Approximately 87% of Canada's pulp exports are comprised of bleached and semi-bleached softwood pulp used primarily in the fabrication of fine papers, printing papers, tissue and packaging papers.

YEAR	PRODUCTION	CONSUMPTION [1]	EXPORTS
		(000 TONNES)	
1960	10 398	8 096	2 360
1965	13 220	9 810	3 495
1970	16 609	11 593	5 063
1975	15 113	10 198	4 997
1979	20 728	13 799	7 102
1980	19 985	12 877	7 253
1981	19 326	12 468	6 999
1982	17 164	11 199	6 115
1983	19 376	12 727	6 806
1984	20 346	13 516	7 030
1985	20 417	13 581	7 060
1986	21 712	14 318	7 619
1987	23 032	14 995	8 242
1988	23 697	15 417	8 465
1989	23 562	15 505	8 241

1. Apparent domestic consumption: Production + Imports - Exports.
Sources: CPPA/Statistics Canada.

NEWSPRINT



PRODUCTION, EXPORTS AND CONSUMPTION OF NEWSPRINT

The 1989 Canadian newsprint production was 9.7 million tonnes, marginally down from the record high of 10 million tonnes in 1988.

From 1960 to 1989, Canadian newsprint consumption more than tripled, to reach 1.5 million tonnes. This 4.2% annual increase is the result of expanded circulation and a trend towards higher volume newspapers.

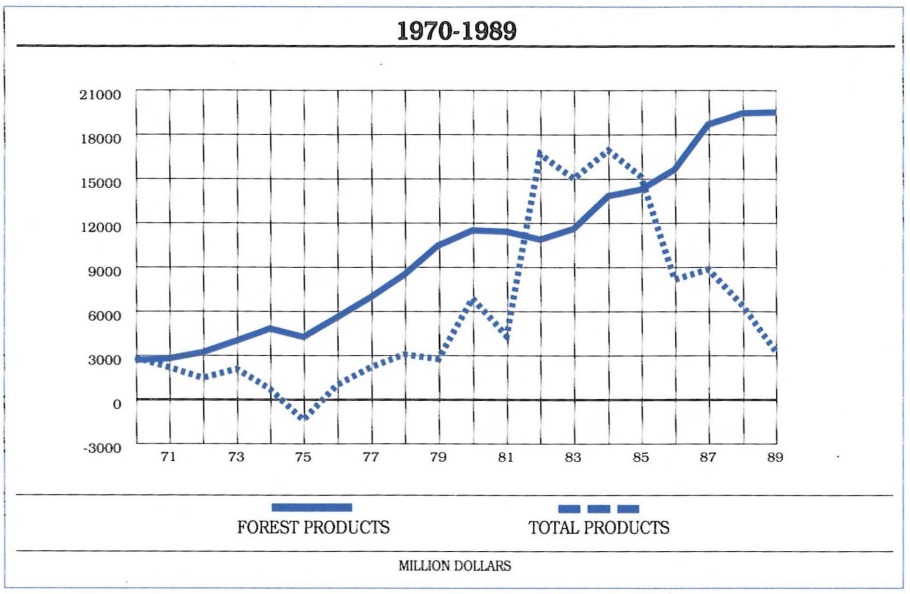
Newsprint exports valued at $5.7 billion grew at a modest annual rate of 1.3% over the period, reaching 8.2 million tonnes in 1989. Canada exports 84% of its newsprint to the United States, and the United Kingdom purchases slightly more than 3%.

The increase in production capacity in the late 1980s, coupled with slower economic growth worldwide, has resulted in a significant drop in newsprint prices. Although currently facing a slump the newsprint sector in Canada has a strong future in the production of higher-quality grades of mechanical printing papers.

YEAR	PRODUCTION	EXPORTS	CONSUMPTION [1]
		(000 TONNES)	
1960	6 068	5 616	452
1965	7 101	6 522	579
1970	7 996	7 339	657
1975	7 010	6 354	656
1979	8 642	7 778	864
1980	8 625	7 718	907
1981	8 946	7 986	960
1982	8 109	7 081	1 028
1983	8 486	7 379	1 107
1984	9 013	8 127	886
1985	8 988	8 285	703
1986	9 288	8 562	726
1987	9 669	8 772	897
1988	9 969	8 566	1 408
1989	9 678	8 185	1 502

1. Apparent domestic consumption: Production + Imports - Exports.
Sources: CPPA/Statistics Canada.

CONTRIBUTION TO THE BALANCE OF TRADE



CONTRIBUTION TO THE BALANCE OF TRADE

Forest products exports generate a significant proportion of Canada's foreign exchange. Since 1970, the contribution to the balance of trade by the forest sector has steadily risen.

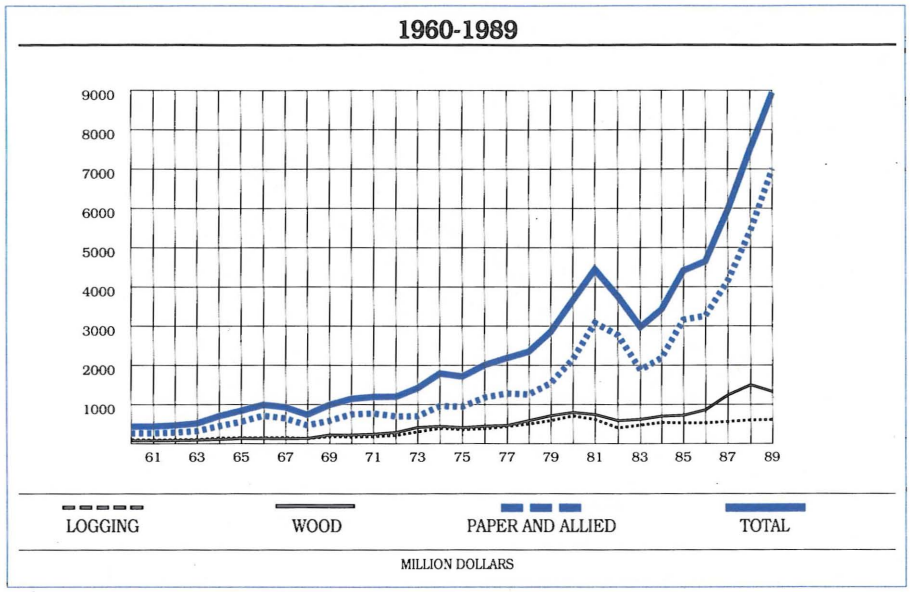
Forestry is Canada's single largest contributor to the balance of trade. In 1989, exports of forest products surpassed imports by close to $19.5 billion, more than the net trading surplus of agriculture, fishing, mining, and energy combined.

Wood pulp, newsprint and softwood lumber account for 79% of Canada's forest products exports. The United States is our largest market, taking 65% of our forest products exports, followed by the EEC with 15% and Japan with 11%.

YEAR	FOREST PRODUCTS	TOTAL PRODUCTS	FOREST PRODUCTS	TOTAL PRODUCTS
	CURRENT DOLLARS $000 000		CONSTANT 1986 DOLLARS $000 000	
1970	2 694	2 868	8 213	8 744
1975	4 266	-1 388	8 706	-2 833
1979	10 470	2 770	15 864	4 197
1980	11 504	6 885	15 759	9 432
1981	11 425	4 329	14 122	5 351
1982	10 886	16 674	12 385	18 969
1983	11 621	15 005	12 590	16 257
1984	13 828	16 924	14 525	17 777
1985	14 271	15 120	14 607	15 476
1986	15 619	8 159	15 619	8 159
1987	18 671	8 848	17 816	8 443
1988	19 434	6 379	17 683	5 804
1989	19 489	3 306	16 918	2 870

Source: Statistics Canada.

CAPITAL AND REPAIR EXPENDITURES



CAPITAL AND REPAIR EXPENDITURES

Capital and repair expenditures in the forest sector reached a record high of more than $8.9 billion in 1989, a 10.9 per cent annual increase since 1960.

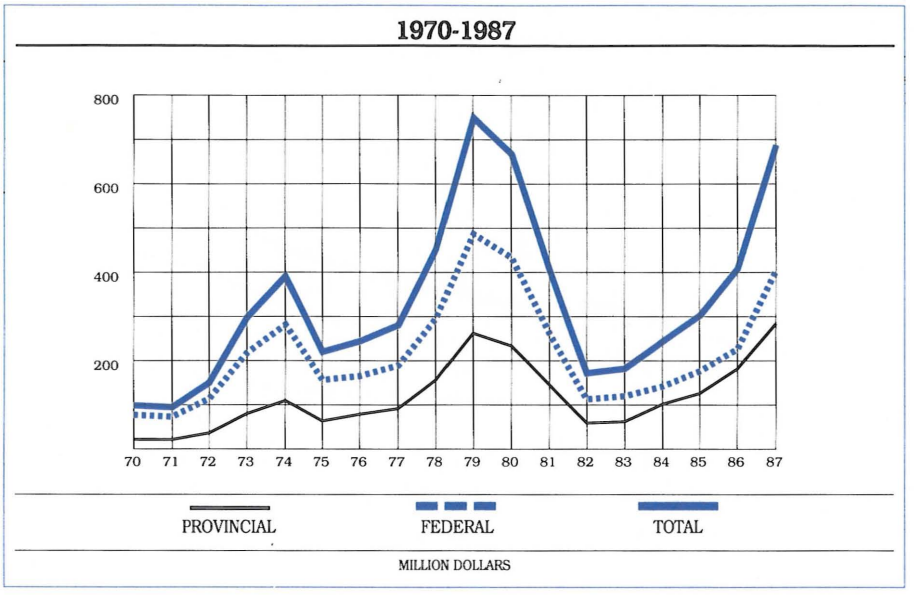
Paper and allied products industries, alone, invested more than $7 billion in 1989, of which $5.1 billion went to the acquisition of new capital.

Investment levels are expected to remain high to enable Canada to take advantage of projected growth opportunities. In addition, the pulp and paper industry will be required to spend several billion dollars on new equipment to meet new pulp and paper regulations aimed at eliminating the discharge of dioxins and furans by 1994.

YEAR	LOGGING	WOOD	PAPER AND ALLIED	TOTAL	LOGGING	WOOD	PAPER AND ALLIED	TOTAL
	CURRENT DOLLARS $000 000				CONSTANT 1986 DOLLARS $000 000			
1960	102	76	269	447	425	315	1 123	1 863
1965	151	132	565	848	570	498	2 133	3 201
1970	173	224	758	1 156	527	684	2 312	3 523
1975	359	409	955	1 723	733	834	1 948	3 516
1979	589	717	1 551	2 857	893	1 086	2 350	4 328
1980	709	796	2 152	3 657	971	1 091	2 948	5 010
1981	618	745	3 086	4 448	763	920	3 814	5 498
1982	403	586	2 777	3 766	458	667	3 159	4 284
1983	473	621	1 889	2 983	512	673	2 046	3 231
1984	541	701	2 196	3 438	569	736	2 306	3 611
1985	529	724	3 170	4 423	541	741	3 245	4 527
1986	528	861	3 269	4 658	528	861	3 269	4 658
1987	563	1 240	4 149	5 952	537	1 184	3 959	5 680
1988	602	1 499	5 423	7 524	548	1 364	4 935	6 846
1989	612	1 325	7 005	8 942	531	1 150	6 081	7 763

Source: Statistics Canada.

CORPORATE INCOME TAXES



CORPORATE INCOME TAXES

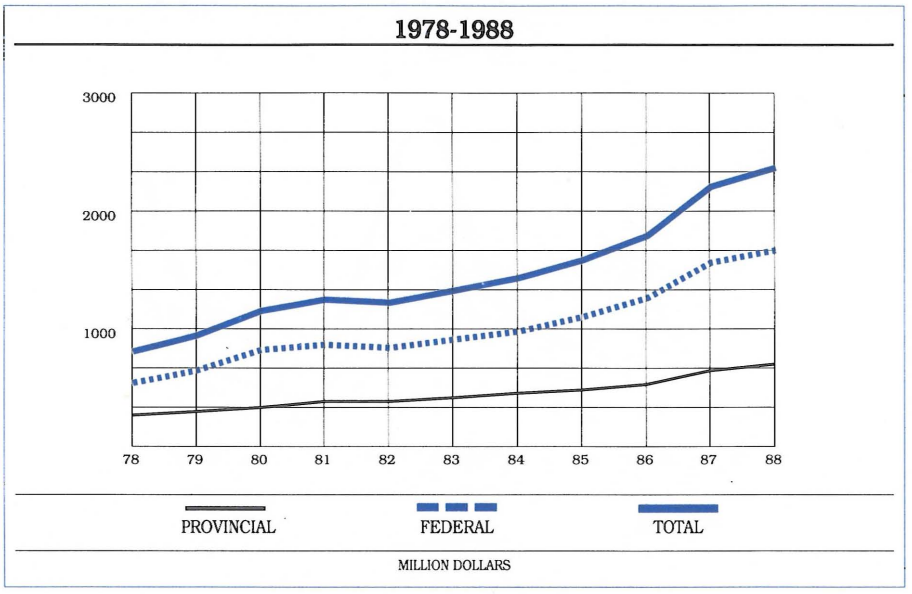
Corporate income taxes paid by Canadian forest industries are influenced by business cycle effects on income. As a result, they are highly cyclical. Over the period 1977 to 1987, there has been no perceivable upward trend in corporate taxes paid.

Federal corporate income taxes are generally double the provincial corporate income taxes.

YEAR	PROVINCIAL	FEDERAL	TOTAL CORPORATE INCOME TAX	PROVINCIAL	FEDERAL	TOTAL CORPORATE INCOME TAX
	CURRENT DOLLARS $000 000			CONSTANT 1986 DOLLARS $000 000		
1970	21.6	74.6	96.2	65.9	227.4	293.3
1975	63.4	154.4	217.8	129.4	315.1	444.5
1977	91.4	187.1	278.5	161.5	330.6	492.0
1978	156.1	294.0	450.1	260.2	490.0	750.2
1979	262.3	484.7	747.0	397.4	734.4	1 131.8
1980	233.5	431.5	665.0	319.9	591.2	911.0
1981	145.3	260.6	405.9	179.6	322.1	501.7
1982	58.9	110.8	169.7	67.0	126.1	193.1
1983	62.1	118.1	180.2	67.3	128.0	195.2
1984	102.0	140.2	242.2	107.1	147.3	254.4
1985	125.9	174.5	300.4	128.9	178.6	307.5
1986	181.7	224.8	406.3	181.7	224.8	406.3
1987	283.7	401.9	685.5	270.7	383.5	654.1

Source: Statistics Canada.

PERSONAL INCOME TAXES



PERSONAL INCOME TAXES

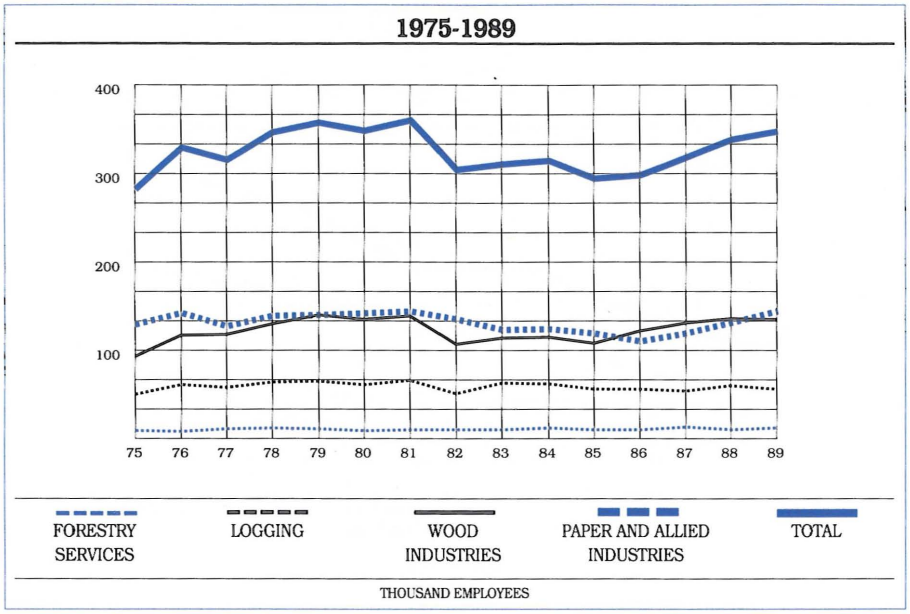
Both federal and provincial personal income taxes[1] paid by forest sector workers have approximately tripled between 1978 and 1988. In part, the increase can be attributed to a higher level of income for workers: wages and salaries doubled over the period. Another factor is the increase in the tax rate itself: the tax-to-income ratio for all taxes has increased from 10% to 17% over this period.

As with corporate income taxes, federal personal income taxes are generally twice the provincial income taxes.

YEAR	PROVINCIAL	FEDERAL	TOTAL PERSONAL INCOME TAXES [1]	PROVINCIAL	FEDERAL	TOTAL PERSONAL INCOME TAXES [1]
	CURRENT DOLLARS $000 000			CONSTANT 1986 DOLLARS $000 000		
1978	266	543	809	443	905	1 348
1979	296	649	946	449	984	1 433
1980	332	822	1 154	455	1 126	1 581
1981	383	866	1 249	474	1 070	1 544
1982	383	841	1 224	436	957	1 393
1983	415	911	1 326	450	987	1 437
1984	453	979	1 432	475	1 029	1 504
1985	481	1 103	1 584	493	1 128	1 621
1986	528	1 264	1 792	528	1 264	1 792
1987	644	1 564	2 208	615	1 492	2 107
1988	700	1 667	2 367	637	1 516	2 154

1. Estimated.
Sources: Revenue Canada/Forestry Canada.

EMPLOYMENT IN THE FOREST SECTOR



DIRECT EMPLOYMENT IN THE CANADIAN FOREST SECTOR

Employment trends in the Canadian forest sector have been quite stable, except during fluctuations in the downward cycles of the industry. Following the recession in 1982, the forest sector showed visible signs of recovery.

Direct employment in the paper and allied products industries rose from 120 000 in 1985 to 145 000 in 1989. The wood product industries also exhibited a large increase over this period, rising from 108 000 to 135 000. Growth in the domestic economy and strong export markets have contributed to this upward shift.

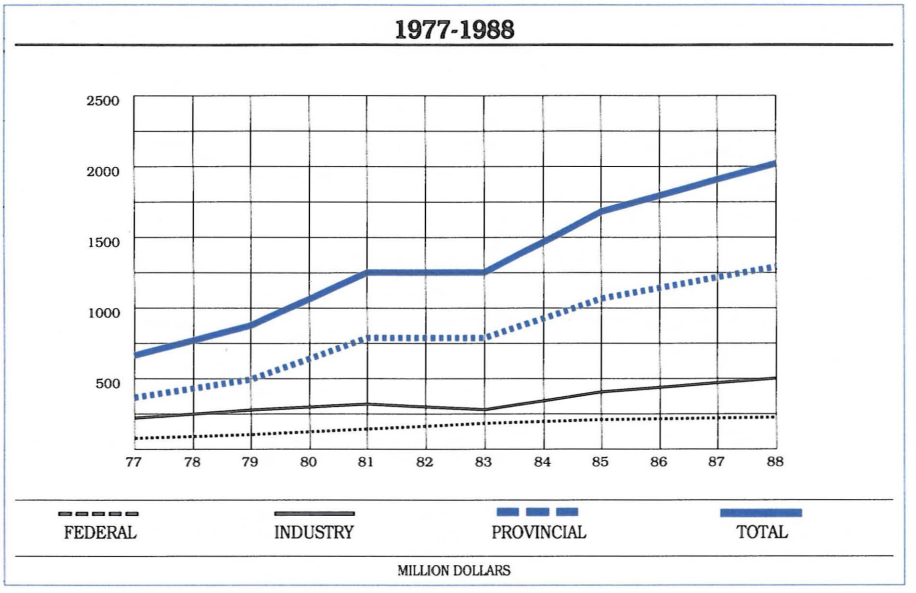
Direct employment in logging has been relatively stable since 1985, at about 56 000. Impacts of technological improvements in wood utilization in both wood product and paper and allied products industries, combined with recycling, will likely prevent significant employment growth in this sector.

Direct employment in forestry services has risen from 11 000 to 13 000.

YEAR	FORESTRY SERVICES	LOGGING	WOOD INDUSTRIES	PAPER AND ALLIED INDUSTRIES	TOTAL DIRECT EMPLOYMENT
			(000)		
1975	10	50	93	130	283
1979	12	65	140	141	358
1980	10	61	135	143	349
1981	11	66	139	145	361
1982	11	51	107	136	305
1983	11	63	114	124	311
1984	13	62	115	125	315
1985	11	56	108	120	295
1986	11	56	122	111	299
1987	14	54	131	120	319
1988	11	60	136	132	339
1989	13	56	135	145	348

Source: Statistics Canada.

FOREST MANAGEMENT EXPENDITURES



FOREST MANAGEMENT EXPENDITURES

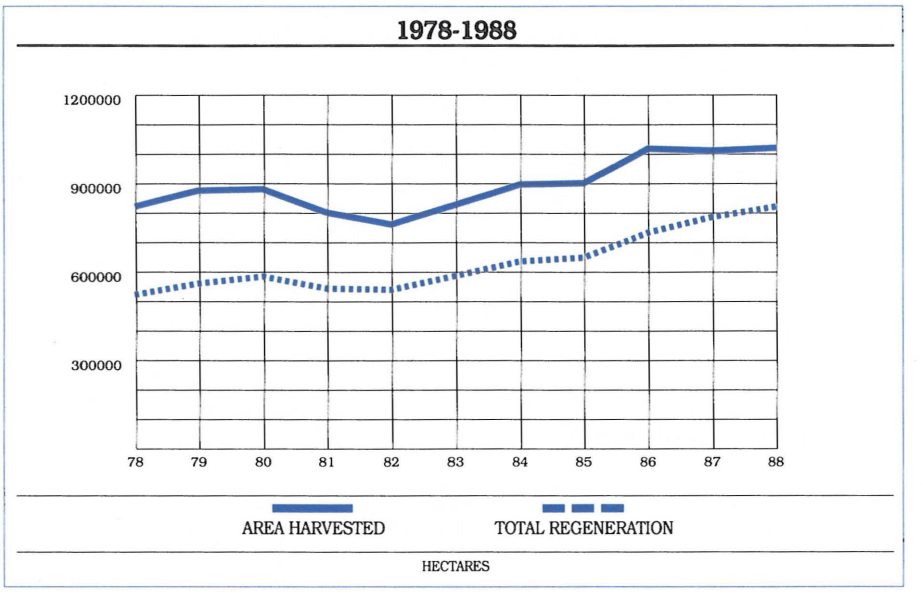
Canada spent more than $2 billion on forest management activities in 1988, compared with $659 million in 1977. These activities included silviculture, protection, access, research, inventory, timber management and administration.

Over the last decade, the federal and provincial governments have funded forest management programs to increase the sustainability of Canada's forests and to maintain forest sector contributions to the Canadian economy. Since 1982, forest management activities have been undertaken in every region of Canada under federal-provincial Forest Resource Development Agreements (FRDA) worth more than $1.1 billion. Approximately 80% of FRDA funding has been devoted to site preparation, regeneration and stand tending operations.

YEAR	FEDERAL	INDUSTRY	PROVINCIAL	TOTAL FOREST MANAGEMENT EXPENDITURES	FEDERAL	INDUSTRY	PROVINCIAL	TOTAL FOREST MANAGEMENT EXPENDITURES
	CURRENT DOLLARS $000 000				CONSTANT 1986 DOLLARS $000 000			
1977	77.7	220.8	360.8	659.3	137.3	390.1	637.5	1 164.8
1979	103.2	278.0	490.5	871.6	156.4	421.2	743.2	1 320.6
1981	142.6	319.5	785.6	1 247.7	176.3	394.9	971.1	1 542.3
1983	183.6	280.3	783.9	1 247.8	198.9	303.7	849.3	1 351.9
1985	209.0	405.9	1 063.0	1 677.9	213.9	415.5	1 088.0	1 717.4
1988	225.8	502.5	1 287.8	2 016.1	205.5	457.2	1 171.8	1 834.5

Sources: CPPA/Forestry Canada.

FOREST REGENERATION SUCCESS



FOREST REGENERATION SUCCESS

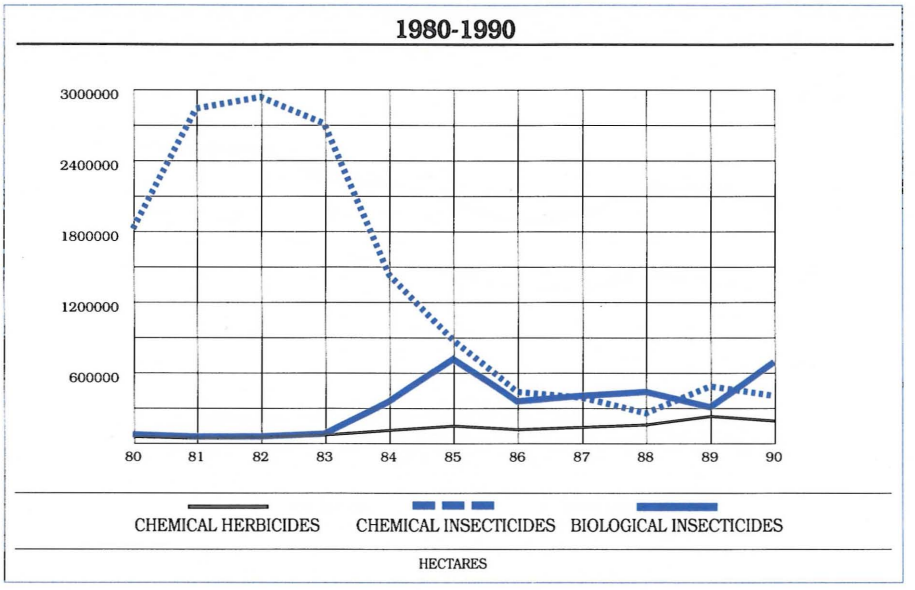
Since 1978, the area of productive forest land harvested in Canada has risen by 25%, while the area planted almost tripled. In 1988, more than one million hectares were harvested, whereas 823 thousand hectares were successfully regenerated, by planting, seeding or natural regeneration. This represents a successful regeneration (as a percentage of area harvested) of slightly more than 80%, a dramatic increase from 64% ten years earlier.

In 1990, more than one billion seedlings were planted or seeded in Canada.

YEAR	AREA HARVESTED	TOTAL REGENERATION	SUCCESSFUL REGENERATION AS A PERCENTAGE OF AREA HARVESTED
	HECTARES		PERCENT
1978	823 009	523 195	63.6
1979	876 433	561 805	64.1
1980	881 419	585 718	66.5
1981	802 637	545 446	68.0
1982	762 935	541 230	70.9
1983	829 956	588 290	70.9
1984	898 069	637 217	71.0
1985	901 552	649 255	72.0
1986	1 018 732	734 693	72.1
1987	1 012 894	788 081	77.8
1988	1 021 619	822 860	80.5

Source: Forestry Canada.

PESTICIDES



PESTICIDE USE IN CANADA

In the past decade, growing concern about chemical pesticides and their effects on the environment has led to the ban of the most toxic pesticides. Governments and industry have both increased their research and development efforts into alternative pest control methods, specifically biological and integrated pest management.

Chemical herbicides are used to control competing vegetation. The area sprayed has increased from 57 thousand hectares in 1980 to 233 thousand hectares in 1989.

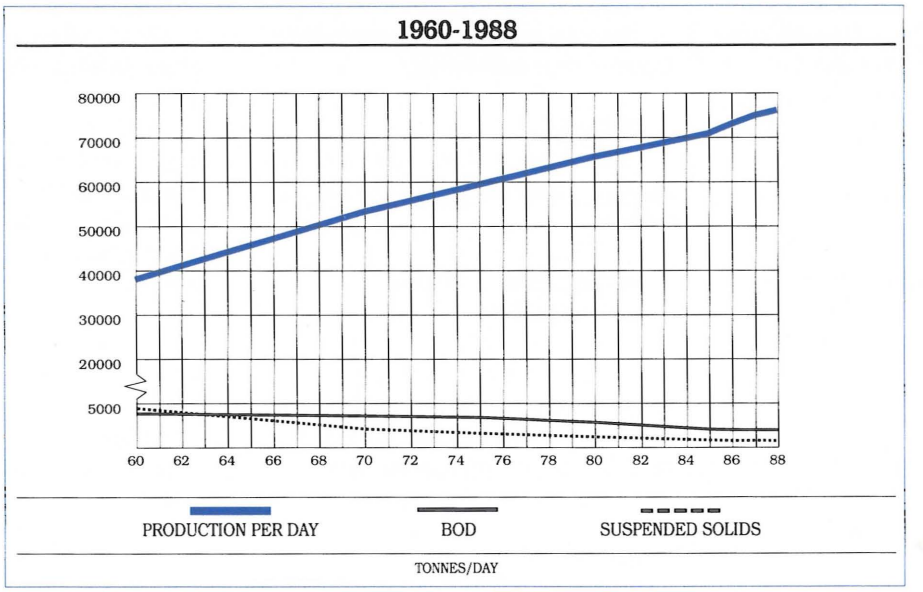
In the fight against spruce budworm, a biological control agent, Bacillus thuringiensis (B.t.), has become the environmentally preferred product. The application of B.t. has risen from 4% in 1980 to 64% in 1990.

Since 1982, the total area of insecticide spraying has declined from about 3 million hectares to about 0.7 million hectares in 1988, primarily due to lower insect population levels.

YEAR	CHEMICAL HERBICIDES	CHEMICAL INSECTICIDES	BIOLOGICAL INSECTICIDE
		HECTARES	
1980	57 457	1 824 000	76 000
1981	47 349	2 842 000	58 000
1982	52 917	2 940 000	60 000
1983	73 549	2 716 000	84 000
1984	113 341	1 440 000	360 000
1985	150 613	880 000	720 000
1986	119 775	440 000	360 000
1987	139 674	392 000	408 000
1988	161 305	259 000	441 000
1989	232 858	488 000	312 000
1990	193 000 [1]	407 000	693 000

1. Proposed.
Source: Forestry Canada.

WATER POLLUTANT DISCHARGE



WATER POLLUTANT DISCHARGE TRENDS

The processing of wood into pulp and paper produces a variety of gas, liquid and solid effluents which cause concern when discharged into Canadian rivers.

A specific concern relates to the form and volume of suspended solids (SS) and the consequent biochemical oxygen demand (BOD) exerted on the receiving waters. These emissions have the potential to severely deplete the concentration of dissolved oxygen in the water and injure aquatic life.

Over the years, the Canadian forest industry has attempted to deal with these concerns by introducing new pollution abatement technology and new mill processes. Although total mill production doubled between 1960 and 1989, the daily discharge of SS and BOD levels decreased by 83% and 49%, respectively.

Regulations under the federal Fisheries Act will set new, more stringent levels of acceptability for toxicity, suspended solids and biochemical oxygen demand in effluents discharged from pulp and paper mills.

YEAR	PRODUCTION OF PULP AND PAPER	BOD	SUSPENDED SOLIDS
		TONNES/DAY	
1960	37 964	3 875	4 471
1970	53 319	3 598	2 116
1975	59 468	3 435	1 636
1980	65 666	2 878	1 227
1985	70 820	2 071	842
1986	72 939	2 009	769
1987	74 911	1 987	799
1988	76 096	1 981	758

Source: CPPA.

GLOSSARY

ACID RAIN
Means more than just rain with lower than normal pH. It has become the popular generic term encompassing all forms of air pollution - wet precipitation, dry deposition, ambient gaseous concentrations of pollutants, and airborne particulates.

ALLOWABLE ANNUAL CUT (AAC)
The average volume that may be harvested annually from a given forest management unit.

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

BIOCHEMICAL OXYGEN DEMAND (BOD)
It is a measure of the degree of organic pollution of water.

BIOTECHNOLOGY
The application of science and engineering to the direct or indirect use of living organisms.

COMMERCIALLY OPERABLE
Timber which is economically feasible to harvest (economically accessible).

ECOSYSTEM
A complex of living organisms with their environment within a particular habitat.

FOREST BIOMASS
The mass of the above-ground portion of woody plants in a forest. It is generally expressed in terms of ovendry tonnes per unit of area of forest.

GENE POOL
The total available genes within an interbreeding population.

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

INTEGRATED FOREST MANAGEMENT
Integration of wildlife, water, recreation and other non-timber values of the forest into forest management; a holistic approach to forest management involving preservation, protection, extraction and development.

INTEGRATED PEST MANAGEMENT
The application of a combination of techniques for preventing and limiting forest damage caused by insects, disease and weeds, including the use of biological and chemical pesticides and silvicultural methods.

MATURE
Trees or stands that are sufficiently developed to be harvestable.

NONSTOCKED (FOREST LAND)
Productive forest land that lacks merchantable tree species.

OVERMATURE
Trees or stands past the mature stage of development.

PRODUCTIVE FOREST LAND
Forest land that is capable of producing a merchantable stand within a reasonable length of time.

REGENERATION
The renewal of a forest crop by natural or artificial means. Renewal by self-sown seed or by vegetative means, e.g., root suckers, is termed natural regeneration. Renewal by sowing or planting is artificial regeneration.

RESERVED
Area or forest land that, by law or policy, is not available for the harvesting of forest crops.
Highly protected conservation areas include both land and water used for ecosystem protection, tourism, outdoor laboratories, preservation of rare species, maintenance of wildlife populations, gene pools, etc. They include ecological reserves, nature and wilderness reserves, migratory bird sanctuaries, and national parks and wildlife areas.

SHIPMENTS
Goods produced and delivered to customers (does not include the inventories of forest products).

SILVICULTURE
The practice of growing and tending forests.

SITE PREPARATION
A mechanical, fire, chemical or hand treatment which provides favourable conditions for planting or seeding a particular forest area.

STAND
A group of trees with distinguishable and uniform characteristics i.e. composition, age or condition.

STOCKED (FOREST LAND)
Land supporting the growth of commercial tree species.

SUPPLY
Economic supply: amount of merchantable timber; the economic dimension of the timber is determined by accessibility, harvesting costs, suitability, product value, stumpage charges, etc.
Physical supply: the growing capacity of the timber; the physical dimension of the timber is determined by factors such as: growth and yield, species, age class, etc.

SUSTAINED YIELD
The yield that a forest can produce continuously at a given intensity of management.