THE STATE OF CANADA'S FORESTS 1994

a balancing act

Natural Resources Canada
Canadian Forest Service

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by David McNicoll

Message from the Minister

I am pleased to present to Parliament the fifth annual report on the state of Canada's forests. Over the years, the information contained in these reports has helped Canadians assess how their forests are being managed. This year's report describes the challenges of maintaining a sustainable supply of timber while conserving habitat for forest wildlife.

Minister of
Natural Resources Canada

Canada's forests are essential to maintaining a healthy environment and provide many recreational opportunities. With half the nation's landscape covered in trees, forests support one of our largest industries. Indeed, the forest sector employs roughly 850 000 Canadians and makes the largest net contribution to our balance of trade.

Balancing our economic and environmental needs is the essence of sustainable development. Countries that consume and produce forest products are trying to come to grips with this balancing act. They share the same quandary: how to best ensure a healthy, vigorous forest for tomorrow, while meeting the needs of today. They also face common challenges: determining what constitutes sustainable forest management; and finding ways to evaluate their own performance in sustaining forests.

Perhaps the toughest problem is coming up with scientific and measurable criteria to assess forest management. Once that issue is resolved, countries would be encouraged to meet internationally agreed-upon standards. These standards could also serve as the basis for an objective labelling system to help consumers identify products that come from sustainably managed forests.

Canada has been involved in efforts to address this issue on a number of fronts, both at home and abroad. Three years ago, the state of the forests report introduced a preliminary set of sustainable development indicators. The Canadian Council of Forest Ministers has taken this initiative one step further as part of the National Forest Strategy. Through nationwide consultation involving some of our best scientists and representatives from industry, environmental, Aboriginal and social groups, they developed a set of scientific measures of sustainable forest management. The Council is now looking at ways to implement this framework.

In February 1995, Canada and nine other countries (Australia, Chile, China, Japan, Mexico, New Zealand, the Republic of Korea, the Russian Federation and the United States) agreed on a set of international indicators for temperate and boreal forests. (Together, these nations account for 90% of these forests.) In April, we presented these international indicators, along with the Canadian framework, at a meeting of the United Nations Commission on Sustainable Development.

As the world's largest exporter of forest products, Canada fully appreciates the importance of coming up with internationally agreed-upon rules for forest management. As this evolves, we will continue to improve our domestic forest management practices, while we work hard to achieve an international consensus.

Anne McLellan

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HIGHLIGHTS

BALANCING THE DEMANDS ON CANADA'S FORESTS

Forests cover nearly half of the Canadian landscape and are the dominant feature of our economy, culture, traditions and history. The demands that Canadians place on their forests are growing, bringing about changes in the way the nation's forests are managed. This year's report looks at balancing the use of our forests to provide a sustainable supply of timber for industry, while maintaining forest habitat for wildlife.

CANADA'S FORESTS

There are 417.6 million hectares of forest land in Canada. Some 37% of this area is open forests, comprising muskeg, rock, barrens and marshes, as well as slow-growing or sparse forests; almost 56% are considered commercial forests — capable of growing a merchantable crop of trees within a reasonable length of time. Approximately 119 million hectares of forest, or 28%, are currently managed for timber production. An estimated 50 million hectares (12%) are protected from harvesting by legislation or policy.

Most of Canada's forests are publicly owned; provincial governments are responsible for managing 71% of our forests, and federal and territorial governments oversee 23%. Six percent are on private property, belonging to more than 425 000 private landowners.

MANAGING FOREST WILDLIFE

Two-thirds of Canada's estimated 300 000 wildlife species live in the forest. Some 117 species are listed as threatened or endangered, including 41 forest-dwelling species. Traditionally, wildlife managers focused on only a few species, such as commercial or game species, or species at risk. With the growing importance of biodiversity, our definition of "wildlife" is expanding to include all wildlife.

Different approaches are being developed to manage for a broader range of species. These new methods include guild management, indicator species, habitat management, and more recently, ecosystem management. Considerable research remains to be done to further develop forest and wildlife management approaches, and to improve our ability to report regionally and nationally on the status of wildlife in this country.

TIMBER SUPPLY

The supply of timber in Canada is determined by the allowable annual cut (AAC), which is the maximum volume of timber that can be harvested from an area over a set period of time. In 1993, Canada harvested 87% of its softwood AAC and 35% of its hardwood AAC. Several provinces are reviewing their AACs and may reduce them to reflect the new areas being protected from harvesting for environmental reasons, or the lower wood volumes found in second-growth forests. Options to increase Canada's wood supply include greater access to remote areas, more intensive silviculture, expanded fire protection, better utilization of wood, and increased recycling. All of these options must be evaluated in the context of sustainable forest management to achieve the goal of managing forests as ecosystems.

SUSTAINING CANADA'S FORESTS

Between 1978 and 1992, the volume of wood in Canada's commercial forests increased by 4%, or 940 million m^3. The volume of wood in old forests (mature, overmature and mixed-aged) increased by 1 billion m^3 and accounts for 71% of the total volume in Canada's commercial forests. Fire, insects and disease affected an average 1.14 million hectares annually, while harvesting was carried out on an average 887 000 hectares annually.

This year's report presents new data regarding the status of regeneration on areas harvested since 1975. The area that had been regenerated with commercial species increased to 82% in 1992 from 68% in 1980. Despite this, the area that had not regenerated after harvesting also increased, from 585 000 hectares in 1975 to 2.5 million hectares in 1992. However, the area in 1992 that had not successfully regenerated with commercial species was smaller than it had been in 1991 (2.8 million hectares) and is the first year of such a decline. The area not regenerated in 1992 represents 1.1% of the commercial forest landbase.

ECONOMIC GROWTH

In 1994, shipments of pulp and paper rose 9.3% to a record level of 28.9 million tonnes. Production of lumber and panels increased 3.4% between 1993 and 1994. Most of this increase was due to higher exports, which were up 5.6%. Profits in the wood and paper sector increased from $152 million in the first quarter of 1994 to $1.3 billion by the fourth quarter. Employment in the forest sector increased by 70 000 to 847 000, although a new study predicts that employment levels will decline over the next decade as a result of new technologies.

INTERNATIONAL EVENTS

Forestry continued to be an important issue internationally. A long-standing dispute over Canadian exports of softwood lumber to the USA was resolved. A bilateral consultation process was established to promote future cooperation on forestry matters.

Canada and nine other nations, which together represent 90% of the world's temperate and boreal forests, finalized a comprehensive set of criteria and indicators of sustainable forest development. These indicators will provide a foundation for future international talks on the conservation of forests.

CHAPTER ONE

Year in Review 1994

MANAGING FORESTS

New Rules

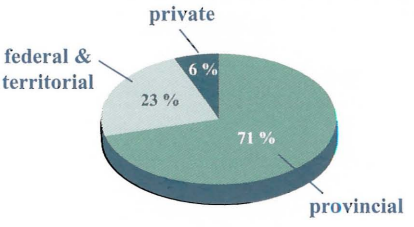
British Columbia introduced legislation for its Forest Practices Code that will govern all aspects of forest management on Crown lands. The Code establishes strict new standards and heavy penalties — up to $2 million a day for repeat offenders. Enforcement officers will protect streams and wildlife habitat, and ensure that logged areas are replanted. In some parts of the province, clearcut areas will be limited to 40 hectares.

British Columbia's new Forest Land Reserve Act is intended to secure the province's commercial forest landbase from urban development and other non-forest uses. All privately managed forest lands are included in the reserve (exclusions can be obtained through public processes); provincial Crown lands are added to the reserve following land-use planning processes. Lands dedicated to forestry and other sustainable resource uses will be zoned and managed in one of three ways: low-intensity areas (to ensure that environmental, recreational and cultural heritage values are respected); high-intensity areas (to produce more and better timber through labour-intensive enhanced silviculture); and multi-resource use areas (to manage for a range of resource values).

In October, Saskatchewan adopted a new forest management policy framework, outlining the province's commitment to the sustainable management of its forest resources. New legislation is being developed, with broad-based public consultation, to support the implementation of the framework's strategic directions.

OVERVIEW OF CANADA'S FORESTS

The vast majority of the nation's forests (94%) are publicly owned; the remaining 6% are privately owned — the property of more than 425 000 landowners. On behalf of the Canadian public, provincial governments manage roughly 71% of our forests, while the federal and territorial governments manage approximately 23%. Forest management is a matter of provincial jurisdiction, and each province has its own set of forest legislation, policies and regulations. The same can be said of the Northwest Territories. In the Yukon, however, forest management remains a federal responsibility. The general framework for forest management planning in Canada is detailed on page 8. The federal government's role in forestry pertains to such areas as research, trade and commerce, international affairs, the environment, pesticide regulation and Indian affairs.

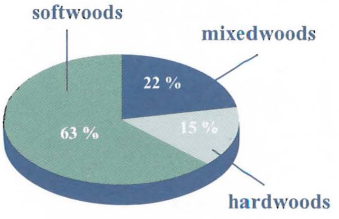


Forest Land Ownership

Forty-five percent of Canada's land is forested. Of those 417.6 million hectares, almost 56% are considered "commercial forests" — capable of producing both timber and non-timber products — although only about 28% are currently managed for timber. Approximately 12% (an area roughly equivalent to France) have been protected from harvesting by policy or legislation. (Heritage forests are protected by legislation, and sensitive sites are protected by policy.)

Canada's forests play a key role in moderating our climate, regulating our water systems, preventing erosion, alleviating air pollution, and providing habitat for wildlife. They also offer a multitude of recreational opportunities enjoyed not only by Canadians, but also by tourists from around the world.

The forest landbase in this country is enormous and extremely diverse. Our eight major forest regions *(see pullout map)* each have unique combinations of predominant tree species — all told, there are 165 tree species in Canada. Sixty-three percent of the forest cover is composed of softwoods, 15% is hardwoods, and 22% is mixedwoods. Most of our forests are even-aged due to such cyclical and widespread disturbances as fire and insect infestations.



Forest Types in Commercial Forest

Canada's Forests

		million hectares
Heritage forests[a] (protected from harvesting by legislation)		22.8
Commercial forests (capable of producing timber and non-timber products)		236.7
✦ managed forests[a] (currently managed for timber production)	118.9	
✦ unallocated forests (currently unallocated and unaccessed)	90.3	
✦ protection forests (unavailable for harvesting by policy)	27.5	
Open forests (small trees, shrubs and muskeg)		156.2
Total forest land		**417.6**

[a] Estimates

Source: Canadian Forest Service

FOREST MANAGEMENT PLANNING FRAMEWORK

Ontario passed a new Crown Forest Sustainability Act, replacing the Crown Timber Act written in 1952. The new Act defines forest sustainability, sets out the requirements for forest planning, defines licensing mechanisms that provide fairer access to timber, and provides remedies and penalties for non-compliance.

Under Quebec's new forest policy, maximum cutting areas will be reduced from 250 hectares in the province's three main forest areas (to 50 and 100 hectares in 90% of the cutting areas in south and central Quebec, respectively; and to 150 hectares in northern Quebec). Beginning in 1995, alternative harvesting techniques that better protect regenerating forests and soils will be used instead of traditional clearcutting practices.

New Approaches

In 1992, the British Columbia government created the Commission on Resources and Environment (C.O.R.E.) to provide independent advice on land-use planning. By engaging regional stakeholders and communities, C.O.R.E. attempts to achieve a consensus among different interests. Where consensus is not achievable, it attempts to develop recommendations for the government to consider.

In September 1994, the Long Beach Model Forest was established on the west coast of Vancouver Island. The 400 000-hectare forest encompasses part of the Clayoquot Sound area and is the last of 10 model forests to be created across Canada.

Following public consultations, Alberta completed a draft of its conservation strategy for woodland caribou. The strategy is expected to be finalized in 1995.

To move toward ecosystem management, Manitoba is finalizing an ecological site-classification field guide for its forests and a long-term, integrated forest resource management plan.

In April 1994, after more than four and a half years of public hearings, Ontario completed its environmental assessment for timber management on Crown lands. The assessment includes 115 legally binding requirements that will change the way forests are managed. For example, it calls for the establishment of citizens committees to advise on forest management planning at local levels, the development of a conservation strategy for old-growth forests, and research on the impact of harvesting on forest productivity.

Quebec has been developing the concept of an "inhabited forest" — a new approach to managing forests close to populated areas. This type of community forestry promotes the development of all forest

resources and the sharing of management responsibilities between local residents and communities.

Quebec also released its forest protection strategy. The main objectives are to sustain current levels of forest productivity and socio-economic activities, protect forest sites, minimize or — if possible — eliminate the use of pesticides in the forest, and promote the harmonious use of all forest resources.

The New Brunswick Federation of Woodlot Owners released a code of practice as part of an initiative to develop stringent land-use guidelines and practices. Over the next two years, the Federation will encourage provincial woodlot owners to formally accept the code, establish harvesting standards, and develop effective incentives to eliminate abusive harvesting practices.

Nova Scotia's Minister of Natural Resources and 24 representatives from the province's forest sector signed a forest accord in December 1994. The accord is a broad-based commitment to continue implementing the National Forest Strategy. For example, it commits signatories of the Accord to refining forest inventory information, reviewing harvesting and silvicultural activities, and establishing demonstration forests for sustainable forest management.

The document *Stewardship and Sustainability — A Renewed Conservation Strategy for Prince Edward Island* was released in 1994, and will guide the sustainable development and conservation of the Island's natural resources. Since then, a survey has been undertaken to determine the impact of non-native tree species on local bird populations, and a manual has been produced for woodlot owners interested in forest wildlife management methods.

In 1994, an ecological classification system was completed for the Western Newfoundland Model Forest. From this initial step, the government intends to produce a complete set of ecological site maps for the province.

Newfoundland began preparing its second Twenty-Year Forestry Development Plan. The Plan, to be completed in 1995, will be revised every five years. It sets a new direction for forest management in the province, and reflects the transition from traditional timber management to ecosystem management. A detailed environmental protection plan is now being put in place.

The Standing Committee on Natural Resources tabled its report on clearcutting in the House of Commons in June 1994. The report, entitled *Canada: A Model Forest Nation in the Making*, observed that many countries practice clearcutting and concluded that it is an

Under the Canadian Wildlife Federation (CWF) Reforestation Program, 6 000 trees were planted at a deer wintering site in Glencoe, New Brunswick. The seedlings, donated by J.D. Irving Limited, were planted by 120 students from Fredericton High School under the supervision of the New Brunswick Department of Natural Resources and Energy, and the New Brunswick Wildlife Federation. In turn, the CWF donated $1 000 to the school's environmental science program.

ecologically appropriate practice for most forest types in Canada. In responding to the report's 17 recommendations, the federal government reiterated its commitment to research alternative harvesting practices and to improve scientific knowledge and data on forest ecosystems.

Most of the responsibility for regenerating and managing Canada's forests has been assigned to forest companies. Forest management expenditures totalled $2.4 billion in 1993.

New Investment in Forest Renewal

Under British Columbia's Forest Renewal Plan, an estimated $2 billion (paid for by increases in stumpage and royalty payments) will be invested over the next five years in forests and the people who work in them. A new Crown agency, Forest Renewal BC, has been established to oversee this investment. In the summer of 1994, the government announced $52 million in forest renewal funding focusing on silviculture and watershed restoration projects.

Alberta has changed the way it charges companies for the right to harvest sawlogs. Rather than a flat rate, companies now pay a fee based on the market price for lumber products. In 1994, stumpage fees doubled as a result of higher lumber prices; a portion of these fees is being reinvested in the forest.

Under Ontario's new stumpage system, the money paid by companies to harvest timber on public lands will go directly into trust funds. Before logging operations begin, companies are required to obtain approval from the province for their renewal plan. Later, they are reimbursed from the Forest Renewal Trust Fund for silvicultural expenses. In the past, stumpage fees went directly into the government's general revenue account.

A $2-million private forests sustainability fund was established to assist woodland owners in southern Ontario. Community stewardship councils will be set up to provide owners with information on woodlot management.

In 1994 the federal government, through the Federal Office for Regional Development in Quebec, provided $6.5 million to private woodlot owners in the Gaspé/Lower St-Lawrence region by extending the Plan de l'Est until March 1996.

The federal government also contributed $1.6 million to Prince Edward Island and $4.9 million to New Brunswick to extend their respective forest agreements until April 1995.

Beginning in 1995, New Brunswick will invest an additional $10.7 million each year to increase the long-term sustainable harvest from Crown lands by approximately 40%; greater emphasis will be placed on hardwoods.

EXPANDING PROTECTED AREAS

In April 1995, the World Wildlife Fund released its Annual Endangered Spaces Progress Report, which evaluates government progress in establishing protected areas and policy across the country. The report also includes information on the work of non-governmental organizations in the campaign to protect endangered spaces *(see pages 67 to 68).*

The Nature Conservancy of Canada, a non-profit organization headquartered in Toronto, bought 3 118 hectares of land in 1994 and set up 56 reserves across Canada to protect forest, wetland, and tall- and short-grass prairie areas.

British Columbia is doubling its parks and wilderness areas. Since implementing its protected areas strategy in May 1992, 81 new parks and other areas have been created, increasing the total from 6% to 8.65% of the province, or to 82 000 km^2 — an area larger than New Brunswick or Scotland.

Manitoba recently established four new protected areas (parklands) totalling 2.1 million hectares. The area designated as "special places" has increased to 5.5% of the province's landbase.

To date, 30 new parks and protected areas have been announced under Ontario's "Keep It Wild" campaign, launched in 1994. These areas include 14 old-growth red and white pine forests. In setting aside these sites, the province has more than doubled the amount of protected old-growth pine, to over 32 000 hectares.

In March 1994, Nova Scotia released a proposed plan for parks and protected areas, as well as a list of potential sites. A public review committee will gather comments and make recommendations in 1995.

For the fiscal year 1994-1995, 37 urban tree planting and maintenance projects were approved and funded under the Green Streets Canada program — a five-year, $6 million component of Tree Plan Canada. The projects, valued at $1.5 million, resulted in some 100 000 trees being planted in urban centres.

PROTECTING THE ENVIRONMENT

The Canadian Environmental Assessment Act became law in January 1995. Under the Act, mill and forest industry operations will be assessed for potential adverse environmental effects. For example, if a company requires permits for a project that involves depositing substances into aquatic habitat, the project may be required to undergo an environmental assessment. Likewise, a company requiring permits for harvesting operations on Crown land also may be required to comply with this new legislation.

Approximately 5.8 million hectares of forest in Canada were burned in 1994, making it the second worst year on record since 1918. Almost 3 million hectares of forest were burned in 627 fires in the Northwest Territories alone; most of the fires were in non-commercial forests.

The Pulp and Paper Round Table — a national group of 25 stakeholders — reached consensus on a set of environmental principles for the industry. The principles are designed to guide the production, consumption, disposal and/or reuse of pulp and paper.

Under a federal-provincial agreement, Quebec will collect all of the data from mills in the province with respect to federal and provincial pulp and paper regulations. The federal government will have access to the information collected. Both levels of government will continue to provide appropriate authorizations, and both can take legal action against a mill that violates the law.

When the discharge regulations under the federal Fisheries Act came into effect in December 1992, some pulp and paper mills were unable to meet the deadline and were given extensions until December 31, 1995. Environment Canada reports that all of Canada's 157 mills have made a commitment to carry out the necessary installations to reduce their dioxin, furan and chlorine levels to the new standard by the time those extensions expire.

The use of fenitrothion (a chemical insecticide) to control the spruce budworm in Canada's forests will be phased out by December 1998. Research is continuing in the interim to improve the effectiveness of existing registered products, such as the biological insecticide *Bacillus thuringiensis (B.t.)*. For example, the Canadian Forest Service, in collaboration with industry, is involved in some aspects of the research on a new biochemical called "Mimic" (tebufenozide), which is effective against the spruce budworm and may be approved for use as early as 1996.

REBUILDING THE ECONOMY

In 1994, total shipments of pulp, paper and paperboard increased 9.3% over 1993 levels, to a record 28.9 million tonnes. Many mills were operating at close to full capacity. While domestic shipments of all products rose 7.3%, the real activity came in the export sector, which was boosted by the drop in the value of the Canadian dollar. Exports to Japan grew 24.3%; shipments to other Asian markets and the Middle East jumped 42.2%; and exports to Western Europe rose 23.3%.

The forestry index of the Toronto Stock Exchange (TSE) increased 20% between 1993 and 1994, compared with a 5% rise in the overall TSE index of 300 Canadian companies.

In the wood and paper sector, net profits turned around in early 1994 and continued their upward path throughout the year, growing from $152 million in the first quarter to $1.3 billion by the fourth quarter. In the pulp and paper sector, the Canadian Pulp and Paper Association is forecasting solid profits for each of the next three years.

Over the past two years, the volume of timber harvested in the Northwest Territories has increased 150%. The sawmill in Fort Resolution reopened in 1994, and timber was harvested along the Slave River. Harvesting also took place along the Liard and Mackenzie rivers, and north of the Arctic Circle in the Mackenzie Delta.

Louisiana-Pacific Canada Ltd. has been granted a forest management license to harvest hardwoods in western Manitoba. The company is completing an $80-million oriented strand board (OSB) mill, which is expected to create 450 new jobs.

Two softwood and nine hardwood mills have been proposed in Ontario to produce value-added structural board and lumber, in some cases from wood waste. Expansions of existing mills also have been proposed. This growth represents an investment of $600 million and employment for more than 4 000 workers.

New Brunswick announced a program to assist value-added manufacturers who make outdoor furniture, hardwood floors, doors and other finished wood products. The four-year, $730 000 program is intended to help manufacturers market their products in Canada and abroad, and adapt to new technologies.

Some 1 450 Prince Edward Islanders were employed directly and indirectly in the forest sector as a result of expanded markets for softwood lumber and improvements in manufacturing technology. This represents an increase of almost 50% since the beginning of the decade.

Despite all the economic growth that occurred in 1994, the long-term trend for employment in the forest industry is less optimistic. A joint industry-labour-government report forecasts that employment in the pulp and paper industry will fall over the next decade, from the current figure of 72 000 to between 52 000 and 57 000. The report also concludes that workers will be required to upgrade their skills to keep pace with emerging technologies, and single-industry towns will need to diversify their economies.

Total employment in the forest sector increased by 70 000, to 847 000 in 1994. However, a recent joint-industry-labour-government report forecasts that employment in the pulp and paper industry will fall over the next decade.

A mid-November windstorm of unusual strength in north-central New Brunswick blew down an estimated 4 million m^3 of timber. This amount is equivalent to three-quarters of the annual softwood harvest on the province's Crown land. Salvage operations are underway to recover all of the usable timber over the next two years.

IMPROVING TRADE

The long-standing dispute over Canadian softwood lumber exports to the USA was resolved in the fall of 1994. The USA has cancelled the duty on Canadian spruce, pine and fir, and is in the process of refunding more than $800 million collected between 1992 and 1994.

In an effort to avoid costly and disruptive trade actions in the future, Canada and the USA have agreed to establish a consultative process to discuss issues of mutual concern, and to promote cooperation within the North American lumber sector.

The federal and provincial governments have joined with industry and non-governmental organizations to design and implement voluntary certification standards to identify products from sustainably managed forests. Currently, the Canadian Standards Association is consulting with the public and developing the elements of a Canadian certification system. Also, Canada has requested that the International Standards Organization consider establishing an international certification system.

INCREASING INTERNATIONAL COOPERATION

In September 1993, under the auspices of the Conference on Security and Cooperation in Europe (CSCE), Canada hosted a seminar in Montreal to discuss the development of criteria and indicators to promote the sustainable management of boreal and temperate forests. In February 1995, representatives from Canada and nine other nations (Australia, Chile, China, Japan, Mexico, New Zealand, the Republic of Korea, the Russian Federation and the United States) finalized a comprehensive set of criteria and indicators. (Ninety percent of the world's boreal and temperate forests are located in the participating countries.)

Mid-term Review of Strategy

Healthy forests and a vital forest sector are important to Canadians, both nationally and internationally. Through their participation in the National Forest Strategy, Canadians are helping to ensure that their forests remain a viable resource for present and future generations.

The Strategy, developed in March 1992 by a multitude of forest stakeholders, identifies 96 commitments to guide the actions of Canada's forest community through to 1997. Some 30 organizations and hundreds of other Canadians confirmed their commitment to the Strategy by signing the Canada Forest Accord and accepting responsibility to improve the sustainability of all forest values.

The Canadian Council of Forest Ministers (CCFM) and the National Forest Strategy Coalition promised an independent evaluation at the mid-term and end of the Strategy. In 1994, an independent panel of experts reviewed the progress to date. This panel examined 47 of the 96 commitments with target dates of 1992, 1993 or 1994. The final evaluation, scheduled for 1997, will report on all of the commitments.

For the mid-term evaluation, signatories of the Accord, and many other agencies and organizations with an interest in forests, were asked to comment on the progress in meeting commitments. The panel ranked progress on an arbitrary scale: fulfilled, substantial progress, some progress, little or no progress, or insufficient information.

The panel concluded that for the most part, Canada is headed in the right direction. Reasonable progress toward sustainability had been made on the bulk of the commitments examined, and most should be fulfilled as scheduled.

A few of the commitments had already been fulfilled. In some cases, it was possible to identify specific examples of commitments being honoured and progress being made. In other cases, commitments may no longer be appropriate. For example, given the emerging recognition that marginal agricultural land is ecologically valuable, converting those lands into forest (Commitment 8.5) may not be a current priority.

Panel members included: Dr. G.L. Baskerville, Forestry Professor, Department of Forestry and Resource Management, University of British Columbia; Mr. A.T. Davidson, President, Canadian Wildlife Foundation; Mr. D. Lamarre, Past-president of the 1993 National Forest Capital of Canada (Matapedia Valley, Quebec); and Mr. C.H. Murray, formerly Assistant Director General, Forestry Department, Food and Agriculture Organization, United Nations.

According to the panel, the success of the Strategy hinges on meeting four commitments:

- completing an ecological classification of forest lands;
- completing a network of protected areas that are representative of Canada's forests;
- broadening forest inventories to include information on a wide range of forest values; and
- developing a system of national indicators of the sustainability of forest management.

Although they will require considerable efforts and financial resources to fulfill, the panel urged signatories to focus their efforts on meeting these crucial commitments. In 1994, at their annual meeting, members of the CCFM agreed to increase their efforts in these four key areas. Otherwise it will be difficult, if not impossible, to make the Strategy a reality.

> The Strategy document is entitled "Sustainable Forests: A Canadian Commitment."

A summary of the panel's findings for some of the commitments are presented in the following tables. The first table outlines the four commitments described as "crucial" by the panel, and the second provides a cross-section of the other commitments.

(For further information, please contact the National Forest Strategy Coalition Secretariat listed on page 108.)

Crucial Commitments

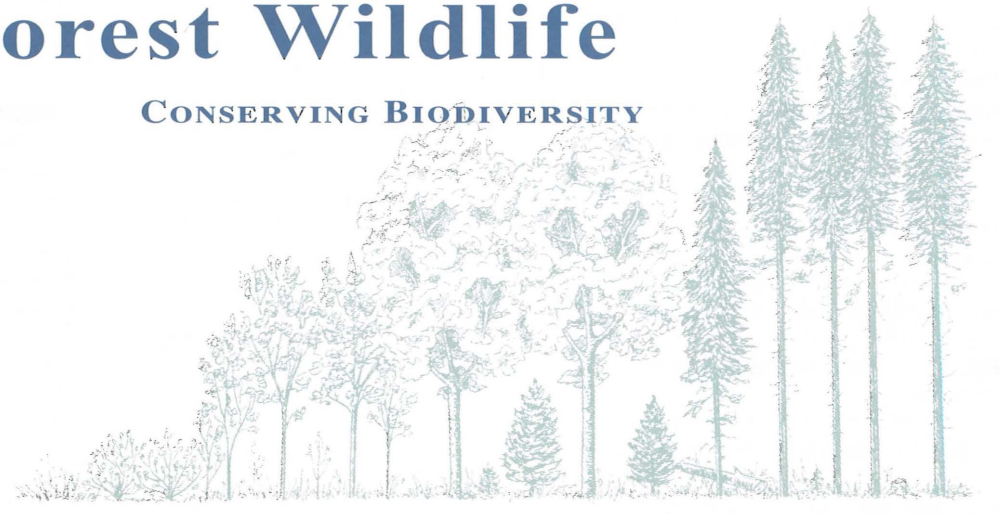
Strategic direction	Fulfilled	Substantial progress	Some progress	Little/no progress	Notes
Forest stewardship: The forest environment 1.1 Complete an ecological classification of forest lands.			✔		most provinces/territories developing systems; requires increased effort and progress
1.8 By 2000, complete a network of protected areas representative of Canada's forests.			✔		four provinces/territories have approved strategies in place; important that governments implement strategies
Forest stewardship: Forest management practices 2.1 Broaden inventories to manage forests for a full range of values.			✔		all provinces revising inventories; approaches differ; additional information may be required
Public participation: Expanding the dialogue 3.5 By 1993, develop national indicators to measure progress in achieving sustainable forest management.		✔			many stakeholders involved in developing criteria and indicators; to be finalized in 1995

Other Selected Commitments					
Strategic direction	**Fulfilled**	**Substantial progress**	**Some progress**	**Little/no progress**	**Notes**
Forest stewardship: The forest environment 1.3 Evaluate soil, climate and wildlife conditions when planning roads and forestry activities.		✔			all but Saskatchewan require pre-harvest plans or assessments from companies
1.10 Develop guidelines to protect genetic, species and habitat diversity.		✔			guidelines vary by province; BC's most comprehensive; much work remains
Forest stewardship: Forest management practices 2.6 By 1995, review and revise timber harvesting and silvicultural systems.			✔		progress uneven; four provincial/territorial reviews done; sole industry review is by CPPA
Public participation: Expanding the dialogue 3.1 By 1993, ensure that the public is involved in forest management planning.		✔			various mechanisms in place; degree of public participation varies
Economic opportunities: A changing framework 4.3 Identify means of encouraging investment in value-added production.			✔		several industry-government initiatives undertaken; reviews completed in Saskatchewan and Ontario; none completed by industry associations
4.6 Increase capacity to use recycled paper as an additional fibre source.		✔			increased use
Forest research: A team approach 5.6 By 1993, ensure that research priorities reflect sustainability, environmental protection and competitiveness.			✔		national review complete; regional/provincial strategic review incomplete; reviews by industry research institutes completed
The workforce: The demands are growing 6.5 By 1994, assess the feasibility of a certification system for silviculture and forest workers.	✔				recommendations made on feasibility
Aboriginal people: A unique perspective 7.1 By the end of 1992, develop a comprehensive Aboriginal forest strategy.			✔		discussion paper prepared by National Aboriginal Forestry Association; no federal response
Private forests: A growing opportunity 8.3 Expand the skills and knowledge of private forest owners, and recognize and support model forest practices.			✔		all provinces have programs in place; some offer awards
Our forests: The global view 9.7 Pursue an international convention on conservation and sustainable forest development.			✔		Canada supports convention; no international consensus at this time

CHAPTER TWO

Forest Wildlife

CONSERVING BIODIVERSITY



Canada was the first industrialized nation to ratify an international agreement to conserve the world's biological diversity. The treaty, known as the "Convention on Biological Diversity," took effect in December 1993.

In Canada, wildlife is a valued part of our natural environment. In the most recent survey of Canadians' attitudes toward wildlife, 86% of respondents indicated that maintaining abundant wildlife was important to them, and 83% agreed it was necessary to protect endangered or declining species.

CHANGING ATTITUDES

Traditionally, our view of wildlife focused only on a few animals: big game and fur-bearing mammals, sport fish, migratory birds and some endangered species. Today the term has come to mean all wild life. This change in perspective is a result of the growing recognition of the importance of biodiversity — the total variety of living things on Earth.

Maintaining diversity in our natural systems helps ensure that the planet's ecological systems are strong and healthy enough to withstand the stresses and changes from human intervention and nature. Consequently, conserving biodiversity has become an important objective for forest and wildlife managers. And a new approach to managing forests — ecosystem management — is emerging, one that aims to sustain all species, as well as the relationships among them, and the environmental systems upon which they depend.

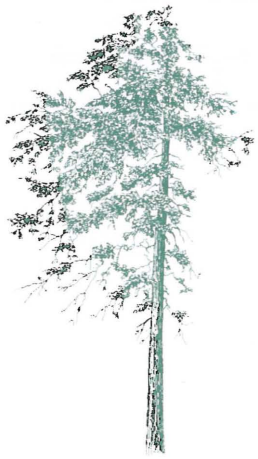
This new attitude has important implications for how we manage forests, because two-thirds of Canada's estimated 300 000 species require a forest habitat, including 60% of birds and 76% of mammals. Furthermore, new species continue to be discovered: in recent years, scientists working in British Columbia's Carmanah Valley have identified more than 60 new insect species in the canopies of coastal old-growth forests.

A Wildlife Policy for Canada defines "wildlife" as all wild life, including wild mammals, birds, reptiles, amphibians, fish, invertebrates, plants, fungi, algae, bacteria and other wild organisms.

In addition to its ecological importance, a diversity of forest wildlife provides Canadians with a wealth of economic and social benefits. Canada's early development was driven by the fur trade, which relied on forest-dwelling mammals, such as beaver, marten, wolf, fox, mink and raccoon. Wildlife continues to be important to local economies. In 1991, Canadians spent more than $5 billion participating in wildlife-related activities, including hunting, fishing, hiking, canoeing, nature photography, and guiding and outfitting.

Although it is difficult to put a price on educational, aesthetic, cultural and spiritual values, these intangibles are becoming increasingly important factors in decisions regarding forest management. Some Canadians living in urban centres may never see much of Canada's wildlife, but value forest species and want wilderness areas preserved for future generations.

Conserving the natural diversity of forest species preserves the potential to discover and develop new products for medicine, biotechnology, forestry and agriculture.



Western yew tree

Forest species may have values that we are not yet aware of. The recent discovery of the cancer-fighting properties of western yew trees is a case in point.

WILDLIFE AND FOREST HEALTH

When timber production was the primary goal of forest managers, a "healthy" forest was thought to be one that was free of insects and disease, protected from fire, and well-stocked with commercial tree species. With the growing recognition of the importance of forests as natural ecosystems, a new view is emerging. Today, forest managers increasingly believe a healthy forest is one that maintains its natural processes (ability to recycle nutrients), its productive capacity (ability to support life), and its natural resiliency (ability to recover from, and adapt to, environmental stresses such as fire).

Areas with many species, called ecological "hotspots," are important to preserve for biodiversity.

For example, many species in the boreal forest have adapted their life cycles to periodic natural disturbances such as fire. Jack pine depends on recurrent fires to open its cones and shed its seeds, and to create soil conditions that favour seedling growth. Similarly, large stumps of fire-killed spruce and poplar are important to many birds that nest in the boreal forest, such as the yellow-shafted flicker and bufflehead.

A healthy forest also depends on the complex relationships between tree species and other organisms. For example, soil fungi that are spread by small mammals, such as the California red-backed vole, enable the roots of young Douglas-fir seedlings to absorb essential nutrients from the soil. In general, there is still much to learn regarding these and other interrelated roles of organisms in maintaining ecological processes.

Knowing why an area is rich in species and what natural factors contribute to this richness helps scientists predict how a species will be affected by human activities. For example, in the floodplains of western Canada, stands of black cottonwood are naturally diverse, productive ecosystems because the soil in these regions is inundated periodically with nutrient-rich water. Changing the flow of the river would affect the species richness of these ecosystems by altering their nutrient dynamics and lowering their productivity.

For most of this century, management of timber took priority over wildlife concerns, and responsibility for wildlife and timber usually rested with different organizations within government.

Measuring the health of a forest, and its interactions and processes is a complex task. The health of an ecosystem can be signalled by the presence and abundance of wildlife; the status of some species can be used to tell us whether the natural processes of the ecosystem have been significantly or permanently altered. In other words, these "indicator species" can serve as barometers of stress and as benchmarks for measuring impacts on forest health.

However, choosing wildlife indicators that are scientifically sound and practical is not easy. Many possibilities have been proposed, but few have been tested. Possible examples include the condition of the understorey of shrubs and herbs as indicators of changes in forest productivity, the presence of non-native herbs to signal changes in forest composition, and the presence or absence of cavity-nesting birds to indicate changes in forest structure.

MEASURING THE STATUS OF WILDLIFE

To determine the status of wildlife in Canada requires a knowledge of the type and number of species, how populations are changing over time, and the factors that may be causing those changes. Keeping track of Canada's estimated 200 000 forest wildlife species, however, is almost impossible.

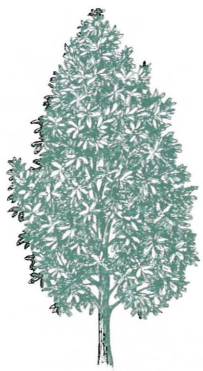
Although lists of species exist for specific locations, most inventories concentrate on plants, animals and fish; very few lists include insects, fungi and other microorganisms. Furthermore, population estimates are available for only a few species, including such big game animals as the grizzly bear (20 000) and such endangered species as the cucumber tree (100 naturally occurring trees). Population estimates do not exist for some endangered subspecies, such as the eastern cougar and eastern populations of the wolverine.

The number of wildlife species varies greatly from one region to another. For example, fewer than 40 tree species grow within Canada's vast boreal forest, whereas almost twice as many are found in the small Carolinian forest in southern Ontario. With respect to mammals, southern British Columbia (BC) is home to 80 species, 60 can be found in southern Ontario, and only 30 live beyond the treeline in northern Canada.

Species also vary within a forest stand. For example, the diversity of below-ground species greatly exceeds the above-ground species. Knowledge of the biodiversity in forest soils is limited, but our understanding of the role of insects, fungi, bacteria and other organisms in soil processes is increasing.

For these reasons it is difficult to say how the diversity of Canada's forest wildlife is faring. However, there is information on the population trends of some species. For example, white-tailed deer and beaver have increased throughout most of their Canadian range. This upward trend can be attributed to a combination of factors: forest clearing has created suitable habitat and an abundant food supply; the decline of wolves and cougars has reduced deer and beaver mortality; and lastly, carefully regulated hunting and management programs have benefited these species. Other species whose populations appear stable include the black bear and moose, for much the same reasons.

Eastern cougar



Cucumber tree

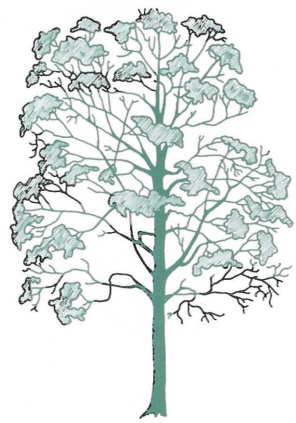
The growth and survival of an estimated 80% of seed-plant species are dependent on fungi, which protect them from infection and enable them to absorb nutrients from the soil.

DECLINING NUMBERS TIED TO HABITAT LOSS

Other forest-dwelling species in Canada have declined significantly in recent decades. The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) has classified some of these species

WILDLIFE SPECIES AS INDICATORS: MARBLED MURRELET

The marbled murrelet is a robin-sized seabird that summers along the Pacific coast. The bird feeds offshore and in inland saltwater areas near the coast; in the southern part of its range, it nests on the large moss-covered branches of old conifers. The murrelet's apparent dependence on the humid old-growth forests of the Pacific coast suggests that it may be an indicator of the status of these forests. For example, populations of the murrelet have declined in recent decades, possibly as a consequence of harvesting in older forests. However, additional information on the species is required to confirm this conclusion.



Kentucky coffee tree

as rare, vulnerable, threatened or endangered. Endangered species are those facing extinction or extirpation (extinction in an area) as a result of human activities.

Many of COSEWIC's species are found in the deciduous Carolinian forest (located in southern Ontario between Toronto and Windsor), where more than 90% of the forest has been cleared and converted to agricultural land, or for industrial and urban development. The Carolinian forest is the most northern range for many species more commonly found in the USA. It is home to an estimated 2 200 different herbs, 70 types of trees and 400 bird species, as well as mammals, reptiles and amphibians found nowhere else in Canada. Among its more unique species are the Kentucky coffee tree, the cucumber tree, the prothonotary warbler, the eastern prickly pear cactus, the Karner blue butterfly, and the blue racer snake. All of these species are endangered in Canada.

Over the past decade, the Carolinian Canada program sponsored by the World Wildlife Fund, the Nature Conservancy of Canada and Wildlife Habitat Canada — and involving many other organizations — has promoted the conservation of the region's remaining natural areas.

Other species on COSEWIC's list have suffered from habitat loss in different forest types: populations of the spotted owl and marbled murrelet in the Coastal forest region of British Columbia; and the woodland caribou in the Acadian and Great Lakes – St. Lawrence forest regions of eastern Canada.

THE COMMITTEE ON THE STATUS OF ENDANGERED WILDLIFE IN CANADA (COSEWIC)

COSEWIC has representatives from federal and provincial wildlife agencies, universities, scientific institutions and non-governmental conservation organizations across Canada. The committee meets annually to consider candidate species for which status reports have been prepared by experts. By 1994 COSEWIC had evaluated 351 species or populations, 10 had insufficient information to permit classification, and 86 were found to require no designation.

Recent studies have indicated significant and rapid declines in some forest songbird populations over the past decade. The primary causes of decline appear to be forest fragmentation and the loss of habitat along migration routes, due to urbanization and agricultural development.

Similarly, an overall drop in amphibian populations has been observed worldwide. In British Columbia, for example, the clouded salamander (a species that relies on rotting Douglas-fir logs) is in decline. A taskforce of the International Union for the Conservation of Nature (IUCN) is studying this issue.

National programs such as COSEWIC and RENEW (Recovery of Nationally Endangered Wildlife) involve government agencies and conservation groups working together to help protect endangered species. Monitoring programs — such the Breeding Bird Survey and the Forest Bird Monitoring Program — engage amateur naturalists, and academic, government and museum scientists in surveys of songbirds, shorebirds, birds of prey, and amphibians. National non-governmental conservation organizations also have programs for endangered species and spaces, and many local conservation and naturalist groups are active in efforts to preserve endangered species.

Although COSEWIC and RENEW monitor and assess species at risk, there is no comprehensive program in Canada to assess the status of wildlife in general, or of forest species in particular. However, wildlife researchers continue to gather information to increase our understanding of species' habitat requirements, population sizes and fluctuations, and the effects of forestry practices on wildlife.

The Carolinian forest is the most threatened forest type in Canada, largely because it is located in a densely populated area. The warm climate of this region accounts for the diversity and uniqueness of its species.

Status of Canada's wildlife in 1994

Species group	Known species	Status of species and subspecies at risk				
	Total	Endangered	Threatened	Vulnerable	Total	%
Mammals	193	11	8	22	41	21.2%
Birds	578	14	9	22	45	7.8%
Fish	1 091	3	12	38	53	4.8%
Plants	4 328	23	30	29	82	1.9%
Amphibians and reptiles	83	4	3	7	14	16.8%
Total	6 273	55	62	118	235	3.7%

Source: 1994 Report of the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)

Forest dwelling* species at risk

	Mammals	Birds	Plants
Endangered	Wolverine	**Northern bobwhite**	Large whorled pogonia
	Eastern cougar	Northern spotted owl	**Wood poppy**
	Vancouver Island marmot	**Acadian flycatcher**	Small whorled pogonia
		Whooping crane	Cucumber tree
		Kirtland's warbler	Heart-leaved plantain
			Pink milkwort
			Spotted wintergreen
			Hoary mountain-mint
			Small white lady's slipper
			Furbish's lousewort
			Southern maidenhair fern
Threatened	Woodland caribou (Gaspé population)	Marbled murrelet	Red mulberry
		Hooded warbler	Purple twayblade
	Wood bison	**Yellow-breasted chat** (Okanagan population)	Kentucky coffee tree
	Newfoundland pine marten		Nodding pogonia
		White-headed woodpecker	Bird's-foot violet
			Blunt-lobed woodsia
			Sweet pepperbush
			Ginseng
			Golden Seal
			Round-leaved greenbrier
			Deerberry
			Mosquito fern
			American chestnut
			van Brunt's Jacob's ladder
			Blue ash
Vulnerable	Fringed myotis bat	**Cerulean warbler**	Phantom orchid
	Spotted bat	Prairie warbler	Wild hyacinth
	Keen's long-eared bat	**Ancient murrelet**	Shumard oak
	Pallid bat	Flammulated owl	Western silver-leaf aster
	Southern flying squirrel	Prothonotary warbler	Swamp rose mallow
	Nuttall's cottontail rabbit (Okanagan population)	Cooper's hawk	Broad beech-fern
		Louisiana waterthrush	False rue-anemone
	Gaspé shrew	Great grey owl	Few-flowered club-rush
	Eastern mole	**Yellow-breasted chat** (Eastern population)	Green dragon
	Grey fox		Hop tree
	Grizzly bear		**American columbo**
	Woodland caribou (Western population)		

* Species added to the list in 1993 and 1994 are in bold.
Source: 1994 Report of the Committee on the Status of Endangered Wildlife in Canada (COSEWIC)

Threatened species in selected countries (percentages)

	Canada	USA	Australia	Finland	Norway	France	Germany	UK
Mammals	6.2	10.5	12.3	11.9	7.4	50.4	51.0	45.2
Birds	3.3	7.2	3.4	6.8	9.2	37.4	44.0	28.3
Fish	4.4	2.4	0.4	11.7	—	22.7	68.0	12.2

Note: Threatened species expressed as a percentage of known species, early 1990s. The percentages for Canada vary from those presented in the table on page 23, due to the changes in terms and definitions used by the OECD in compiling international data. Also, the source year is different.

Source: OECD Environmental Indicators 1994

ROOM TO THRIVE

American goldfinch

The population and distribution of a species is determined by factors such as climate, food and water availability, vegetation type, presence of other species, and space requirements of individuals within a species. Some areas within a species' geographical range are better suited to meet its needs than others and thus are the preferred habitat for that species.

Habitat Requirements

The requirement for space is often described as a species' home range. Range sizes vary tremendously among species: wolf packs can occupy thousands of square kilometres; a deer mouse, a few hundred square metres. Both the size of an organism and its lifestyle determine its space requirements. In general, for animals of similar size, plant feeders have smaller home ranges than predators because plants typically occur in greater concentrations than prey. The space requirements of a species must be considered in conservation efforts.

Some forest species migrate to different areas during the year or over their lifetime to avoid unfavourable weather, reproduce or find food. Animals may migrate a few kilometres or thousands of kilometres. For example, woodland caribou in Alberta migrate on average 84 km, whereas many songbirds that breed in the boreal forest migrate thousands of kilometres to their winter ranges in South America.

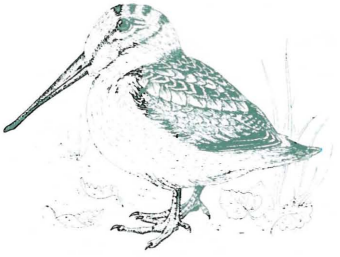
Species are considered either habitat specialists or generalists, depending on the variety of habitats they require for survival and reproduction. Specialists may require one particular type of habitat

Home ranges of selected wildlife

Wildlife species	Range (hectares)
Grizzly bear	377 000.00
Gray wolf pack	153 000.00
Cougar	49 700.00
Bobcat	11 600.00
Lynx	5 710.00
Wolverine	4 900.00
Black bear	1 760.00
Elk	943.00
Coyote	453.00
Marten	215.00
Porcupine	34.90
Muskrat	2.90
Snowshoe hare	2.55
Chickadee	0.54
Townsend vole	0.18
Deer mouse	0.06

Source: Harris, 1984

(the Pacific giant salamander, Hammon's flycatcher and the red tree vole require the old-growth forests of the Pacific northwest), or a diverse environment containing several types of forest habitat (the American woodcock requires moist woodlands and swamps). Specialists may also be dependent on a particular stage in the development of a forest (e.g., a young forest), a particular tree species composition (e.g., an oak forest), or a particular structural element in a forest (e.g., large dead standing trees).



American woodcock

In contrast, habitat generalists can find food and shelter in a variety of forest environments. Many large forest mammals are habitat generalists; for example, moose and white-tailed deer require older forests for shelter and younger forests for food. Their population typically expands when harvesting or fire increases the diversity of habitat types across a landscape.

Population Requirements

Species are distributed in populations across their range, depending on the location and availability of habitat. If a population has too few individuals, it is unlikely to survive in the long term. The minimum number of individuals required to form a viable population varies from hundreds to millions, depending on the species. For small carnivores, such as the American marten, the minimum size has been estimated at between 200 and 300 individuals. Reliable estimates for most species are limited by the lack of life history and information on breeding age, male/female ratios, number of young, average age at death, and natural population fluctuations. These characteristics are influenced by weather, food availability, disease and predators, available space, and the number and proximity of other populations.

A species' long-term survival is also affected by the amount of genetic variation within a population. If the variation has been reduced — which may occur, for example, when the loss of individuals leads to inbreeding — a population is more likely to become extinct due to the loss of adaptive traits, among other things.

Until recently, most of the information on habitat requirements and population dynamics was used primarily to estimate sustainable hunting, trapping and fishing levels for commercial and sport species. In principle, it is possible to determine a sustainable rate using

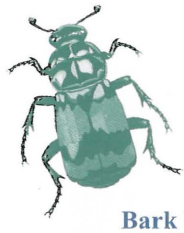
Declining forest bird species

Yellow-bellied sapsucker
White-throated sparrow
Chimney swift
Yellow-shafted flicker
Red-breasted nuthatch
Veery
Gray-cheeked thrush
Wood thrush
Brown thrasher
Ovenbird
Scarlet tanager

Source: Breeding Bird Surveys 1969-1988

biological and population trend data. In practice, there is not enough information on habitat or populations to reliably use this approach for most species and ensure their conservation.

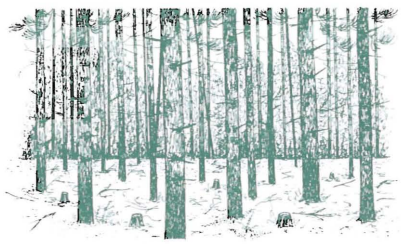
As wildlife management objectives broaden, the focus is shifting to encompass non-commercial species and conserve biodiversity. This requires a new understanding of the relationship between the health of wildlife populations and their habitat. Because two-thirds of Canada's wildlife inhabit forests, new approaches to integrating timber and wildlife management are being developed.



Bark beetle

THE EFFECTS OF FOREST MANAGEMENT ON WILDLIFE

Forest management activities — such as road building, tree harvesting, planting, and controlling weeds, insects and fire — affect habitat and therefore forest wildlife. The impact of these activities can occur at different scales, from the individual tree to the forest landscape. Removing a single tree may disturb a colony of insects, while cutting a large stand may create new habitat for a population of moose.



Selection harvesting

Effects at the landscape level

Harvesting

As it ages, a forest changes naturally through an ecological process called "succession." At each stage of succession, a forest exhibits unique habitat characteristics. Harvesting changes the forest and initiates the successional process to varying degrees. Although it removes the habitat of some species, other animals — such as sharp-tailed grouse, snowshoe hare and ground squirrel — prefer the young plant communities that begin to grow soon after harvesting. Furthermore, harvesting can increase the habitat diversity across a landscape by creating a mosaic of regenerating stands of different ages. However, species such as lynx, which use young forests for hunting and old forests for breeding, may not benefit from this diversity if harvesting alters or reduces these habitats.

The method of harvesting can also effect the habitat characteristics of the forest. Selection or shelterwood harvesting removes less tree cover than clearcutting, but may also change the species composition of the

Forest succession

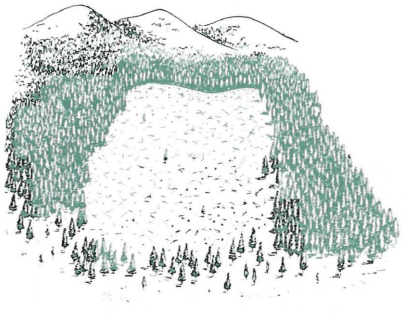
forest. For example, in the Great Lakes – St. Lawrence forest region, the amount of hemlock, white pine and yellow birch has declined in some areas that were selectively logged, while the amount of aspen and birch has increased.

Shelterwood harvesting

Clearcutting is the most common method of harvesting in Canada. Some species, such as deer or moose, prefer young plants found in openings that can be created after clearcutting. However, some large mammals in the boreal forest, such as the woodland caribou, as well as smaller ones, such as the red squirrel, avoid large clearcuts. In addition, it can be difficult to reestablish some sites with the same type of forest for a variety of reasons: rising water tables in wet sites, colonization by grasses and non-forest plants, and a lack of seed sources for plant species.

Some forest animals, such as the boreal owl and woodland caribou, require large tracts of mature forest to move through their range. Leaving isolated patches of mature forest surrounded by large clearcuts greatly reduces the habitat for these species. One solution is to leave corridors of mature forest to link the patches of suitable habitat until the cutover areas have regrown. However, concentrating species in corridors may attract more predators to these areas. A greater number of smaller clearcuts, even if linked by corridors, increases fragmentation of the forest and may not be suitable for species such as caribou and bear, which require large contiguous areas of forest. These approaches are all relatively new, and their effects on wildlife are not fully understood.

Kirtland's warbler

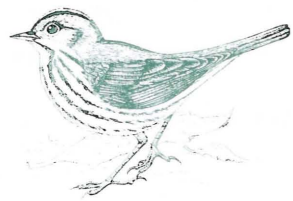


Clearcutting

Some groups of forest birds are strongly associated with particular plant communities and will not return to an area if the species they depend on are no longer present. The Kirtland's warbler, for example, needs large stands of jack pine to survive and reproduce. The stands must have dense clumps of trees 2 to 6 metres high with living branches that reach the ground. Furthermore, the area must have a ground cover of low shrubs or deeply rooted herbs interspersed with open grassy areas. The warbler's habitat regenerates naturally through fire; however in recent times, its habitat has been severely reduced through fire control and conversion of jack pine forests to other species.

Harvesting stands or groups of trees also creates "edge habitat" — the boundary between the remaining forest and the harvested area. (This habitat occurs naturally, too — along the edges of burned areas, for example.) The diversity and abundance of plants and animals are often higher along an edge than in either of the adjacent habitats. Some species, such as deer, are attracted to edge habitat; the open area provides food, and the treed area offers shelter.

It was once thought that the more edge habitat created, the better. The preference of game species for edge habitat greatly influenced this belief. However, recent research has revealed that edge habitat, despite its high diversity, is not ideal for all species. For example, the white-tailed deer browses heavily near forest edges, causing significant damage to the young trees and shrubs in those areas. Similarly, the brown-headed cowbird lays its eggs in the nests of other birds near the edges of forests. It is responsible for the decline of many bird species in fragmented forests with large amounts of edge habitat. Species such as the ovenbird avoid edge habitat; it prefers the habitat that lies deep in the forest interior.



Ovenbird

Effects on aquatic life

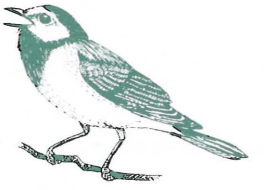
Forested landscapes contain many other types of habitat. Among the most important are those with water — forest wetlands, lakes, rivers and streams. Many kinds of wildlife other than fish require water to complete their life cycle, for example, frogs and dragonflies. Other species, such as beaver and river otters, use forest wetlands and streams for food, shelter and breeding.

There are five types of wetlands: bogs, fens, marshes, swamps and shallow waters. Wetlands not only provide habitat for wildlife, but also control flooding and soil erosion while protecting surface- and ground-water quality. Furthermore, wetlands form important links between uplands and lakes and streams.

Edge habitat

Forests adjacent to rivers and streams are fertile, productive areas that provide habitat for many species and often serve as travel corridors. These riparian zones are home to such wildlife as willows and alders, river otters and muskrats, osprey and mallards, and many amphibians and reptiles. Riparian forests regulate the ground water that replenishes lakes and streams, provide shade to moderate stream temperatures, and supply woody debris and leaves that are used by

aquatic wildlife for shelter and food. For these reasons, provincial harvesting regulations specify the width of riparian forest required as a buffer zone to protect aquatic habitat. The habitat value of riparian forests changes over time — as the forest ages, the large canopies of older trees shade streams for fish and provide cover for breeding songbirds; however, the quality of habitat for some species, such as beaver and deer, declines. As a result, some riparian forests need to be managed in such a way as to meet ongoing habitat needs.



Hooded warbler

Natural disturbances

Disturbances such as fire, insects and disease also affect habitat, but are natural processes to which many plants, animals and microorganisms have adapted. The extent to which disturbances affect forests varies from region to region, and can alter the distribution of a species within single stands and across landscapes.

Fire-suppression policies have decreased the frequency of fires and the total area burned. In south-central Ontario's Boreal forest region, fires burn a stand approximately every 578 years, for a total annual area of roughly 81 000 hectares. Before fire-control policies were implemented, fires burned a stand every 65 years, and the average area affected was approximately 720 000 hectares annually.

Between 1978 and 1992, natural disturbances such as fire, insects and disease affected 1.14 million hectares of commercial forest annually.

It is uncertain what impacts these changes will have on the pattern and distribution of habitat across the forest landscape. Researchers are studying this issue, and their findings will be incorporated into forest and wildlife management programs.

Roads

Road building, too, has an impact on wildlife. It creates edge habitat and increases access into remote areas for both wildlife and humans. Animals make use of roads for the same reason humans do — it is easier to walk on a road than through the forest. However, greater access can disrupt breeding and feeding behaviour, and road building makes animals more vulnerable to death or injury from predators and motor vehicles. In the past, poor road construction across streams and wetlands damaged fish habitat, although current technology and stricter regulations can now prevent this type of damage.

Effects at the Stand Level

Within a stand of trees, wildlife diversity is affected by the same natural and human disturbances as at the landscape level, but on a smaller scale. At this scale, forest management affects three characteristics of the forest that determine its suitability for habitat: the presence of dead and dying trees, the forest's vertical structure (the number of layers from the floor to the canopy), and the specific requirements of specialist species.

Dead and dying trees are necessary for many species. A single fallen tree may seem insignificant, but it plays an important role in the regeneration of many plant species. When a tree falls, it creates an opening in the forest canopy and exposes seedlings, shrubs and herbs to sunlight. Also, fallen logs and debris on the forest floor and in streams provide food, shelter and breeding sites for many small wildlife species.

Many species, including red squirrels, northern long-eared bats, and marten, use snags (dead standing trees) and fallen trees for cover, feeding, reproduction, preening, lookouts, bridgeways (runways and tunnels) and hibernating. Snags are also essential habitat for many forest birds, especially such cavity-nesting species as the pileated woodpecker. Snags are usually cut down before an area is harvested to prevent them from toppling onto loggers. However, today there is a growing understanding of the need to leave some snags standing to meet the needs of wildlife.

The vertical structure of a stand (the forest floor, herb and shrub layer, and tree understorey and canopy) also is important to wildlife. The number of layers in a stand is determined by the forest age and type. Even-aged forests, such as a jack pine stand in the Boreal region, consist of relatively few layers. The dense canopy created by jack pine trees of the same age and height blocks the light, resulting in a sparse layer of plants on the ground. Consequently, in these forests, most birds forage for insects on the ground, while a few forage in the sparse herb and shrub layer, and very few feed above the canopy where insects are available for only a short period during the year.

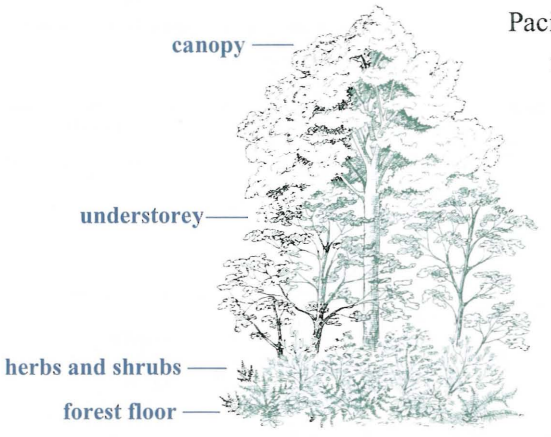
In contrast, uneven-aged forests such as the mixedwoods of the Great Lakes – St. Lawrence region or the temperate rainforests on the west coast have many different layers. Selection cutting can maintain the vertical structure of an uneven-aged forest because only individual trees or groups of trees are harvested. Other methods, such as clearcutting, can be modified to retain snags and clumps of trees

Boreal forest species in Ontario requiring snags for nesting, perching and roosting

Mammals	Birds
Northern long-eared bat	Bufflehead
Silver-haired bat	Northern hawk owl
Red squirrel	Barred owl
Northern flying squirrel	Osprey
Raccoon	Downy woodpecker
Marten	Pileated woodpecker
Fisher	Tree swallow
	Red-breasted nuthatch
	Brown creeper
	Eastern bluebird
	Bald eagle
	Hooded merganser

Source: Baker, 1988

Woodpecker



Vertical structure

for wildlife. However, altering cutting methods to better maintain wildlife habitat has not always been successful. For example, in the Pacific northwestern USA, leaving small uncut patches of forest for the spotted owl put the bird at greater risk from predators. As the effects of forest management on wildlife are better understood, new approaches are being developed and tested.

APPROACHES TO MANAGING FOREST WILDLIFE

Single-Species

Traditionally, most wildlife management programs have focused on only a few species in an approach called "features-species" management. The objective of this approach is to produce desired numbers of selected species in specific locations. It is most often used to manage commercial and game species or to restore endangered species.

Single-species management usually involves developing guidelines to minimize the impact of timber harvesting or to create more habitat for species such as moose. The mountain caribou program in BC is an example of the single-species approach. Leaving no-cut zones along streams and protecting critical upland habitat are two techniques used to maintain selected species. However, a species-by-species approach is impractical for conserving thousands of species. Furthermore, focusing on a few chosen species is no guarantee that the overall health of the ecosystem is being maintained.

Multiple-Species

Several approaches to managing wildlife are based on the fact that many species share similar habitats. One such approach assembles species with similar habitats into groups called "guilds." In guild management, one species is selected to represent the entire guild. Conserving the habitat of this particular species is assumed to benefit all of the species in the guild, and is seen as a useful approach to maintaining diversity. Guild management is being developed for application in the Foothills Model Forest near Hinton, Alberta.

A variation on this approach uses indicator species that require a particular type of forest habitat to monitor the effects of management activities. For example, managing to ensure habitat for one species that needs old growth conserves not only the old-growth forest, but also all of the other wildlife species dependent on it. Generally this is

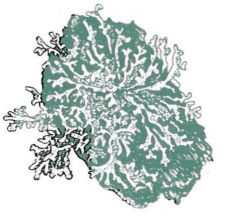
PROTECTING MOUNTAIN CARIBOU IN BRITISH COLUMBIA

In 1988, a program was established in Prince George to address BC's declining mountain caribou population. There are only 1 700 mountain caribou scattered across southeastern BC, compared with 12 000 northern caribou throughout the province. Caribou feed on the lichen that grows on mature trees in old-growth forests. Wildlife groups, government agencies and the forest industry are working together to protect caribou habitat by minimizing the impact of logging in old-growth forests and by improving the habitat in areas already logged or burned. Maintaining caribou habitat will also benefit other wildlife species that rely on old-growth forests, such as flying squirrels, grizzly bears, pine marten and cavity-nesting birds.

Caribou

Partial-cutting methods enable forest managers to retain some of the lichen-bearing trees while maintaining a constant supply of timber. A land-use strategy to classify caribou habitat is being developed that will identify priority management zones and guidelines: primary ranges for caribou may be protected from harvesting; special management areas will be managed for both timber and caribou by using partial cutting and by establishing longer rotation periods; low-priority areas will be managed so that other resource values will take precedence over caribou habitat.

done by setting a population-size target for the indicator species and determining how much habitat must be conserved to meet or maintain that target. This approach makes extensive use of models — based on a number of assumptions — to determine the amount of habitat needed to support different population levels. In New Brunswick, American marten and white-tailed deer have been selected as indicator species for mature coniferous habitat.



Lichen

Habitat Diversity

Another approach to wildlife management focuses less on particular species and more on the diversity of available habitat. By ensuring a variety of habitats (such as old-growth conifers, uneven-aged hardwoods and open areas) throughout a large area of forest, this approach is intended to maintain the diversity of wildlife species that depend on different habitats. Indicators of habitat diversity may be used for wildlife management, such as the amount of woody debris in stands, or the distribution of stand sizes and ages throughout the forest.

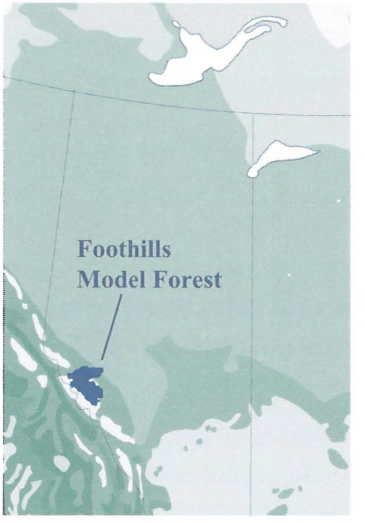
Ecosystem Management

Ecosystem management shifts the emphasis of traditional forest management away from the production of resources — particularly timber — to the maintenance of healthy, diverse ecosystems and their

ALBERTA'S FOOTHILLS MODEL FOREST

The Foothills Model Forest encompasses approximately 1.2 million hectares of boreal forest on the eastern slopes of the Rocky Mountains. One of the primary goals of the model forest project, which is managed by more than 70 partners, is to develop an ecologically based computer system that integrates data on wildlife population levels, habitat requirements and supply.

The computer models will help predict the response of wildlife to changes in habitat related to harvesting. Models were developed for 36 species, selected to represent all of the habitats in the Foothills Model Forest. Several other habitat models are being tested, based on studies regarding songbirds that feed in spruce stands, northern flying squirrels that live in coniferous forests, woodpecker summer and winter habitat use, and barred owl distribution and habitat use. Weldwood of Canada Ltd., which has a forest management agreement within the model forest, will implement this approach in its next forest management plan.

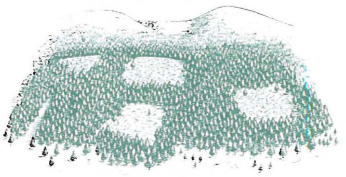


ecological processes. Any of the approaches to wildlife conservation described above can be used in ecosystem management, but more than one approach will be necessary to achieve stand and landscape objectives for species and habitat.

How does this approach differ from conventional forest management? In ecosystem management, the boundaries of forest management areas are natural, not artificial — a watershed, for example, rather than a forest management area. Under conventional forest management, inventories generally contained information on the age, species and volume of trees. Ecosystem management necessitates more detailed information, including data on soils, plant communities, productivity and habitat requirements. Also, a planning process is required to set a vision and establish goals for the future state of the forest landscape, including its age, structure, composition, distribution and aesthetics. Objectives are determined for both timber and non-timber resources.

Ecosystem management demands a greater level of knowledge with respect to the functioning of forest ecosystems and the relationships between habitats and wildlife. More detailed information and sophisticated computer systems are required to compile and map this data and to develop projections regarding the future condition of forests, based on different management scenarios.

Under ecosystem management, forests are managed to more closely emulate natural changes. Selected areas may still be managed intensively, but are interspersed across the landscape. Harvesting and silvicultural methods are designed to model the natural disturbance pattern of ecosystems, and to include more natural regeneration and a greater range of harvesting techniques — from light partial cutting to clearcutting — where suited to the ecology of the forest. Additionally, to maintain a distribution of old growth, forests are managed on significantly longer rotations. And some levels of natural disturbances — such as fire — are allowed to occur; they too affect the distribution of forests. Biodiversity and wildlife are conserved as a result of managing forests to more closely mimic the processes occurring in natural ecosystems.



Patch cutting

NEW BRUNSWICK'S FOREST LAND HABITAT MANAGEMENT PROGRAM

In 1992, the Government of New Brunswick introduced changes to its forest management planning process, incorporating objectives for wildlife habitat.

Since 1980, companies in New Brunswick have been required to prepare 25-year plans outlining the harvesting and silvicultural levels required to maintain a sustainable supply of timber over an 80-year period. The plans are approved by the provincial government and updated every five years. At first, the focus of the plans was on timber production. Wildlife considerations were introduced later as constraints on timber operations, such as leaving uncut zones as buffers along sensitive habitat areas.

Subsequently, the province undertook a habitat supply analysis to identify forest-dependent wildlife species and their specific habitat requirements. Forecasts indicated a shortage of mature coniferous forests in 20 to 30 years that would affect the 25 bird species and 4 mammal species identified as dependent on this habitat.

The American marten, which is particularly dependent on mature coniferous forests, was chosen as an indicator species for this forest habitat. The provincial analysis identified the minimum viable population level for marten as 250 adults. This population would require a total of at least 50 000 hectares of suitable habitat, in patches of no less than 500 hectares, connected by travel corridors. A similar analysis of the winter habitat for deer was also done.

As a result of the Forest Land Habitat Management Program, the plans prepared by companies now include specific objectives for maintaining this wildlife habitat. Under the program, each company must maintain a specific amount of mature habitat at any given time. On average, 10% of the license area is required to maintain a marten population 3.5 times greater than the minimum levels. A company's plans must also reflect the fact that the composition of the forest is not static; areas of habitat will not remain forever in one location — new areas age and become suitable as mature habitat. By ensuring habitat for the marten, this approach should also benefit other species that rely on a similar habitat.

THE WHITE RIVER TIMBER MANAGEMENT PLAN

The Ontario Ministry of Natural Resources and Domtar have started to implement an ecosystem management approach in the White River Forest northeast of Lake Superior. They feel that an ecosystem approach is needed to ensure that the goals of sustainability and maintenance of biological diversity can be met.

Their general approach is to model human disturbances (such as harvesting) to closely mimic natural disturbances (such as fire, weather and disease). The ecosystems and species that occur in this part of the boreal forest have evolved with, or adapted to, natural disturbances.

At the landscape level, an attempt is being made to move the cut pattern closer to the natural fire patterns in the area. This involves using a range of different sizes and shapes for cut and uncut areas. This should provide habitat for species that are not suited to open areas or edge habitat, as well as for those that thrive in these conditions.

At the stand level, the plan is to maintain the full range of natural habitats. The emphasis is on keeping the stand composition and age structure similar to those of the natural forest. This should continue to provide habitat for all species, including those requiring old growth.

There is also a recognition that fire creates special habitat, such as snags, and has important effects on soil productivity. There is an attempt to retain the characteristics of burned areas by leaving standing trees and woody debris, and by deliberately setting small controlled fires (prescribed burning).

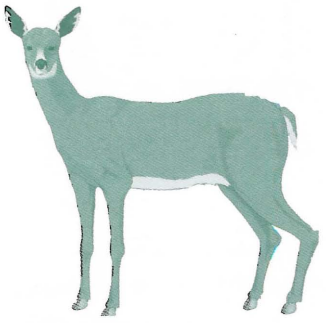
The development of ecosystem management is still in its early stages. However, many governments, forest companies and conservation groups are pursuing this goal. For example, in 1994, the Ontario government passed its Crown Forest Sustainability Act to guide the province toward an ecological approach to forest management. There are few concrete examples in place, although a number of cooperative projects are underway at a practical level, to test and adopt different aspects of the concept and to try different approaches.

Private Land Stewardship

Approximately 6% of the forest in Canada is privately owned. On private lands, regulation of natural resources is limited; to be successful, any non-legislated approach to forest wildlife management must respect the different objectives that landowners have for their properties. However, voluntary programs that encourage wildlife management on private lands have been popular in both agricultural and forest areas. One example is the Quebec Deer Yard Program.

QUEBEC'S DEER YARD PROGRAM

The Deer Yard Program, developed by the Quebec government and the Fondation de la faune du Quebec in cooperation with the forest industry, provides private woodlot owners with technical and financial assistance to plan timber harvesting that will conserve the critical winter habitat of white-tailed deer. The Program also provides assistance to encourage the planting of trees that are beneficial to the white-tailed deer's habitat.



White-tailed deer

In Quebec, the white-tailed deer is at the northern limit of its range, and the availability of winter habitat is a major factor affecting its population levels. Deer require mature coniferous stands that provide shelter from the wind and cold, and allow only a thin layer of snow to accumulate on the ground. Deer also require an abundance of young broad-leaved trees for the twigs that are their basic diet. A diversity of shelter and food within a deer yard reduces the distance that deer have to travel during rigorous winters. Maintaining these deer yards ensures the long-term stability of the deer population.

SUMMARY

Wildlife management is evolving rapidly as the focus changes from managing a few high-profile species to maintaining the diversity of all wildlife. In recent years, innovative approaches to managing wildlife have been developed and are being tested.

These new techniques should enable managers to plan, model and predict wildlife requirements. However, there are several key areas where further progress is required. The need to integrate timber and wildlife management objectives into forest plans and operations is widely recognized. In addition, further expanding public involvement in forest management planning, and more closely integrating the agencies responsible for timber and wildlife will help ensure that forest ecosystems are managed for both values.

Also, managing forests as ecosystems requires new technologies, tools and models for synthesizing complex environmental information. Their effectiveness, however, will be measured by the information available regarding the types of wildlife, their location, population and habitat needs. In particular, the development of planning models will necessitate a better understanding of the roles of wildlife in ecosystems, and the impacts of forestry operations on wildlife and their habitat. Finally, a more comprehensive program at regional and national levels is needed to help agencies and the public monitor the status of wildlife and identify species in need of special conservation measures.

Model Forests and Wildlife

Forest managers are searching for new ways to manage forests while protecting wildlife. Researchers in Canada's 10 model forests are examining how and when wildlife use the forest and what part of the forest they prefer, such as old growth, hardwood stands or underbrush.

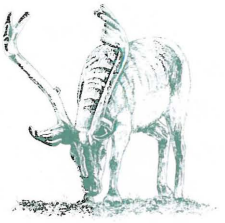
At many sites, researchers had to start by collecting basic data — information on food preferences, shelter needs and breeding habits. Data are also being collected on the population levels of species ranging from moose, to voles, songbirds and trout. More detailed information is being analyzed with state-of-the-art technology to identify both endangered species and indicator species (species used as a measure of forest health).

Counting Caribou

In a number of model forests, large mammals (especially elk, moose, white-tailed deer, woodland caribou, mule deer, grizzly bear and black bear) are being studied.

The Western woodland caribou, which has been identified as a vulnerable species due to declining populations and habitat, is found in the Manitoba and Foothills model forests. The herds in Manitoba are the most southerly of all caribou in Canada's western boreal forests and inhabit a 200 000-hectare area where forestry operations are occurring. The results of a long-term investigation involving industry and other forest stakeholders will lead to a woodland caribou management zone and to specific management guidelines and resource plans.

Researchers in Alberta's Foothills Model Forest are focusing on caribou reproduction and winter food preferences. The availability of lichen, an important winter food source, is being studied in different types of forests. Studies are also assessing the impact of habitat changes on rates of birth and survival and causes of mortality.



CARIBOU

In the Foothills Model Forest and in New Brunswick's Fundy Model Forest, radio-collared deer will be monitored over the next three years to assess and identify their preferred winter habitat. Data on their use of the forest and their habitat will be entered into a computerized geographic information system (GIS) and used to map and plan timber harvesting operations. Based on the results of the study, a management plan will be

Wildlife

All wild life, including mammals, birds, reptiles, amphibians, fish, invertebrates, plants, fungi, algae and bacteria.

prepared to maintain a sustainable supply of deer habitat.

SCRUTINIZING SQUIRRELS

The habitat requirements of small mammals also are being studied. Traditionally, much of the attention has been on large, commercially important mammals. As a result, little is known about smaller, non-commercial species, such as pine martens, snowshoe hares, bats, red-backed voles and squirrels.

In the Foothills Model Forest, the North American red squirrel forms an important link in the food chain. It feeds on conifer seeds and mushrooms and excretes pellets that contain a fungus required in the nutrient cycles of some trees. The squirrel itself is preyed on by a variety of


SQUIRREL

raptors, such as Cooper's hawks, and by such mammals as martens. However, red squirrels often damage young trees before they are well established. Therefore, researchers are looking for ways to reduce the damage done by squirrels without disrupting their role in the ecosystem.

Research in the Western Newfoundland Model Forest focuses on the pine marten, a threatened species. Four studies are underway to address issues left unresolved by two previous environmental assessments. In one project, wildlife biologists are analyzing forest ecosystem classifications, the vertical structure of the forest, and how the pine marten uses different types of forest environments. They are also examining population densities, alternative habitat, and the relationship between habitat and rates of reproduction. Computer models

NEWFOUNDLAND PINE MARTEN

will be used to analyze this data and generate habitat maps to minimize the impact of future timber harvesting.

In northeastern Ontario's Lake Abitibi Model Forest, two studies have been undertaken to determine the type of cover preferred by small mammals and to discover where red-backed voles overwinter. In the past, information on the relationships between small non-commercial mammals and forest ecosystems did not exist.

WATCHING BIRDS

In the Eastern Ontario Model Forest, one monitoring program is assessing the impact of forest management practices on various songbird species, especially the endangered Cerulean warbler.

CERULEAN WARBLER

The results to date suggest that suitable habitat may include large, unfragmented dense forests and is not — as previously thought — restricted to old-growth forest.

The warbler study has had an unforeseen benefit. A privately owned, 607-hectare conservation area located in the Model Forest was donated to Queen's University. The reserve, containing six lakes, a wetland and large woodland areas, is an important habitat for the endangered warbler.

Many bird communities are being studied in Saskatchewan's Prince Albert Model Forest. The research on the American redstart and ovenbird will determine exactly how many bird communities inhabit 10 different types of forest and how the features of each forest contribute to bird reproduction and survival rates.

AMERICAN REDSTART

In a number of model forests, individual species of wildlife are used as indicators to signal certain environmental conditions and to monitor how the forest environment is responding to stresses and strains. For example, in the Prince Albert Model Forest, the barred owl is being used as an indicator species of mature forests. Owls have been banded with radio telemetry harnesses to study their habitat requirements. So far, radio tracking has indicated that the home range of the barred owl varies from 88 to 2 624 hectares.

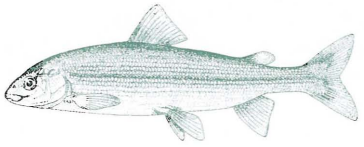
HAIRY WOODPECKER

In the Foothills Model Forest, the nesting and foraging needs of seven woodpecker species are being observed. Woodpeckers are ecologically important in boreal forests. Each year they abandon nest cavities excavated in large trees and snags, which are then used by as many as 40 other species that are unable to hollow out nest sites. Woodpeckers also influence the degree of insect infestation in a forest — they are major predators of destructive wood-boring insects, especially bark beetles. In particular, three-toed and hairy woodpeckers are being studied as indicator species of mature forests. The impact of timber harvesting on their habitat also is being examined.

FISHING FOR INFORMATION

Researchers are studying aquatic wildlife too. A collaborative project in the Fundy Model Forest, involving the forest industry, local governments, local landowners and farmers, is focusing on brook trout and Atlantic salmon habitat. Fish

populations in the Kennebecasis watershed are being evaluated, and new technologies are being used to identify any habitat problems. The two-year study is expected to lead to improved protection and management of this important fish basin.

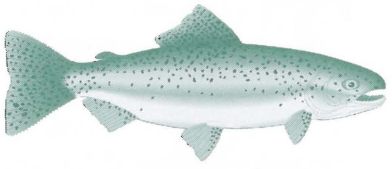


MOUNTAIN WHITEFISH

In Quebec's Lower St. Lawrence Model Forest, Perche River fish populations are being monitored to identify and assess spawning sites. The study has already revealed that the Perche River provides an excellent environment for brook trout spawning and nursery sites. To this end, various sites have been cleaned up, and sills, fish ladders and shelters have been installed. Through the Perche River restoration project, the source of the municipal drinking water also has been cleaned up.

In the Foothills Model Forest, the numbers of Athabascan rainbow trout, Arctic grayling, mountain whitefish and bull trout have declined as a result of timber harvesting, oil and gas development, and road building. These fish are being studied as part of a major watershed assessment project. Data are being gathered on their habitat needs and the impacts of changes in their environment.

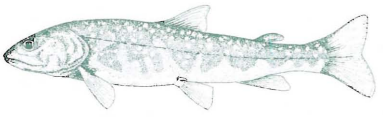
In the Western Newfoundland Model Forest, researchers in the Copper Lake study are determining the width of buffer zone required to protect wildlife habitat and fish, particularly trout and salmon, while maintaining water quality.



RAINBOW TROUT

Criteria will also be developed to help evaluate the effects of forest harvesting on fish habitat.

Many research projects in the model forests have already produced results that have been integrated into forest management plans. Some projects have led to further study and others to computer models. Still other projects have resulted in measures to enhance,



BULL TROUT

repair or restore habitat. For example, in the Lower St. Lawrence Model Forest, habitats have been enhanced by the construction of drumming sites for partridges, nesting boxes for ducks, clearings for woodcocks, protective shelters for small wildlife, and "pre-dams" for beavers.

Over the coming years, partners in the model forests will continue to support habitat studies as they seek to maintain sustainable forests that provide a full spectrum of forest values: economic, environmental, social and recreational.

(*See list of contacts on page 110.*)

CANADA'S 10 MODEL FOREST SITES RANGE IN SIZE FROM 100 000 TO 1 500 000 HECTARES, WITH STRIKINGLY DIFFERENT PHYSICAL, SOCIAL, ENVIRONMENTAL AND ECONOMIC CONDITIONS. SINCE THE MODEL FOREST PROGRAM WAS ANNOUNCED IN 1991, NUMEROUS INNOVATIVE APPROACHES TO SUSTAINABLE FOREST MANAGEMENT HAVE BEEN DEVELOPED AND TESTED.

CHAPTER THREE

Timber Supply in Canada

CHALLENGES AND CHOICES

The global demand for wood and wood products continues to grow as the human population expands. The world's population is expected to double within the next hundred years, exceeding 11 billion, with the level predicted to ultimately stabilize at between 16 billion and 25 billion. These numbers represent an annual increase in population of 100 million. Based on the current annual consumption of wood of 0.7 m^3 per person, the demand for wood could increase by as much as 70 million m^3 annually. To meet such an increase would require a new source of wood each year equivalent in size to the annual harvest of British Columbia. This scenario is unlikely because there is simply not enough uncommitted commercial forest in the world today; and even fast-growing plantation forests could not completely meet this demand.

Will the world run out of wood? Not likely, because there are a number of mechanisms at work that will dampen the demand and increase the supply of wood, causing supply and demand to balance over time. Prices for wood products will rise, recycling and use of wood waste will increase, more substitutes for wood will be used, technologies will improve, and new wood products will be developed. Still, the large projected increase in global population is a significant challenge to forest managers throughout the world.

What are the implications for Canada and its forests? Our forests represent 10% of the world's forests and 15% of all softwoods. In 1993, Canada exported $26 billion of forest products — the largest net contribution to the nation's balance of trade. Canada accounts for 18% of the world's forest products exports, including 50% of softwood lumber exports and 56% of newsprint exports. Clearly Canada's forest sector plays an important role in providing wood products to the world and in contributing to the nation's economy. An increasing demand for wood represents an opportunity to sell more products around the world. This raises the question of whether Canada can maintain or possibly increase its supply of timber to manufacture products for world consumption.

THE EVOLUTION OF CANADA'S TIMBER SUPPLY

The issue of timber supply is inextricably linked to how we view and manage our forests. Canada's approach to forest management has evolved in response to changing societal values and an increased knowledge of forests. When demand for timber was low and supply appeared unlimited — as it was in Canada until the early part of this century — little thought was given to managing forests for the future. There was little need to protect forests from fire, insects and disease, and forests were left to regenerate naturally after logging, as it was believed unlikely that an area would be logged again before nature could replace the timber cut. Additional timber was secured by opening up new lands.

In 1994, approximately 340 000 people were directly employed by the forest industry, and almost 340 communities depended on the forest sector.

By the mid-twentieth century — with the mechanization of logging, the rapid expansion of industry, and a growing demand for products — the need for changes in forest practices was apparent. Improvements were made to forest protection to reduce losses from fire, insects and disease; inventories were completed to better estimate available supplies; and some areas were planted and seeded to speed up regeneration after harvesting. However, the emphasis remained on managing forests for one value — timber.

Today, Canadians view forests as more than a supply of timber or a source of wealth and employment. With the adoption of the principles of sustainable development, forests are now viewed as complex and dynamic ecosystems. Values such as wildlife, wilderness and recreation also must be maintained. Sustaining these other values and protecting the health of forest ecosystems poses a challenge to those wishing to expand timber production.

TIMBER SUPPLY: A NATIONAL PICTURE

Timber supply is the rate at which timber is made available for harvesting. The forest industry uses timber to manufacture products, such as lumber, newsprint, tissue paper and cardboard, that are used around the world. The quantity and quality of timber changes over time, depending on the age and species composition of the forest and how much land is dedicated for timber production. The concept of timber shortages invokes visions of large areas of denuded forest land. This is not the case, however, as there is a significant distinction between the expanse of the forest and the availability of fibre for industrial use. Canada has a vast area of forest, but only a portion is suitable and used for timber production.

Despite a century of harvesting, our nation remains a land of forests. Almost 50% of Canada's land (417.6 million ha) is forested: some 37% of this area is open forest land, comprising muskeg, rock, barrens, marshes and meadows, as well as slow-growing or sparse forests; approximately 5.5% is protected from harvesting by legislation; and the remaining 56% is considered commercial forest — capable of growing a merchantable crop of trees within a reasonable length of time.

Approximately 146 million hectares of the commercial forest are currently accessible by road, rail or water, of which more than 27 million hectares are excluded from harvesting by provincial

ALLOWABLE ANNUAL CUT

The provinces own most of the forest land in Canada. Each province regulates and controls the harvest rate on provincial Crown land through an allowable annual cut (AAC). AACs determine the volume of timber that forest companies are permitted to harvest annually from a particular area over a specified period of time.

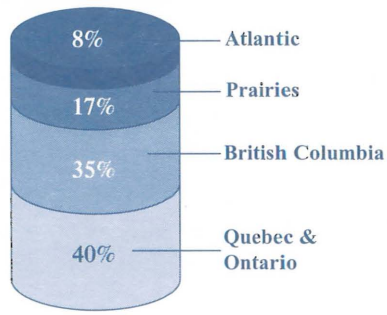
The method of determining AACs is complex and varies significantly across Canada. The calculations are based on estimates of the extent of the forest landbase; the growth rate of trees; losses due to fire, insects and disease; accessibility; economic conditions; environmental considerations; silvicultural investment; degree of protection; and management objectives.

AACs are not static numbers; they are revised periodically to reflect changing conditions and improvements in data and knowledge. Most provinces recalculate AACs every 5 to 10 years. Furthermore, there is no one "correct" harvest rate for a forest, but rather a range of rates that correspond to various public policy options, such as creating protected areas or controlling forest fires. In this way, AACs reflect society's values, as well as the biological and economic conditions of the forest.

policies that protect lakes and streams, steep slopes or fragile areas. Only an estimated 119 million hectares (29% of Canada's total forest area) are currently managed for timber production. In 1993, an estimated 968 584 hectares were harvested in Canada, equal to approximately 0.6% of the accessible commercial forest.

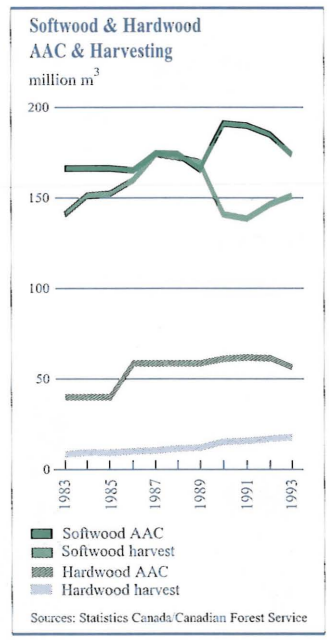
Provincial governments manage approximately 71% of Canada's forests: the federal and territorial governments are stewards of roughly 23%; and some 6% are privately owned. The harvest rate on provincial Crown land is regulated by setting an allowable annual cut (AAC) — the maximum volume of timber that can be harvested annually from an area over a period of time.

Canada's AAC



There is no "official" national AAC. AACs are calculated for small regions within a province or territory; these AACs are totalled to arrive at provincial/territorial figures, which are then rolled up to obtain a national number. The AAC for Canada presented in this report includes estimates for all Crown, private and federal lands. (In general, private lands are not regulated and do not have an AAC, therefore estimates were made of the harvest potential on private lands.)

Canada's AAC has remained quite stable over the past two decades. The 1993 AAC was 227 million m^3: 172 million m^3 in softwoods and 55 million m^3 in hardwoods. Approximately one-third of Canada's AAC is in British Columbia (BC), 40% is in Quebec and Ontario, the prairie provinces comprise roughly 17%, and the Atlantic region has 8%. The largest portion of the softwood AAC is located in BC (44%), whereas most of the hardwood AAC is found in Ontario, Quebec and Alberta.



The level of harvest increased from 117 million m^3 in 1970 to 185 million m^3 in 1987, before levelling off at an average 161 million m^3 for the past four years. An additional 6 million to 7 million m^3 are harvested for fuelwood. In 1993 the industrial roundwood harvest was 169 million m^3, of which 150 million m^3 was softwood *(see graph)*.

Some AACs are being recalculated to reflect changing economic, social and biological factors; and in many cases, they are being reduced. In the future, as forest land is urbanized or set aside for parks and wilderness, the size of the commercial forest landbase may decrease. Most provincial governments have introduced legislation and policies designed to meet sustainable forest management objectives. This trend will further reduce the amount of wood available for harvesting, by increasing the width of buffer zones along streams, reducing the size of clearcuts, increasing the time between

CONFERENCE ON TIMBER SUPPLY IN CANADA

To fulfill a commitment under the National Forest Strategy, in 1994 the Canadian Council of Forest Ministers sponsored a conference in Alberta, entitled "Timber Supply in Canada: Challenges and Choices." The objectives of the conference were two-fold: to assess the opportunities to maintain or expand the sustainable supply of timber from public and private lands, and to examine how sustainable development is changing the way forests are managed.

This conference brought together forest resource managers and others concerned with forestry issues. It was clear from the wide range of participants and viewpoints that timber supply can no longer be discussed only by timber supply analysts — the context for discussion has broadened. This conference was hopefully the beginning of a process that will bring people together to make timber supply decisions that reflect all of society's values.

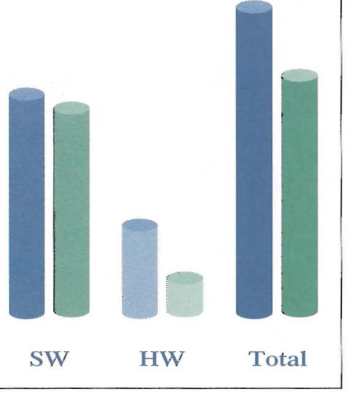
(Conference proceedings are available from the Canadian Forest Service – HQ — see information on inside back cover.)

harvesting activities on adjacent areas, or improving the visual appearance of logging. Additionally, in some regions, second-growth forests may be harvested at a younger age and may therefore produce lower volumes of timber per hectare than the original forest, or regenerate with more hardwood species, resulting in reductions in softwood AACs.

Atlantic region (1993)

	million m³ AAC	Harvest*
Softwood	14.0	13.0
Hardwood	5.6	2.1
Total	19.6	15.1

*Annual average 1990-1993



Regional Summaries

As a result of the conference mentioned above, most provinces produced assessments of their current timber supply, and several presented scenarios for potential expansion. Brief regional summaries are described in the following section.

Atlantic region

The Atlantic region encompasses Newfoundland and Labrador, New Brunswick, Nova Scotia and Prince Edward Island (PEI). The AAC for the Atlantic region is 19.6 million m³, which represents 8% of Canada's total AAC. Each province regulates the harvest on public (Crown) lands and assesses the potential of private lands to provide sustainable quantities of timber. Although the total area of forest land in Atlantic Canada is small, the proportion of private lands is significant, comprising 92% of the commercial forest landbase in PEI, 70% in Nova Scotia, and 50% in New Brunswick, but only 2% in Newfoundland.

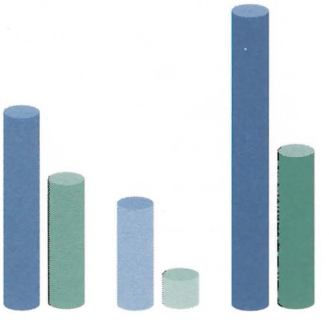
The forests of Atlantic Canada have been managed much longer than forests elsewhere in this country, and some areas have already been harvested two or three times. With the exception of Labrador, where much of the forest is inaccessible, the rate of logging in softwood forests is close to or exceeds the AAC. The harvesting of hardwood species is well below the AAC, with most of the surplus in New Brunswick and Nova Scotia. The island of Newfoundland is relying on shipments of softwood logs from Labrador and other regions to meet short-term shortages.

In the longer term, the potential to increase supply in the Atlantic region is highly dependent on three factors: increasing silvicultural activities, such as planting and thinning; obtaining more fibre from every tree harvested (better utilization); and recycling. For example, Nova Scotia is implementing a comprehensive forest policy that includes intensive forest management objectives intended to double the province's 1986 forest production levels by 2025. In New Brunswick, current levels of silviculture (7 500 ha of planting and 8 700 ha of spacing on Crown land) can maintain the current rate of softwood harvest, but if planting and spacing were intensified on an additional 10 000 hectares, the softwood AAC could be increased 50% by 2050.

Quebec (1993)

	million m³ AAC	Harvest*
Softwood	36.9	23.8
Hardwood	19.4	5.4
Total	56.3	29.2

*Annual average 1990-1993



Central Canada

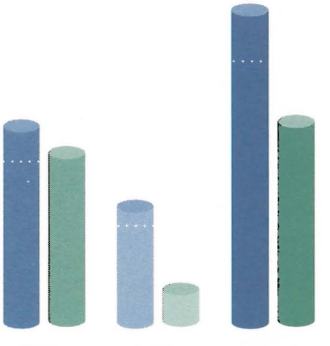
Quebec and Ontario together comprise 40% of the commercial forest land in Canada and account for 40% of the national AAC. This region is typical of most in that more than half of its commercial and available forest landbase is classified as mature and over-mature forests (49% in Quebec and 54% in Ontario). Private ownership in this region is lower than in the Maritime provinces, but is much higher than in western Canada. With respect to size, Quebec contains the largest area of commercial forest land, while Ontario is third after BC.

Ontario (1993)

	million m³ AAC*	Harvest**
Softwood	18-22	18.8
Hardwood	12-13	3.5
Total	30-35	22.3

* Maximum depletion estimated and converted to m³

**Annual average 1990-1993



Ontario regulates its harvest on public lands on the basis of area, whereas other provinces use volume. The province's harvest regulation is changing to meet new forest legislation and planning requirements. According to recent figures, the maximum area of Crown land that can be depleted annually by fire, insects and harvesting is 426 000 hectares (236 000 ha of softwoods and 190 000 ha of hardwoods). The current harvest is approximately 200 000 hectares — well within the allowable level; fire depletes an average of 80 000 hectares annually. Average harvest levels are approximately 18.8 million m³ of softwoods and 3.5 million m³ of

THE IMPORTANCE OF PRIVATE LANDS

Private lands in Canada represent 10% of the commercial forest, but produce 19% of the timber cut annually. Two-thirds of the private forest lands are owned by an estimated 425 000 woodlot owners; 13% are larger holdings, generally owned by industry; and the remainder belong to municipalities or unknown owners. The total annual harvest on private lands amounts to approximately 27 million m^3, of which 22 million m^3 are softwood.

Governments do not regulate the harvest of timber on most private lands. The level of logging is determined by the owners based on market conditions, demand and their own objectives. In some regions, private landowners have formed associations or belong to marketing boards. These organizations help the owners by providing technical expertise, preparing management plans, conducting silvicultural and harvesting operations, and marketing the wood. In New Brunswick, the boards also estimate AACs for woodlots on a regional basis. In most regions, governments estimate the harvest potential for private lands (based on biological growth information, and assumptions regarding woodlot owners' objectives) to plan and forecast the province's wood supply.

hardwoods. The most recent provincial estimates (converted to a volume basis and including private lands) indicate an available timber supply of 30 million to 35 million m^3, of which 18 million to 22 million m^3 are softwoods. Preliminary forecasts show a gradual decrease to between 25 million and 29 million m^3 by 2135. The final level will depend on local forest management objectives, the amount of land available for timber production, and the level of silvicultural activities. Ontario is revising its forest planning system and will complete an assessment of its timber supply later this year.

The AAC for Quebec amounts to 56 million m^3, of which two-thirds is softwood; of the 42.3 million m^3 of AAC on public lands, 33.5 million m^3 has been allocated to industry under forest management agreements. The 1993 harvest was 32.3 million m^3, of which 83% was softwood.

Although both Ontario and Quebec are cutting softwoods within their AACs, local shortages have been experienced. Both provinces have substantial reserves of hardwood, and Quebec also has reserves of softwood. As noted above, Ontario expects its softwood AAC to decline. Without increased levels of silviculture, the supply of softwood timber may not meet the projected demand before the middle of the next century.

Both provinces have developed initiatives to improve forest management that will affect timber supply. Quebec's new forest protection strategy is aimed at balancing environmental and economic needs, promoting natural regeneration, and better respecting the ecology of the forest. Similarly, Ontario has recently developed a new forest policy framework and Crown Forest Sustainability Act that will promote greater public participation and community involvement in forest management. It is also adopting an approach that will see forests managed as ecosystems.

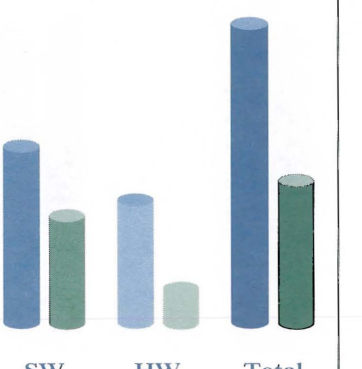
Prairie provinces

The prairie provinces encompass Alberta, Saskatchewan and Manitoba. Alberta is fairly typical of most Canadian regions, with more than 50% of its commercial forest landbase made up of mature and over-mature forests. Forests in these older age classes comprise only 18 to 20% of the commercial forests of Saskatchewan and Manitoba, partly due to the differences in fire management policy. The estimated AAC for the prairie region amounts to some 39 million m^3, of which 60% is softwood. This represents 17% of Canada's total AAC. The 1993 harvest for the prairie region amounted to some 20 million m^3, of which 76% was softwood. Hardwood harvests have increased — from 1.44 million m^3 in 1985 to 5.7 million m^3 in 1992. Large surpluses exist for both softwoods and hardwoods.

Prairie provinces (1993)

	million m^3 AAC	Harvest*
Softwood	23.6	13.8
Hardwood	15.7	4.5
Total	39.3	18.3

*Annual average 1990-1993



Commercial timber production in the prairie provinces is relatively recent compared to eastern Canada and BC, and opportunities exist for long-term expansion. Harvest levels in Manitoba and Saskatchewan are well within the softwood AAC. However, both provinces have some areas with trees that are shorter and smaller in diameter than can be used by existing mills. As investments are made to update processing capabilities to use smaller trees, more wood could be processed and in some cases, more areas could be added to the AAC landbase. More intensive silviculture and enhanced protection from fire, insects and disease also have the potential to increase timber supply.

In Alberta, the total AAC has remained relatively stable over time. Ten years ago, very little of the province's AAC had been allocated to industry. Currently, 94% of the softwood AAC is allocated for timber production. There are sufficient mills in Alberta to utilize the full softwood AAC, and this will likely occur soon. Although approximately 71% of the hardwood AAC has been

allocated, only 32% is harvested annually. Some new mills that are not fully operational are not yet utilizing their allocated cut.

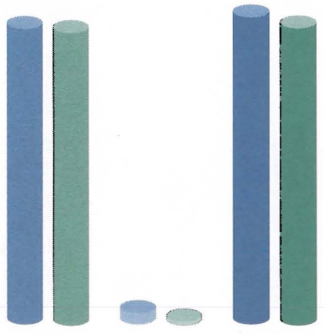
While all three provinces have privately owned forests, the most significant amount of harvesting carried out on these lands is in Alberta. Recently, many mills in BC have begun purchasing timber from private lands in Alberta to augment their supply. Harvests of softwoods from private lands in Alberta almost doubled between 1991 and 1993, from an estimated 436 000 m^3 to 811 000 m^3. Private lands are unregulated; however, an estimated harvest potential (636 000 m^3 for softwoods and 377 000 m^3 for hardwoods) for private lands in Alberta is included in the prairie total, based on the average harvest over the past three years.

Through public consultation, all three provinces are changing their policies and practices to address sustainable forest management objectives. Alberta is developing a forest conservation strategy, and Manitoba has completed a new forest strategy. Saskatchewan has produced a conservation strategy and a new forest management policy framework; it is also introducing legislation that commits the province to managing forests on a sustainable basis.

British Columbia (1993)

	million m^3	
	AAC	Harvest*
Softwood	75.9	75.2
Hardwood	2.9	1.1
Total	78.8	76.3

*Annual average 1990-1993



British Columbia

British Columbia has 21% of Canada's commercial forests, including some of the most productive forest land. Although BC accounts for 23% of the annual area harvested in Canada, it produces 45% of the annual volume cut. More than 44% of the nation's forest products exports are from BC. Over the past 50 years, as more areas have been made available for timber production, the province's timber supply has expanded rapidly. There is no more accessible commercial forest landbase available to expand BC's timber production.

BC determines its AAC on less than half the land area currently allocated for commercial harvesting; steep slopes, forests with sparse tree cover, areas currently too expensive to harvest, and environmentally sensitive areas are not included. AACs are determined every five years for each of the province's 37 timber supply areas (TSAs) and 34 tree farm licenses (TFLs). A major timber supply review is underway to assess and update the AACs for these areas by the end of 1996. As of May 1995, new AACs had been determined for 6 TSAs and 11 TFLs, representing 17% of the regulated harvest. The softwood AAC for these areas was reduced on average by 11% (the total softwood and hardwood AAC was

reduced on average by 5%). This reduction is due in part to the "falldown effect" (second-growth forests are harvested at a younger age, producing a lower volume of timber per hectare than the original old-growth forest). Other factors may lead to reductions in AACs, including land-use decisions regarding parks and wilderness, Aboriginal land claims, updated inventory information, and changes in forestry practices.

Over the past several years, the annual harvest from BC Crown lands has been equal to the AAC — an annual average of roughly 69 million m^3. With no surplus supply, some companies are importing timber from Alberta, the Yukon and Alaska to make up for local shortages.

In addition, an average 7 million m^3 has been harvested annually from private lands. When timber prices have been high and the supply on Crown lands limited, the annual harvest has occasionally reached 12 million m^3. Although some private lands are regulated as part of Crown license areas, the majority are not. An estimated harvest potential (6.7 million m^3) for the unregulated private lands is included in the BC total, based on the average harvest over the past four years. These harvests may not be sustainable in the long term, once the higher volume old-growth forests have been cut.

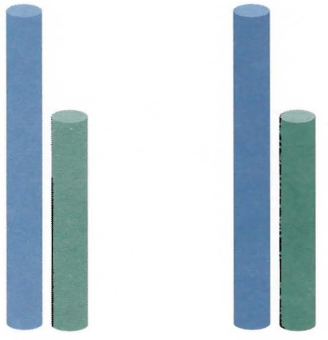
Based on analyses to date, there could be a reduction in the AAC (softwood and hardwood) for regulated forest lands in BC from the current 71.3 million m^3 to 60 million m^3 by 2050, with a further decline to 57 million m^3 in the long term. More intensive silviculture could offset some of this decline. In addition, areas not currently economical to harvest — which are excluded from the AAC calculation — could be added to the provincial supply, depending on wood markets and prices, improvements in technology and transportation, and demands for other forest values.

BC has several initiatives in place to address sustainable forest management objectives. The new Forest Practices Code will impose strict regulations on logging. The Commission on Resources and Environment (C.O.R.E.) is developing a land-use plan to identify additional protected areas, as well as areas for commercial timber production. And a new forest renewal plan will raise a projected $2 billion over the next five years from stumpage revenues; the money will be used in part for intensive silviculture to help offset declines in AACs.

Yukon & NWT (1993)

	million m^3 AAC	Harvest**
Softwood	0.3	0.2
Total	0.3	0.2

*AAC only refers to NWT
**Annual average 1990-1993
***Hardwood data not available



The Yukon and the Northwest Territories

The AAC for the Northwest Territories (NWT) is approximately 300 000 m^3 (all of which is softwood), divided equally between territorial and federal lands. The Yukon does not calculate an AAC, but preliminary estimates confirm that current harvest levels are well within the annual net growth of its forests. At present, very little timber is harvested in either the Yukon or the NWT; the total harvest for industrial purposes in both territories was 293 000 m^3 in 1993. Much of the timber is too remote and expensive to harvest. Most cutting is for fuelwood, although some timber is now being exported from the Yukon to mills in BC.

CAN CANADA'S HARVEST LEVELS BE MAINTAINED OR INCREASED?

Given the changing demands on forests and the need to manage this resource in a sustainable manner, can Canada's current level of harvest be maintained or increased? There are a number of options that could increase timber supply, each with costs and benefits. However, these options must be balanced with the need to maintain healthy forest ecosystems and other values — such as wildlife habitat and wilderness — and be assessed within the social context of jobs, communities, Aboriginal rights and spiritual values. Consequently, choices and trade-offs will have to be made.

Accessing New Areas

One way to maintain or expand Canada's timber supply would be to extend road systems into remote areas, thereby adding to the area available for commercial timber production. Approximately 90 million hectares — 38% of the commercial forest — are not accessible by road, water or rail. Most of the areas close to mills are accessible; therefore, new forest areas generally will be far from existing mills, which will increase the hauling distance. The higher transportation cost and the expense of building new roads mean that many remote sites will be too expensive to harvest unless the price of forest products rises significantly. Should prices increase, these areas could become economically viable to harvest, increasing Canada's timber supply.

On the other hand, any increase in timber supply obtained by accessing new areas may be offset elsewhere by reductions to the existing commercial forest landbase. The federal and provincial governments are committed to setting aside 12% of Canada's total

territory as protected space. Under the National Forest Strategy, there is also a commitment to establish a network of protected areas representative of Canada's major forest types. A number of provinces are developing land-use and conservation strategies to identify areas that will be protected, as well as areas that will be available for harvesting. In BC, for example, C.O.R.E. has established a process to resolve land-use issues, and through the "Keep it Wild" campaign, Ontario is identifying areas to protect as part of a network of natural heritage areas that are representative of the province's ecological regions. The resolution of Aboriginal land claims also may affect the amount of land available for industrial purposes.

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Investing in the Forest

A second way to increase timber supply is through more intensive silviculture, which includes weeding, thinning, fertilizing and a greater reliance on planting genetically improved stock. All of these activities are aimed at speeding up the regeneration and growth of commercial species. This is a longer-term solution, however, because it takes 40 to 80 years to grow a tree large enough to be used by pulp mills, and even longer if it is to be used by sawmills. Intensively managed plantations could provide higher volumes of timber per hectare than natural forests and require less land to produce a given volume of wood. However, these silvicultural treatments are expensive and will only be cost-effective on the most productive sites near mills.

Generally, forest management activities are carried out by companies as part of their license agreements with the provinces for the harvesting of wood from Crown land. The duration and conditions of these agreements — referred to as "tenures" — vary by province and even within provinces. In return for the right to harvest Crown timber, companies pay stumpage fees, royalties and other fees to the provincial government, and agree to undertake certain silvicultural activities, such as regenerating the areas they cut.

Although more intensive silviculture would lead to an increase in allowable harvest levels, many companies are reluctant to make this investment on land they don't own without receiving a long-term guarantee of the right to harvest the timber grown. Alberta is trying a new arrangement with Weldwood of Canada Ltd., giving the company the right to harvest any additional timber that results from an increase in its silvicultural investment. In addition, several provinces are setting up dedicated trust funds to ensure that stumpage revenues from the forest will be reinvested directly in the forest.

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Intensive silviculture results in more human intervention in the forest and greater use of plantations, fertilizers and herbicides. Also, it may be at odds with the goal to manage forests as ecosystems — to maintain their ecological functions (such as building soils, cycling nutrients and producing oxygen). Ecosystem management includes such things as using "softer footprint" harvesting methods (such as leaving more trees standing after logging, or using machines with wider tires to do less damage to the ground), encouraging natural regeneration, increasing buffer zones around lakes and environmentally sensitive areas, and leaving snags and woody debris for wildlife. Ecosystem management attempts to maintain a range of forest values across the landscape, although the values may be found in different places at different times. As a concept, ecosystem management is relatively new, and different operational approaches are still being developed and tested.

Several provinces are adopting silvicultural techniques that are more sensitive to forest ecosystems. For example, Quebec's new forest protection strategy promotes natural regeneration. While the province will still plant trees in certain circumstances, Quebec believes it can improve forest productivity by using a variety of cutting methods that provide favourable growing conditions for younger trees. Another approach, which is being used in BC, is that of zoning forests and other lands for different uses, including intensive forestry, recreation and protection.

Better Forest Protection

Increasing the timber supply can also be accomplished by providing greater forest protection. By reducing the losses from nature, more timber could be made available for harvesting. In addition, salvaging timber on recently burned areas or cutting stands that are likely to be attacked by insects and disease can reduce losses, effectively increasing the timber supply.

However, fire, insects and disease are naturally occurring events in a forest ecosystem. They are part of natural succession, the process by which forests grow, die and regenerate. Controlling all of the fires in a forest can affect its species composition and age structure. For example, in the past, fires occurred naturally in the ponderosa pine forests of central BC every 5 to 15 years. The pines survive ground fires because their bark is fire resistant. In fact, their cones require the heat from a fire to open and release their seeds. However, with increased fire control, the fast-growing ground shrubs and shade-tolerant trees that fill openings on the forest floor are no longer

burned regularly. Consequently, when a fire does occur, the flames climb the "ladder" created by those plants, reaching the tree tops and killing the pines.

Using Wood More Efficiently

A further way to increase the available timber supply is to improve wood utilization: for example, making better use of trees that are cut and using species, such as hardwoods, that were previously considered of little commercial value.

Until recently, the forest industry harvested softwood species (spruce, pine and fir) almost exclusively, partly because they account for 77% of the volume in Canada's forests, but primarily because they provide superior lumber and newsprint. In contrast, hardwoods were generally left uncut because of their low commercial value, although small volumes were cut for fuelwood and making furniture. Hardwoods were often considered "weeds" that competed with more desirable softwood species.

However, the situation is now changing: softwood supplies are almost fully allocated; new technologies can be used to produce pulp from hardwoods; and new products, such as oriented strand board, can be made from such hardwood species as aspen. Today, hardwoods are viewed as a major source of timber. In Ontario, for example — where three new oriented strand board mills and one new hardwood lumber mill are planned — the hardwood harvest is expected to triple.

Over the past hundred years, technology has played an important role in increasing timber supply by making more efficient use of each tree harvested. For example, on-site chipping of branches and small trees has enabled the forest industry to remove more timber from the areas logged. Although this practice recovers more fibre from each tree cut, there are limits to the gains that can be made. Some branches, tops and woody debris need to be left on the site to prevent soil erosion and provide nutrients for new growth. In addition, dead trees and logs are important habitat for wildlife.

Another way to expand timber supply is through new mill technology. Increasingly, companies are making products from laminated chips, sawdust and other wood by-products. They are also using smaller logs that were considered too short or thin to process economically, and thinner saws are reducing the amount of wood lost as sawdust. In addition, new technologies are enabling mills to produce more pulp from each cubic metre of wood. Although these developments will continue to expand the timber supply by improving wood utilization, the extent of this increase is difficult to forecast.

Producers of recycled-content newsprint in Canada

	1990	1994	1996 announced
Number of mills	1	18	20
Recycled-content capacity (million tonnes)	0.3	5.6	6.1
Percentage of total newsprint capacity	1%	58%	62%

There are a number of ways to improve Canada's timber supply, including greater access to remote areas, more intensive silviculture, expanded fire control programs, better utilization of wood and wood waste, and increased recycling. All of these options are being considered in the context of managing forests as ecosystems.

RECYCLING

Recycling paper and cardboard can extend Canada's timber supply by reducing the amount of new wood fibre required to make pulp and paper products. For example, one tonne of old newspapers can be used in place of 11 to 24 trees, depending upon their size and species. Recycling also lessens the amount of waste going into landfills and reduces the energy required to produce paper. Recycling paper frees up timber for other solid wood products, such as lumber and panels, and can reduce the pressure on areas that could be used for conservation or wildlife. Given that paper can be recycled only a number of times, however, there will always be a need for virgin fibre.

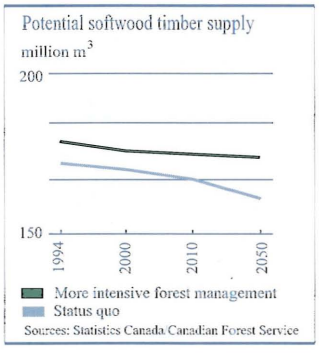
The potential exists to increase recycling in this country: in 1991, Canada collected only 26% of the paper it consumed — a rate well below that of Europe (38%) and the USA (37%). However, there are other environmental and economic considerations. Canada currently imports 687 000 tonnes of old newspapers from the USA. Removing the ink from waste paper creates a wet sludge that must be treated and disposed of. In addition, transporting old newspapers over such a distance results in higher costs for Canadian mills.

CONCLUSIONS

Canada has traditionally expanded its timber supply by opening up new areas of forest. While we are not overcutting our forests, we are harvesting softwoods at a rate that is close to our allowable cut. Any room for expanding Canada's harvests is likely to come from hardwoods, which are being harvested at a rate well below the AAC. The timber supply situation varies across the country and some local shortages are being experienced, particularly with respect to the availability of large softwood sawlogs used to make lumber. Canada has a number of options for its timber supply in the future, each with environmental and economic costs and benefits.

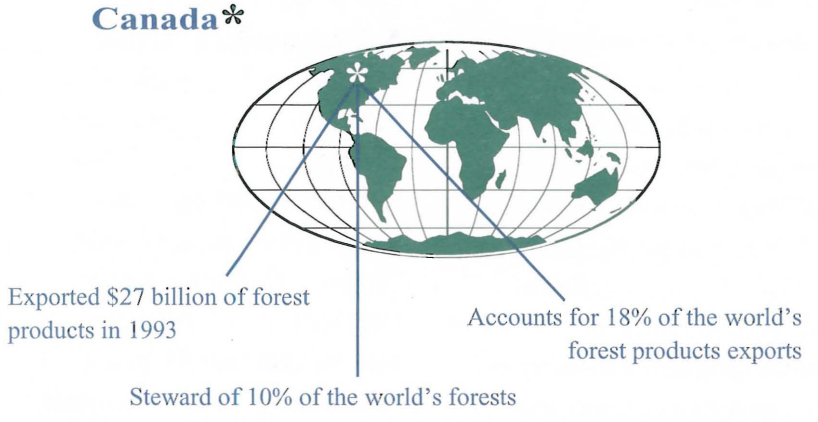
Ensuring a sustainable supply of timber while meeting society's changing demands for forests is an ongoing challenge. In response, forest management practices and processes are evolving rapidly. Within the lifespan of a single tree, our focus has moved from harvesting trees to sustaining forests, and the pace of change is accelerating. All of these changes create uncertainties that make it difficult to predict the outlook for timber supply in Canada.

One of these uncertainties concerns the forest landbase — knowing what and how much land will be available for commercial timber production and other forest values. The different forest values and societal viewpoints to be considered have led to the creation



of a number of processes to increase public participation in forest management planning. Several provinces are undertaking land-use planning processes and developing strategies to identify additional protected areas. Greater public involvement in deciding how forests are to be managed can help reduce conflicts over forest use and improve the security of timber supply.

Timber supply will also be affected as the principles of ecosystem management are incorporated, either voluntarily or through such regulations as forest practices codes. New practices include increasing buffer zones along streams and lakes to protect



water and wildlife, creating reserves to protect environmentally sensitive areas or maintain old-growth forests, and using alternative forest management methods to conserve biodiversity. All of these initiatives will enable forests to be managed as ecosystems, but will also affect the amount and cost of wood that can be harvested.

The extent to which future technologies can increase timber supply is uncertain. Furthermore, the global demand for forest products and the supply will affect prices over time. Higher prices can make remote or inaccessible areas more economically attractive to harvest, expanding the timber supply.

There are a number of ways to improve Canada's timber supply, including greater access to remote areas, more intensive silviculture, expanded fire control programs, better utilization of wood and wood waste, and increased recycling. All of these options are being considered in the context of managing forests as ecosystems. Canada's future timber supply will reflect the value that society attaches to all of the uses of the forest, balanced against the need to maintain the ecological health of the forest.

Point of View

Forest Wildlife Experts

The central theme of this year's report to Parliament is the challenge of finding a balance between the timber and non-timber values of Canada's forests — ensuring a healthy, vigorous forest for tomorrow, while meeting the needs of today. This feature section of the report summarizes the views of six people who deal with one non-timber value: forest wildlife.

All six individuals — environmentalists and government and forest company officials from New Brunswick and British Columbia — share their opinions regarding the state of Canada's forest wildlife, the threats it faces, and what can and should be done to protect forest wildlife and habitat in this country.

We hope their comments will shed light on a complex and challenging field.

Our participants from New Brunswick are Mike Sullivan, John Gilbert and Jim Goltz. Sullivan is a Forest Habitat Program Manager of the Fish and Wildlife Branch of New Brunswick's Department of Natural Resources and Energy; Gilbert is Manager of Fish and Wildlife Environment for J.D. Irving Ltd.; and Goltz is President of the New Brunswick Federation of Naturalists.

The participants from British Columbia are Don Eastman, Steve Tolnai and Wayne McCrory. Eastman is Manager of the Research and Development Section of the Wildlife Branch of British Columbia's Ministry of the Environment, Lands and Parks; Tolnai is Chief Forester for Weyerhaeuser of Canada Ltd.; and McCrory is Director of the Valhalla Wilderness Society.

What is the state of forest wildlife and wildlife habitat in Canada?

Mike Sullivan noted that many species are doing well, including those favouring young second-growth forests. Other species, however, are experiencing difficulty. Having perceived a problem with mature softwood-dwelling species, New Brunswick moved to promote that particular type of habitat. However, Sullivan wonders, "Are we maintaining the right types of habitat for each species?" and points to the "huge amount of information lacking on that issue." Nonetheless, he notes that there has been a marked improvement in habitat management over the past decade. Now wildlife personnel are involved in every step of the process — setting, implementing and assessing forest habitat objectives. In New Brunswick, the commitment to manage for more than just timber has resulted in a 20% reduction in the provincial wood supply.

John Gilbert also cites improvements over the past five years: "Now most companies are hiring biologists and training foresters on environmental issues." He believes that New Brunswick's Crown lands and industrial freeholds are well managed, but is concerned about private woodlots.

Gilbert states, "... plenty of mature habitat exists, and we have a good handle on some of the larger species. On others, we need more research." Habitat and stand types are tracked province-wide using a geographic information system. "We fly over the forest continuously and we know what's out there."

Jim Goltz defines wildlife in its broadest sense — plants and animals. Given that definition, he cautions that it's difficult to ascertain the state of wildlife and their habitat. "In general, though, species that require old-growth, undisturbed habitat are very much in peril," because their habitat has decreased considerably. Goltz foresees that because of growing demand (particularly since he believes that New Brunswick's total allowable annual cut of hardwoods is soon to be fully utilized), the situation will continue to deteriorate, "except for species that like forest edges or tolerate clearcuts well."

Don Eastman has witnessed "a tremendous change in the awareness of interactions between wildlife and forestry" during the past two decades — a shift from a "very narrow perspective" to a "far greater ecological awareness." Changes have occurred in part because of the activities of non-governmental groups, but also through the efforts of concerned officials within provincial ministries.

Eastman looks forward to British Columbia's new Forest Practices Code, which will introduce measures aimed at integrating the habitat requirements of a whole range of species into management plans. He points out, "We're learning more and more about how wildlife species contribute to healthy, functioning forests. If we do away with some of them, the forests will be less productive. So in the long haul, the industry will gain more by protecting them."

Steve Tolnai says there has been "tremendous improvement" over the past five years: "We have adjusted our practices to consider wildlife in every activity we do. Many measures don't cost much money and benefit several species at once. Snags and standing trees are scattered across a cut block, and instead of being burned, the woody debris is left on site to provide food and shelter for wildlife."

He accepts British Columbia's policy of setting aside 12% of the landbase as protected areas, and feels that the public is generally satisfied with the way the forest resource is being managed by both government and industry. He cautions, however, that he is speaking primarily about conditions in the Kamloops region, where "habitat is not a constraining factor. Along the coast, where certain species require old-growth habitat, there are different issues."

Wayne McCrory takes a more pessimistic view: "I've been monitoring the situation for 30 or 40 years and can say that forests and wildlife are both deteriorating. The British Columbia Conservation Data Centre has identified well over 300 species of plants and animals that are considered at risk. Despite this and other evidence, the province lacks an Endangered Species Act, and so does the nation. We're in a biodiversity crisis, and the main cause is the massive onslaught of clearcut logging."

What are the primary threats to forest wildlife?

John Gilbert cites a lack of knowledge regarding habitat requirements: whether a certain type is in short supply, or whether the needs of given species remain somewhat obscure. He favours ecosystem-based management: "We want to know what was there in the past, what's there now, and what we must do to fulfill the future

needs of the species, whether they're animals you can see and count, or small rare plants."

To gain more information, J.D. Irving Ltd. acted as the prime mover in the Fundy Model Forest — a large tract of land administered by a coalition of stakeholders on a consensus basis. Ongoing research in the model forest addresses biodiversity issues, riparian strip management and alternative harvesting practices.

Mike Sullivan singles out the ever-increasing worldwide demand for a variety of forest products. "Society is driving this thing. People need jobs and timber products. That leads to harvest pressure, which in turn causes pressure on certain habitat types."

Another factor is the growing network of logging roads, which draw snowmobiles and all-terrain vehicles to previously inaccessible areas. Sullivan foresees a time when "there'll be hardly anywhere in New Brunswick that doesn't have a road within 400 or 500 metres."

For Don Eastman, non-forest activities in British Columbia are one of the biggest long-term concerns regarding the loss of critical habitat. He cites urban sprawl, hydroelectric reservoirs and transportation corridors, all of which have an impact on the valley bottoms used by wildlife in this mountainous province.

Jim Goltz believes that habitat loss and public attitudes in New Brunswick are the primary threats to wildlife. He centres on the need for far more protected natural areas and public education. He also feels that forest management is unidimensional — it focuses on "economic value, based on the volume of fibre produced, the job situation and the financial gain."

Wayne McCrory identifies clearcutting as the primary threat in British Columbia. He points to the erosion of coastal salmon and interior trout streams that resulted from a lack of compliance with guidelines related to road-building and skid-trail layout. He disagrees with the harvesting practices on private lands. "We see a green gold rush — people buy land to clearcut it because the trees are worth more than the land."

Steve Tolnai believes that "overwhelming percentages" of British Columbia's interior forests (which are naturally short-lived) are now in an over-mature and declining condition, and are unsuitable for the many species that thrive on "healthy, good-growing" habitats. This is due in part to firefighting in an area that naturally burned every 100 years, on average.

Elsewhere, he mentions the impact of predation on wildlife — notably the effect of wolves on woodland caribou.

How stringent are wildlife regulations, and how rigorously are they enforced?

In British Columbia, the Forest Practices Code stipulates that the ministries of Forests and of Environment, Lands and Parks must both sign off on a proposal before it's accepted and implemented, which Don Eastman views as "a major step forward." The Code contains numerous guidelines dealing with biodiversity and sensitive wildlife species, along with a range of "fairly stringent penalties."

Steve Tolnai views the new Code as "important and necessary," provided there's an element of flexibility: "We seem to have standard requirements regardless of local conditions — a one-size-fits-all approach. I have no doubt that the plan will develop into something practical, usable and more site-specific, but we'll have some rough going in between."

Wayne McCrory both acknowledges and criticizes British Columbia's efforts to establish protected areas: "There's been a decent move

in this direction during the past several years, but these parks have been severely compromised wherever there's been a conflict with industry, and key habitats have been lost." He is dubious about the prospects of vigorous enforcement. "We have weak guidelines, insufficient staff and an entirely wrong approach to harvesting anyway."

Mike Sullivan feels that New Brunswick's regulations are indeed strict — from the planning stage to operational activities. "However, we must be sure that a given regulation makes for better forest management, and not for more and better bureaucracy." The size of clearcuts has been reduced in response to a public that prefers smaller cuts from an aesthetic perspective — not because reductions may be appropriate to particular ecosystems or groups of species. Sullivan contends, "There's no single optimum cut size for all of the species we have out there. I think you want to be much more visionary about the process and focus on the end result — a forest to maintain the values identified as important."

John Gilbert praises New Brunswick's attempts to identify habitat types that will be in short supply and to demand specific management plans to ensure an adequate stock in the future. "We like what they've done. We may not agree with all aspects of it, but we basically agree with the philosophy behind their actions." He questions the province's reliance on a single indicator species — the pine marten — and believes that recent studies have shown that the guidelines pertaining to it may be changing. He qualifies, "But if so, they've erred on the side of conservatism, which is probably good for wildlife in the long term." He feels that enforcement tends to get a bit heavy handed. "Our position as an industry is: tell us what you want and we'll do it. Check us afterward, and if we made a mistake, prosecute us to the full extent of the law."

Jim Goltz grants that wildlife managers and enforcement staff are "truly committed to doing a good job," given the funds available. But he questions the regulations as a whole. There's a move to protect unique sites, but typical sites are equally vulnerable, if not more so. New Brunswick's Endangered Species Act lists just six species, and protects only the habitats of endangered plants, not of animals. He finds it ironic that the province's forest industry is exempt from the environmental assessment process.

What is the current state of knowledge and research?

Wayne McCrory sees a greater need for studies that examine alternative harvesting systems, such as single-tree selection. "With the exception of the federal Department of Environment's endangered species report — which identifies clearcutting and overharvesting as the prime causes of species loss — no one is taking the information we have and coming up with obvious solutions."

Steve Tolnai feels that some research in British Columbia is too narrow, focusing on single species. He favours a well-organized program that would address "specific issues with broad application" on a landscape level. He also suggests that universities might play an even greater role in this research.

Mike Sullivan admits that "an infinite number" of questions remain unanswered, but stresses that management issues should direct research. He queries the merits of many site-specific or narrowly focused projects: "The big issues should be addressed, such as the spatial patterns and structure of the forest across the landscape and how they relate to wildlife communities. But these things are conceptually very difficult. They're costly and long term, and funding tends to come on a short-term basis."

John Gilbert sees the need to focus on cause-and-effect relationships — on ecosystem-based landscape management. "You can't study everything. So maybe you start at a landscape

level, to gain interim protection until you learn more about specific animals whose needs you may have to key in on. But first you have to have representative examples of all the different habitat types that occur across the landscape you're managing."

Jim Goltz also is troubled by the fact that full representation is lacking: "To do good research, you need scientific controls, which are hard to come by in a commercial forest. We have to speculate because we lack hard data. In general, though, we need more research on forestry's impact on ecosystems, on biodiversity as a whole, as well as on forest practices that are more environmentally friendly. This will lead to better landscape and resource management, so that protected areas don't become islands of green in a sea of industrial forestry."

Don Eastman agrees that we require "a better knowledge of how forest ecosystems work" and supports the study of natural disturbance regimes and landscape patterns, "which set models for us to follow." He also wants to focus on sensitive species: "The ones we know are at the edge, either because their numbers are in decline, or because the habitat on which they depend is changing or being lost." The challenge is "to minimize risk in the face of uncertainty."

What can and should be done?

Mike Sulllivan calls for the identification of forest-level issues and the setting of forest-level objectives. He believes that forest inventory information is very weak in most jurisdictions: "We're taking aerial photographs and interpreting them to make relationships for songbirds." However, forest management models are becoming much more sophisticated.

New Brunswick requires a detailed plan for each of the province's deer wintering areas, to show sustainable shelter habitat production over an 80-year forecast. This requires complete ground-level stand data, but New Brunswick contains approximately 900 deer yards, totalling 290 000 hectares. "This data collection is very costly, and that's just one species. Frankly, I don't think society is willing to pay for the information required to manage the forest for many of the values that people are placing on it."

"There are big trade-offs coming down the road. "Do we want pine marten in everybody's backyard, or are we going to maintain healthy populations in certain areas? Not everyone is going to be happy with these decisions, because the issues are complicated and the solutions can be costly."

John Gilbert believes that it will become more difficult to extract wood while looking after newly discovered habitat types. "But this has to be done, and I think the industry is up to it. New Brunswick has a limited landbase, and every tree has somebody's name on it. Biodiversity and wildlife issues won't go away.

Our markets are consumer driven; by dealing with the issues now, we can ensure the health of both our forests and our future markets. We need to answer the questions being posed by user groups and ourselves about the relationships between what we do in the forest and the habitat down the road. But the big thing is public education; people fear the unknown. We want to involve people in the process and try to accommodate their concerns within our plans. If we can show them what we're doing for a piece of land and why we're doing it, they'll better understand and appreciate forestry."

Jim Goltz calls first for changes in forest management practices — notably, greater

action to protect natural areas and the abolition of clearcutting — followed by changes in both provincial and federal legislation, including the introduction of a federal Endangered Species Act and amendments to the capital gains tax (to offer financial incentives to people donating their land for conservation purposes). He wants the province to set a good example on Crown land to send a clear message to industrial freehold private woodlot owners. But Goltz also wants balance and practical compromise: "Environmentalists realize that New Brunswick's economy is based on natural resources and that forestry has to take place. The issue isn't economics versus environment; it's short-term gain versus long-term sustainability. Unless we mend our ways, we aren't going to have a natural resources-based economy down the line."

Wayne McCrory believes that clearcut logging destroys wildlife habitat and feels that foresters ought to approach each ecosystem separately, taking a small percentage of the trees on a selection basis. Harvests would be spread over time, utilizing techniques that were the norm until the recent past. "We need laws to halt the pillaging of private land, as well as federal and provincial Endangered Species Acts with teeth in them. My view is that Canada is a very gifted, very endowed nation. We have so much wealth that we can afford to use it properly — to be a world model of proper stewardship of the land."

Don Eastman notes that extreme controversy surrounds the management of British Columbia's forests. It speaks to the high value that people place on forest resources. "It speaks also to the size of the problem. But controversy creates gulfs between people, and sooner or later we'll have to work together to make changes happen. If clearcutting, for example, were to end tomorrow, some wildlife species would benefit, but not others. Clearcutting and fires aren't equivalent, but we can look at the way fires impact stands and modify our practices in terms of patterns and perimeters — whether cuts are square or irregular, and how patches are distributed across the landscape.

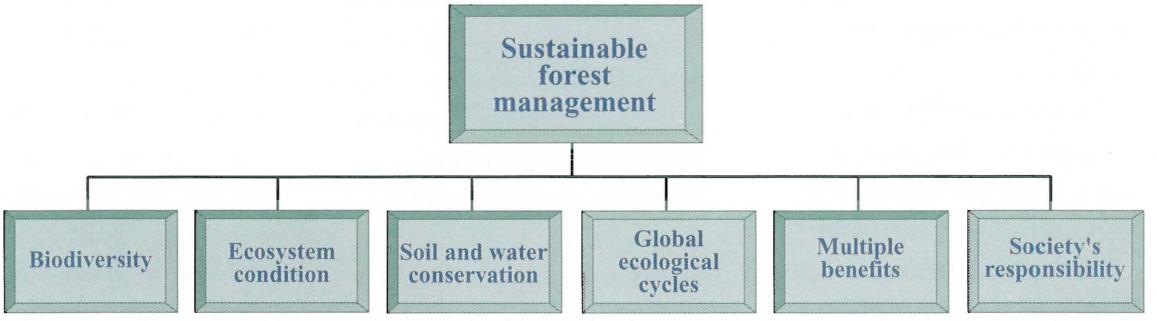
I would hope that 200 years from now, people will look back on this period as a time of remarkable change in our appreciation of forests, our knowledge of how they function, and our efforts to use them sustainably."

Steve Tolnai believes the greatest benefit would be derived from a long-term, coordinated habitat and management plan for each region and zone, and eventually for British Columbia as a whole. "I emphasize the word 'coordinated' — it would have to bind all of the stakeholders. That way we could reach rational decisions regarding forest protection, utilization and preservation; as well as management techniques and priorities. The important thing is that we're willing and able to adjust our practices, thinking and approach as better information becomes available — or as the public sets new objectives and standards for us to meet.

CHAPTER FOUR

Sustainable Development Indicators

MEASURING OUR PROGRESS



Three years ago, in *The State of Canada's Forests 1991*, we introduced a series of reference points or indicators to help track the nation's progress in achieving sustainable development and balancing environmental, economic and social objectives.

In 1995, the Canadian Council of Forest Ministers (CCFM) approved a national framework of criteria and indicators that had been developed through a comprehensive consultation process involving representatives from governments, industry, environmental organizations, Aboriginal groups, academia and other interest groups. A science panel was created to ensure that the indicators are scientifically based and reflect the best knowledge available.

The Canadian framework serves a number of purposes. It provides an agreed-upon and more precise scientific definition of what sustainable forest management means, and identifies the factors to be measured. And lastly, this national framework enables Canada to participate in the international debate regarding what constitutes sustainable forest management.

NATIONAL FRAMEWORK OF CRITERIA AND INDICATORS: THE CANADIAN APPROACH

The Canadian framework identifies six principal sustainable forest management criteria:

- conserving biodiversity;
- maintaining and enhancing forest ecosystems;
- conserving soil and water;
- contributing to global ecological cycles;
- providing multiple benefits to society; and
- accepting society's responsibility for sustainable development.

The chart on page 66 provides an outline of the final framework and shows each criteria subdivided into a number of elements. From these elements, 84 indicators have been established.

Criteria: What's important; a forest value we want to protect (e.g., conserving biodiversity).

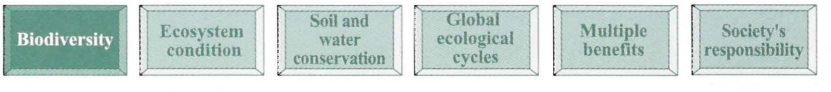
Element: One facet of the criteria (e.g., ecosystem diversity).

Indicator: What we use as a measure (e.g., the amount and type of forest protected).

The State of Canada's Forests Indicators

This chapter presents a series of performance indicators based on the Canadian framework. It is not possible to report on all of the indicators at this time because the data for some do not yet exist. The CCFM will be developing an implementation plan to identify gaps in the data and set priorities for collection. The chart on page 66 highlights the indicators that will be used in this year's report. The highlighted indicators fall into two categories: indicators that will be reported on annually, and others that will be reported on periodically. Some can be measured yearly, while others tend to be more descriptive (which we call "theme indicators") and do not lend themselves to annual measurement.

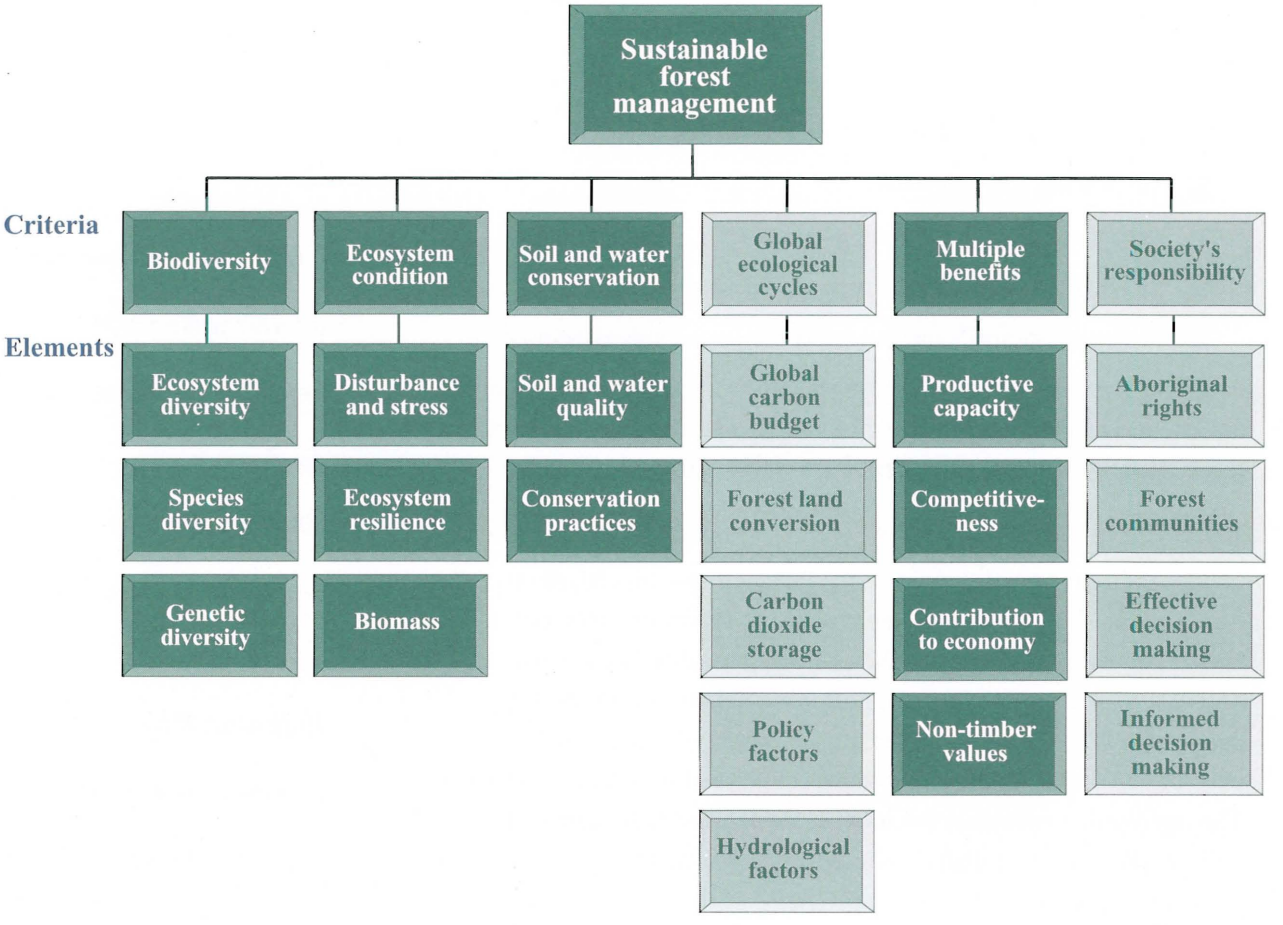
The theme indicators will vary from year to year. This report concentrates on some of the environmental aspects of sustainable forest development. Next year's report will describe some of the economic dimensions. And two years from now, the theme indicators will focus on certain social aspects of sustainable forest development.

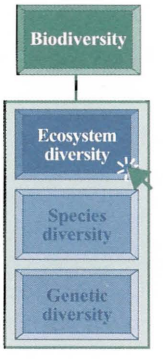


CONSERVING BIODIVERSITY

Conservation of biological diversity is important to ensure the viability, resiliency and future sustainability of ecosystems. Biodiversity conservation is generally considered at three separate levels: ecosystem diversity, species diversity and genetic diversity. In many respects, these levels are interrelated.

Criteria and Indicators of Sustainable Forest Management: The Canadian Approach





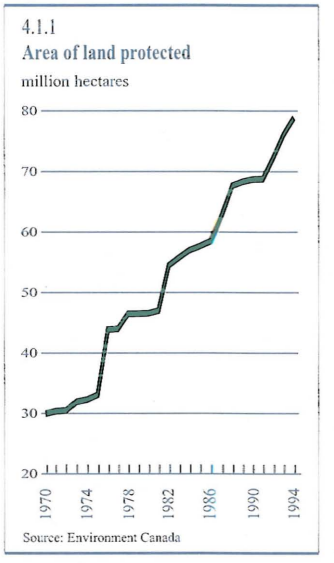
1 Protected areas *(annual indicator)*

Are representative areas of Canada's forests being preserved?

"Ecosystem diversity" refers to the variety, type, age and condition of the forest across the landscape. One means of measuring ecosystem diversity is to look at protected areas.

Federal and provincial governments have pledged to set aside 12% (120 million ha) of the country's total area. The National Forest Strategy commits the federal, provincial and territorial governments to working toward completing a network of protected areas by 2000 that are representative of Canada's forests.

Over the past three decades, the protected area in Canada has almost quadrupled — from 22.1 million hectares in 1960 to the current figure of 78.8 million hectares *(Graph 4.1.1)*. Protected areas now account for more than 7.9% of Canada's total land and freshwater *(Graph 4.1.2)*. *(These figures have been revised since last year's report as a result of a more precise definition of protected areas, as well as changes in data collection methods.)*



Not all protected areas, however, are forested. Within the forested regions of Canada, an estimated 22.8 million hectares are protected by law from harvesting. In addition, many forests on shallow or rocky soil, steep slopes, or along lakes and waterways are excluded from harvesting by provincial policy. The total area of these "protection forests" within Canada's commercial forest is estimated at 27.5 million hectares. All told, more than 50 million hectares of forest (12% of Canada's total forest land) are protected by either policy or legislation.

The World Wildlife Fund (WWF) document *Endangered Spaces Progress Report 94-95* provides a comprehensive summary of the status of Canada's protected areas. The report covers changes that took place over an 18-month period, from the fall of 1993 to the spring of 1995. Extracts from the WWF report that pertain to forest lands are as follows:

Federal government — No federal protected areas in forest regions were created during the 18-month review period.

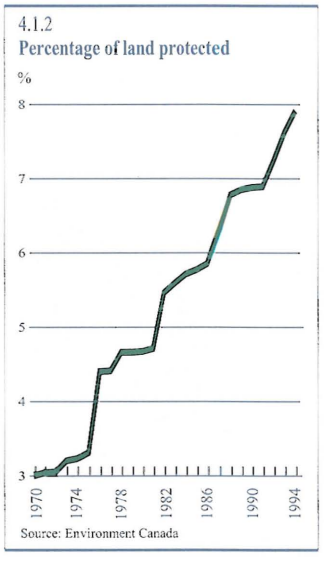
British Columbia — Two provincial terrestrial parks and one wildlife management area were designated. Among these, Ts'yl-os Provincial Park (233 240 ha) provides significant ecological representation, while the Khutzeymateen grizzly sanctuary protects increasingly rare bear habitat.

Alberta — No protected areas were created during the review period.

Saskatchewan — One wilderness park, representing 17 549 hectares, and one ecological reserve were designated. Some private land was purchased by the Saskatchewan Wildlife Federation and Nature Saskatchewan.

Manitoba — Four parks totalling 2 180 000 hectares were established. These parks are situated in the open forests in northern Manitoba

Ontario — A 25 000-hectare wilderness zone was established in Algonquin Park; and several parks and reserves totalling



14 226 hectares were added. The Ontario government released its report, *An Old-Growth Pine Conservation Strategy*, which includes recommendations for protecting old-growth pine sites.

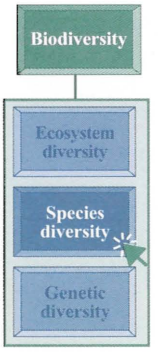
Quebec — Six ecological reserves totalling 22 900 hectares and a 5 500-hectare provincial park (Mont Megantic) were established.

New Brunswick — The 6 880-hectare Kennedy Lakes wilderness area was established. Five ecological reserves that had been announced in earlier years were proclaimed in 1994. Five additional ecological reserves were designated.

Nova Scotia — No sites were designated during the review period.

Prince Edward Island — Habitat was acquired and protected adjacent to Prince Edward Island National Park, doubling the province's protected areas to 5 200 hectares.

Newfoundland and Labrador — No protected areas were designated; however, existing ecological reserves were expanded by 39 300 hectares.



2 Forest wildlife *(annual indicator)*

What is the status of wildlife in Canada?

"Species diversity" refers to the range of plants, animals and microorganisms on Earth. One means of measuring species diversity is to look at the status of forest wildlife.

The Committee on the Status of Endangered Wildlife in Canada (COSEWIC) assesses the status of Canada's wildlife and, if appropriate, assigns the species to one of the following categories: extinct, extirpated, endangered, threatened or vulnerable. In 1993-1994, a total of 10 forest-dependent mammals, birds and plants were added to COSEWIC's list of species at risk. Of the 10 species, 5 are birds: northern bobwhite, Acadian flycatcher, hooded warbler, yellow-breasted chat (Okanagan population), and yellow-breasted chat (eastern population); and 5 are plants: wood poppy, blunt-lobed woodsia, round-leaved greenbrier, deerberry and van Brunt's Jacob's ladder. *(For a more complete list, see page 24 in the Forest Wildlife Chapter.)*

Northern bobwhite

The principal range for the northern bobwhite, a type of quail, is the eastern half of North America — from southern Ontario to Mexico. Ontario's bobwhite population levels are extremely low,

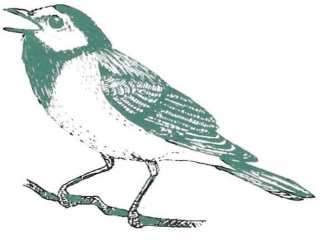
ranging from 200 to 400 birds. However, only the portion of the population that resides in the northern limits of its range — in southern Ontario — has been identified as threatened by COSEWIC.

Within Canada, bobwhites are concentrated in southeastern Ontario, probably due to the mild winters. The bobwhite does not migrate or fly significant distances in search of food and shelter. Because of its sedentary nature, the northern bobwhite requires grassland, cropland and brushy cover in close proximity. The species requires woody cover for roosting and for feeding in the fall and winter.

Acadian flycatcher

The Acadian flycatcher is a migratory bird that winters in Central America and breeds within the Carolinian forest zone in southwestern Ontario. The extreme southeastern portion of Ontario is the northern limit of the species' range. Thirty-eight birds were recorded in Ontario in 1992.

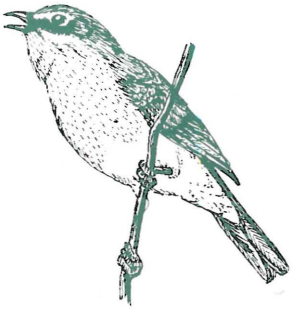
This species requires unfragmented blocks of forest of at least 30 hectares and mature forests with tall trees; to breed, it requires open areas in the understorey. Settlement of southeastern Ontario has drastically reduced the quantity and quality of habitat for the Acadian flycatcher.



Hooded warbler

The hooded warbler is a migratory bird that winters between Mexico and Panama, and breeds within the Carolinian forest zone in southeastern Ontario. The extreme southeastern portion of Ontario is the northern limit for this species.

The warbler requires extensive tracts of mature forests with large trees, open canopies and dense underbrush. Suitable habitat is sparsely distributed in southeastern Ontario. As a result, the hooded warbler's small population is becoming thinly distributed throughout existing woodlots. As a ground or low-elevation nester, it is vulnerable to predators, including mammals, snakes and other birds, such as blue jays.



Yellow-breasted chat

The yellow-breasted chat is a migratory bird widespread in North America. Fewer than 50 pairs breed annually in both British Columbia (BC) and Ontario, and the species is considered at risk.

In BC, the chat prefers breeding in dense brush and thickets, usually bordering deciduous or mixed riparian forests. A decline in habitat can be attributed to agricultural and urban development. The BC population of yellow-breasted chat has been designated as threatened because of small populations and the declining availability of suitable habitat.

In Ontario, chats have been found breeding in fields and pastures overgrown with shrubs such as dogwood, hawthorn, raspberry, wild rose and willow. The bird also occupies open woods, such as oak savannah types with heavy brush nearby. Yellow-breasted chats prefer early successional stages of disturbed sites.

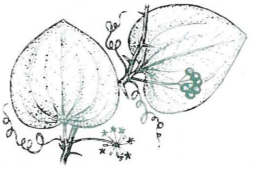
Wood poppy

The wood poppy is a perennial herb found in eastern North America. The known Canadian population is restricted to two sites in Middlesex County, Ontario. The wood poppy grows in rich, moist deciduous woodlands and along forested ravines, woodland streams and ravine bottoms. It is found next to sugar maple trees and sometimes near white ash, American beech or black cherry. The population has been designated as endangered by COSEWIC.

The blunt-lobed woodsia is a small- to medium-sized fern. The Canadian population is at risk at the northern limit of its range. Six isolated populations are known to exist in southern Ontario and Quebec. The woodsia is found on south-facing rocky outcrops in sugar maple forests, and sometimes in association with red oak, white oak, white ash and hop hornbeam.

Blunt-lobed woodsia

The round-leaved greenbrier is a woody climber restricted in Canada to southeastern Ontario. Only nine populations are known in Ontario — within the moist, forested habitats of the Carolinian forest zone. The populations are designated as threatened for the following reasons: the plants are unisexual, and only three of the nine sites contain plants of both sexes; most plants are on private lands; plant numbers are low; and there is some threat of forest clearing for urban development in the Niagara Falls area.



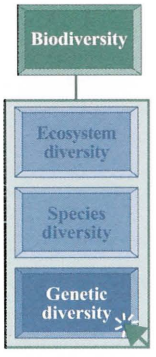
Round-leaved greenbrier

Deerberry

The deerberry is a widespread species in the United States that reaches it northern limit in the Niagara Falls and Thousand Islands area of southern Ontario. Only five known sites with plants are located within the St. Lawrence Islands National Park in Ontario. The species prefers dry, open, rocky wooded areas with a history of fires. While the deerberry sites in Canada are protected, their proximity to existing trails, a lack of seedlings and successional development threatens the viability of the Ontario population.

The van Brunt's Jacob's ladder is a perennial herbaceous plant found in humid grassy clearings in coniferous or mixed forests and in meadows. The species in Canada is limited to nine sites in Quebec,

but the number of known populations is expanding. Five of the Quebec sites are vulnerable to human activity, and one site is exposed to natural threats. One population is in danger of disappearing. In 1993, COSEWIC designated the species as threatened.



3 Genetic conservation *(theme indicator)*

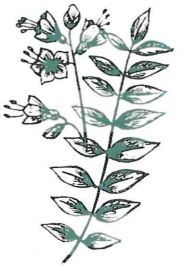
Are human activities changing the genetic diversity of the forest?

Genetic differences distinguish one individual from another — a crooked tree, for example, from a straight one. To ensure the viability of a particular species as a whole, it is necessary to conserve the trait (gene pool) variations found in local, regional and national populations of species.

Genetic diversity keeps a species resilient, allowing it to adapt to changes and survive. Genetic conservation is one means of ensuring diversity. It is only recently, with the new emphasis on biodiversity, that gene pool conservation has been recognized as an important objective. Traditionally, maintaining the genetic diversity in a given area was not an important objective of forest management. For example, the high-grading or selective logging methods used in the past century removed the largest and most valuable trees in a forest. The remaining stand (consisting of poor-quality or diseased trees) was left behind to regenerate the area logged, leading to degraded forests. The practice known as "high-grading" has been largely abandoned. Similarly, modern forestry practices avoid planting vast areas of monocultures (single species derived from a limited seed source).

Strategies for maintaining gene pools fall into two categories: on-site and off-site. On-site conservation (conserving genetic diversity at its original location) has two main objectives: to maintain natural areas where harvesting and other economic development are prohibited; and to maintain a diverse gene pool in non-protected areas. Natural regeneration is used where possible, and a variety of species from different seed sources are planted.

Off-site conservation refers to conserving genetic diversity at a location other than where the wildlife species is normally found. Off-site conservation is a requirement under the United Nations' Convention on Biological Diversity, which took effect in 1993. As a signatory to the Convention, Canada is finalizing its national biodiversity strategy.



Van Brunt's Jacob's ladder

Genetic diversity *describes the range of genetic traits found within a species and among different species, e.g., the variations in size and colour markings that distinguish one silver-tailed fox from another.*

Off-site genetic conservation activities

Region	Provenance tests		Seed orchards: Seedling		Seed orchards: Clonal		Clonal archives	Seed banks	Arboretum
	No. of prov.	Area	No. of families	Area	No. of clones	Area	Area	No. of seedlots	No. of species
Western	1 237	365	1 857	56	2 189	219	14 863	13 361	25
Central	6 624	642	20 558	1 655	8 873	708	23 919	20 326	148
Atlantic	1 706	123	5 708	201	4 080	169	5 155	3 167	0

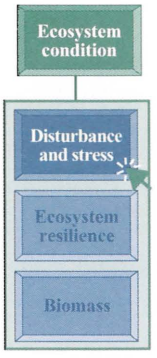
All areas are measured in hectares

In Canada, there are five basic off-site conservation activities. Provenance tests determine genetic differences between seeds or plants from different locations. Seed orchards are plantations of genetically superior trees managed to improve their genetic characteristics and produce abundant seed crops. Clonal archives are facilities for storing a variety of clones (plants produced asexually from the same plant). Seed banks are storage facilities where seedlots (bags of seeds) are stored. Arboretums are botanical tree gardens where trees are maintained for research and display purposes.

The table above summarizes the off-site conservation activities in 1992.

MAINTAINING ECOSYSTEM HEALTH

Healthy forest ecosystems maintain their integrity, resiliency and productive capacity. The integrity of ecosystems involves sustaining a wide range of ecological processes whereby plants, animals, microorganisms, soil, water and air are constantly interacting. These processes form soils, recycle nutrients, store carbon, clean water, and fulfill other functions essential to life. The natural resiliency of an ecosystem enables it to adapt to and recover from disturbances and stress. The "productive capacity" of an ecosystem refers to its ability to produce and support life.



4 Rate of Disturbance *(annual indicator)*

Are the natural dynamics of forests changing?

Forests are the product of thousands of years of evolution and adaptation to disturbance and stress. Significant changes in the level or pattern of natural disturbances may reflect a change in the health of ecosystems. Natural disturbances include fire, wind, insects, disease and changes in climate. But forest ecosystems must also adapt to human activities, such as harvesting, urbanization and recreational use, as well as to conditions that result from human activities, such as pollution.

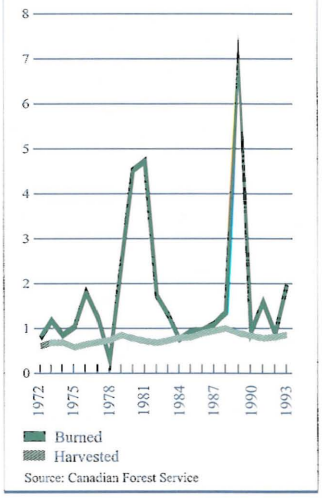
Healthy ecosystems adapt to periodic disturbances; and the renewal of some forests, such as the boreal, depend on those disturbances. Fire and insects remain the most dominant causes of disturbance in most of Canada's forests. However, there are significant regional variations. Insects are the major disturbance in most forests of eastern Canada; fire is the most important disturbance in the western boreal forest; and harvesting is the predominant form of disturbance in BC's coastal forest.

The long-term disturbance trend data illustrated in *Graph 4.4.1* show cyclical patterns in natural disturbances since 1970. Significant deviations from natural cyclical patterns may indicate that changes are taking place in natural ecosystems.

The area burned each year by forest fires varies greatly. Since 1970, the average area burned has declined to between 0.9 million and 1.6 million hectares annually. In 1993, however, the area burned increased to 1.97 million hectares: 86% was in the western boreal forest, ranging from the Manitoba – Ontario border to northern BC; and 13% occurred in the eastern boreal forest of Ontario, Quebec and Newfoundland and Labrador; while the area burned in the Coast, Great Lakes – St Lawrence and Acadian forest regions was minimal.

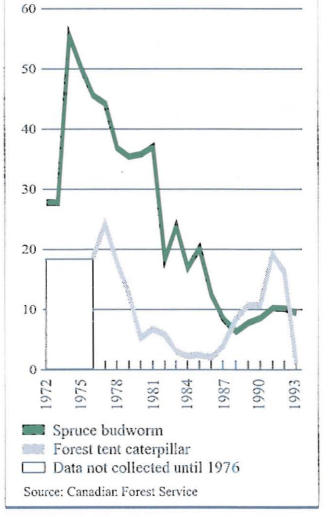
The predominant insect pests in Canada's forests are spruce budworm, jack pine budworm, hemlock looper, mountain pine beetle, gypsy moth and forest tent caterpillar. The population dynamics of these species varies considerably, as does the extent and nature of their impacts on forests. *Graph 4.4.2* shows the area moderately to severely defoliated by spruce budworm and forest tent caterpillar.

4.4.1
Area burned & harvested



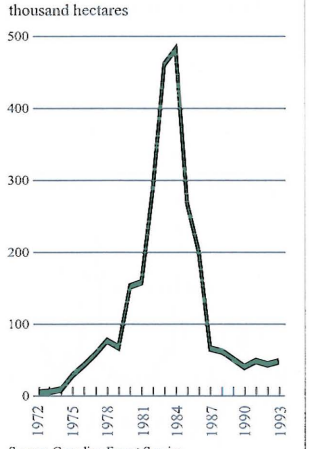
Source: Canadian Forest Service

4.4.2
Area infested with spruce budworm & forest tent caterpillar



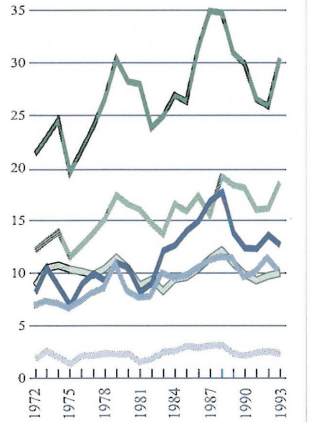
Source: Canadian Forest Service

4.4.3
Area infested with mountain pine beetle



Source: Canadian Forest Service

4.4.4
Harvest by region



Source: Canadian Forest Service

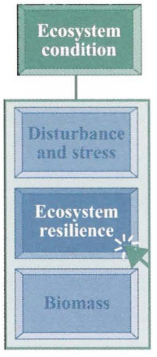
Spruce budworm occurs predominantly in the forest regions east of the Manitoba-Ontario border. The area moderately to severely defoliated in 1993 represented a slight decline over the 1992 level.

The mountain pine beetle is one of the most destructive forest insects in western Canada. Unlike the spruce budworm, the mountain pine beetle does not defoliate trees — it kills them by laying its eggs under their bark and depositing a fungus that clogs the trees and blocks the flow of sap. *Graph 4.4.3* shows that the area affected by mountain pine beetle in 1993 increased by roughly 5 000 hectares over 1992 levels; more than 49 000 hectares were identified as areas with significant mortality. The principal host for mountain pine beetle is the lodgepole pine in the montane forests of Alberta and BC.

There is less variation in the annual rate of harvest than in the rate of natural disturbances. Overall, the annual area harvested in eastern Canada has been relatively constant. However, there has been a significant increase in the harvested area in western Canada, particularly in the western Boreal and interior BC regions. This upward trend reflects the significant growth that occurred in western economies during the post-war period. Harvest statistics include "salvage logging" in areas damaged by insects or fire, and may be counted in both totals.

The total area harvested (by clearcutting) in 1993 was more than 844 000 hectares, an increase of approximately 50 000 hectares over the total area harvested in 1992. This increase reflects the economic recovery that followed the recession of the early 1990s. *Graph 4.4.4* shows that the increase occurred primarily in the eastern forest regions. In fact, the area harvested in the coast, interior and western boreal forests declined in 1993 compared to 1992 levels.

The level of natural disturbances depends on the forest type and age-class structure, climatic conditions and forest protection policies. Over the long term, there do not appear to be significant deviations from the cyclical patterns of disturbance, albeit with some exceptions — the large number of fires that occurred in 1989. Experts have concluded that this anomaly resulted from a combination of abnormal weather conditions and changes in protection policies, which permitted a larger number of fires to burn.

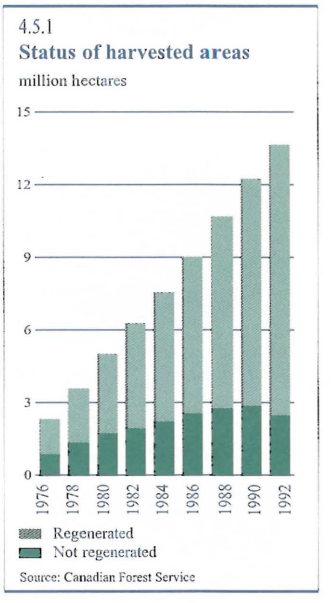


5 Regeneration *(annual indicator)*

Are harvested lands regenerating?

"Ecosystem resilience" refers to the capacity of ecosystems to recover from disturbances. A healthy and diverse ecosystem is better able to respond to and recover from changes in the environment.

The regeneration of forests after harvesting is an important public issue and is one indicator of the capacity of forest ecosystems to recover from disturbances. This year's report presents new data on the state of regeneration on harvested lands. This data is the result of a three-year cooperative effort of the CCFM to provide Canadians with better information on forest regeneration in Canada.

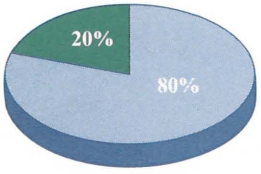


Graph 4.5.1 presents the status of harvested areas in Canada since 1976. It is important to note that the data presented are cumulative; for example, the bar for 1992 represents the total area that had been harvested up to 1992. The data presented include Crown lands only, not private lands.

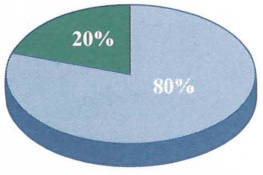
The area successfully regenerating to commercial species has increased steadily — from 68% in 1975, to 82% in 1992. This is a result of the rapid expansion in reforestation programs that occurred during the 1980s. The area planted and seeded has nearly tripled, increasing from 164 000 hectares in 1975 to more than 460 000 hectares in 1992. However, these levels may have peaked, as attention shifts toward natural regeneration techniques.

Notwithstanding this increase in regeneration, the area not yet restocked with commercial species also has increased steadily, from 585 000 hectares in 1975, to 2.5 million hectares in 1992. This area represents 1.1% of the total commercial forest landbase and is equivalent to between 2.5 and 3 years of harvest. However, the area of unstocked lands may have peaked in 1991 at 2.8 million hectares. The first year of decline was 1992; however, it is too early to determine if this is the beginning of a longer-term reduction in unstocked lands.

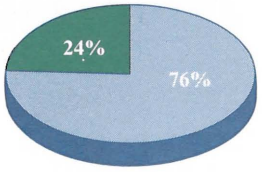
Over the past 15 years, there has been a considerable increase in forest regeneration. The vast majority of areas harvested in Canada appear to be regenerating successfully. Although the levels of planting and seeding seem to have peaked, they will continue to be important components of regeneration programs. As part of an overall shift to ecosystem management, natural regeneration will be used more frequently.



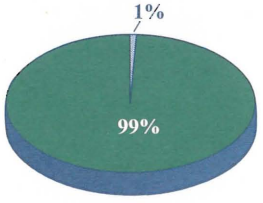
Acadian



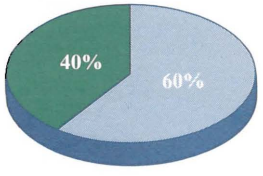
Great Lakes – St.Lawrence



Boreal



Coast



Interior

CONSERVING SOIL AND WATER

Forests stabilize soil and prevent erosion, and regulate the movement of water through forest soils. Healthy soils support a vast diversity of life, not only above ground but also below ground. Soils are important storehouses of carbon and the principal source of nutrients for plants. Wetlands in forests provide habitat for wildlife, control flooding, and protect surface- and ground-water quality. And rivers and streams provide habitat for fish and other aquatic life.

Soil and water quality affect the productivity of an ecosystem — its ability to support life. If carried out improperly, harvesting and road construction can have significant impacts on forest soils by causing soil compaction, erosion and mineral soil exposure. These activities can also affect water quality, particularly temperature and oxygen levels, by adding sediment and disrupting aquatic ecosystems.

6 Impact of harvesting *(theme indicator)*

What is the impact of harvesting on soil and water?

Most provinces have regulations in place to protect soil and water quality. Given the vast size of Canada's forests, it is not possible to collect data and report on the impact of every harvesting operation. Therefore, as a measure of the impact of harvesting on soil and water quality, this indicator looks at the different types of harvesting methods — namely, winter versus summer harvesting, and mechanical versus manual harvesting.

To minimize the impact on soil and water quality, particularly on sites with poor drainage, there has been a general shift toward harvesting when the ground is frozen. Logging on frozen ground minimizes site damage and soil compaction. However, deep snow sometimes makes winter operations difficult and results in taller stumps.

With the exception of the Coast forest region, most harvesting in Canada is done in the winter. In the Acadian and Great Lakes – St. Lawrence forest regions, roughly 80% of logging takes place during the winter. In the northern and eastern boreal forests — where

very wet ground conditions occur in the spring, summer and fall — 76% of the timber is winter harvested. In the Coast forest region — where steep slopes create dangerous and slippery operating conditions during winter — only 1% of the harvest takes place in that season.

Another way to assess the potential impacts on soil is to compare methods of harvesting. In general, manual methods are less likely to damage soil than mechanical methods, and can provide an indication of soil compaction and disturbance.

In manual felling, loggers cut and trim trees on the spot with chain saws. Logs are then hauled to the roadside by skidders, tractors, forwarders and sometimes horses. Manual felling can be done year round, except when deep snow makes operations unsafe. On the very steep terrain that is typical of the west coast, logs are transported using aerial cable systems.

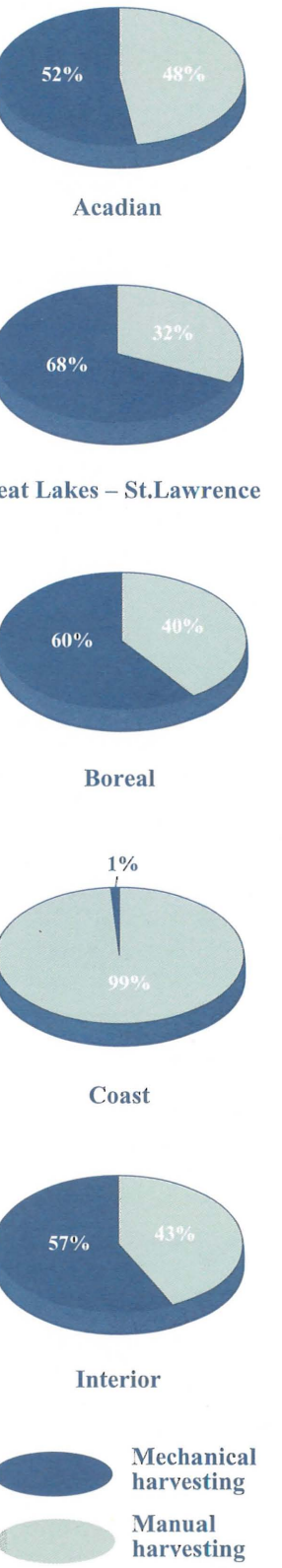
In mechanical harvesting, large machines cut or snip the trees, trim the branches, and carry the logs to the roadside. These machines can cause greater compaction and disturbance; however, wide flexible tires distribute the weight of the machines and can reduce these impacts.

Manual felling is the dominant harvesting method in the Coast forest region. The steep slopes and the large trees in the Coast region preclude the use of large harvesting equipment.

The graphs show that mechanical harvesting has become the dominant system in all remaining forest regions. This harvesting method is useful on flat terrain covered with vast even-aged forests that contain small trees of uniform size. Mechanical harvesting is more prominent in the eastern boreal forest than in the western boreal forest.

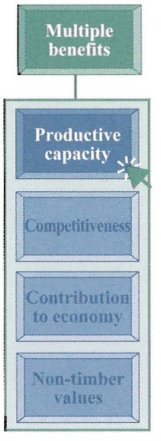
In the Great Lakes – St. Lawrence and Acadian regions, manual felling is still the predominant harvesting system for private lands. There are several reasons for this: large harvesting machines are not cost-efficient on smaller tracts of land and are often too expensive for most woodlot owners. In addition, the hardwood and uneven-aged forests in these regions are better suited to selection cutting, which is done manually. Furthermore, manual cutting is labour intensive and contributes to employment in rural areas.

(See pullout Forest Regions map.)



PROVIDING MULTIPLE BENEFITS

The forest products industry is one of Canada's largest sectors and is an important source of exports and employment. In addition, forests support a number of other values, including tourism, wildlife, recreational use, wilderness experiences and natural scenery. Although not easily measured in economic terms, all of these values are important. Assessing our progress on sustainable development entails reporting on the forests' ability to continue to provide this range of benefits.

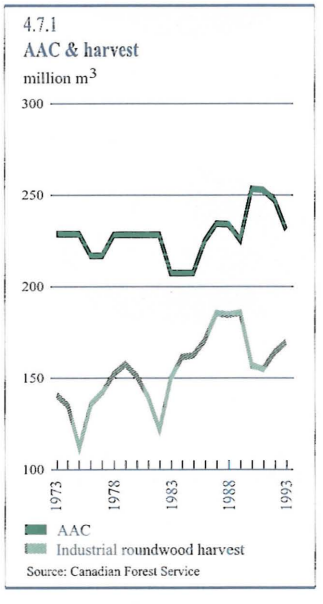


7 Sustainable harvest *(annual indicator)*

Are we overcutting Canada's forests?

In the context of harvesting, "productive capacity" refers to the forest's ability to produce different resources over the long term. "Products" include not only wood, but also such recreational activities as camping, hunting and fishing which can be sustained as long as the biological limits of the forest are not exceeded.

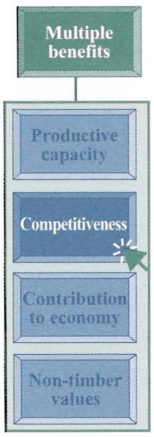
The sustainability of some of the economic benefits that Canadians derive from their forests may be measured by comparing the allowable annual cut (AAC) to the annual harvest rate. The AAC is the maximum rate of harvesting that is permitted for a specific area over a certain length of time.



Graph 4.7.1 shows that Canada's AAC has remained relatively stable over the past 20 years. However, several provinces are reviewing their AACs and are likely to reduce them in some regions to accommodate other land-use requirements, namely protected areas, wildlife habitat and Aboriginal land claims. Nationally, the total harvest remains 25% below its AAC. Although nationally the softwood harvest is approaching its limit, there is an opportunity to expand the hardwood harvest. *(See Timber Supply Chapter for more details.)*

Canada's "competitiveness" refers to its ability to compete and sell products in global and domestic markets. As a major exporter, Canada's forest industries must earn a competitive rate of return to attract the necessary capital to continue generating employment,

maintaining mills and equipment, developing new products, and meeting environmental standards. A number of factors can affect Canada's competitiveness, including the quality and price of products; the tax and regulatory structure; the value of the currency; the efficiency of mills; and the cost of such inputs as labour, energy and timber.



8 Global markets *(annual indicator)*

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

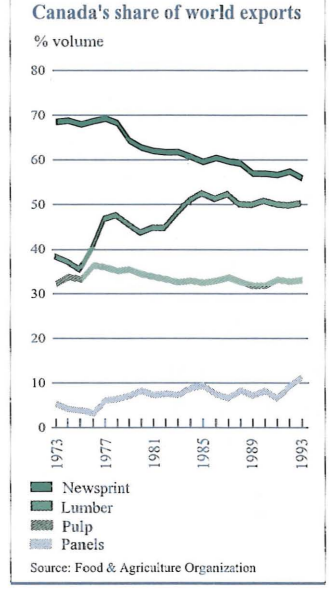
Trends in Canada's share of global markets provide a useful indication of the international competitiveness of the forest products sector over time. If Canada becomes less competitive, its market share can be expected to decline.

Forest products exports are important to maintaining Canada's standard of living. In 1993, our balance of trade (the value of exports minus the value of imports) in forest products was $22.3 billion. In comparison, that same year, our balance of trade in farm products was $2 billion; in fish products, $1.6 billion; in energy, $12.4 billion; and in metals and minerals, $7.8 billion.

Graph 4.8.1 shows Canada's share of world exports for various forest products. Our principal exports are newsprint, pulp, softwood lumber, and panel products (such as plywood, particle board and fibreboard). Canada's share of world trade in softwood lumber increased slightly, to a little over 50% in 1993. The continued growth of Canadian softwood lumber exports into the U.S. market between 1970 and 1993 resulted from the development of new technologies capable of converting small logs into lumber; consumer preferences for Canadian spruce, pine and fir; and favourable exchange rates.

Canada also continued to increase its share of panel products sales, from 9.2% in 1992, to 11.2% in 1993. Since 1970, Canada's portion of the global market has almost doubled. This trend can be attributed to the increasing acceptance of new products made from chips and other wood residues, such as oriented strand board and medium density fibreboard. Particle and strand boards can be produced using hardwood species (such as poplar) and secondary fibres from sawmills. The abundance of these raw materials has led to a significant increase in Canadian capacity in panel production in the past ten years.

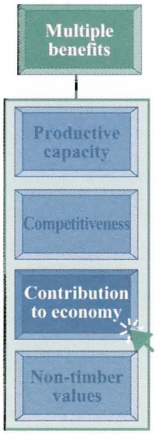
4.8.1
Canada's share of world exports



Source: Food & Agriculture Organization

Canada's share of the pulp market remained constant between 1970 and 1993. Our global market share in 1993 was 32.8%; the average over the 24-year period was 31.9%. Canada's traditional advantage in the global pulp market is due to the high quality of its softwood fibre. However, recent technological advances have enabled manufactures to produce pulp from hardwoods, which has reduced some of the advantages previously enjoyed by softwood pulp manufacturers. Canadian pulp producers have implemented new technologies, such as chemi-thermomechanical pulp, and as a result have been able to maintain their global market share.

Canada's share of world trade in newsprint has declined significantly since 1970. In the early 1970s, our market share averaged 68.6% of world trade; by 1993 it had dropped to 55.7%. The majority of Canadian exports are destined for U.S. markets; however, our share of those markets has declined steadily since 1966. This decline can be attributed to the condition of Canada's mills: many are older and smaller than those of our competitors. Recently, however, a few state-of-the-art mills have been built, particularly in western Canada; and some older mills have upgraded their paper machines.



9 Gross domestic product

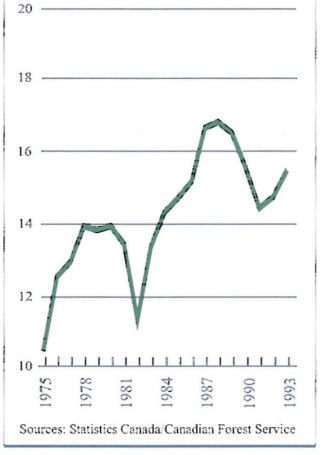
(annual indicator) Is the forest industry contributing to Canada's economy?

Gross domestic product (GDP) is a measure of national income — the amount paid to Canadians in terms of salaries, wages, profits and taxes. An industry's contribution to the GDP generally can be measured by the amount of value it adds to the goods and services it produces (known as "value added").

Graph 4.9.1 shows the forest sector's contribution to Canada's GDP; though erratic, it has increased since 1961. Although the pulp and paper industry makes the largest contribution to the GDP, the wood industries have shown the largest gain — more than tripling over that period.

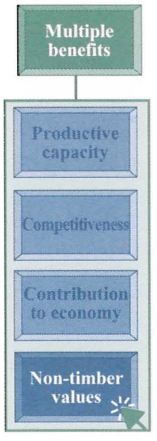
Each of the three major sectors (wood, logging, and paper and allied industries) showed an increase in 1993, reflecting the economic recovery that began in 1991. However, the 1993 level was still below the peak attained in 1988, before the recession.

4.9.1
Forest Sector's Contribution to GDP
million $ (1986$)



Sources: Statistics Canada/Canadian Forest Service

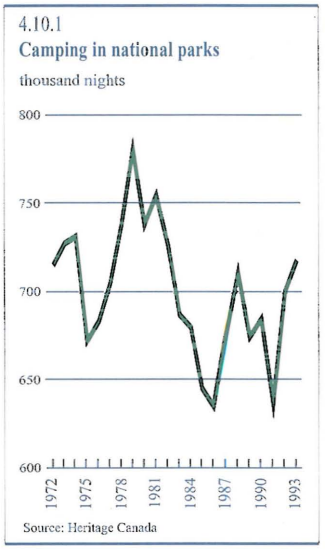
The 1993 increases can be attributed to a number of factors. The lumber increase reflects higher prices and increased exports to the USA; and the pulp and paper increase is due to higher production levels, although prices remained stable.



10 Recreational opportunities

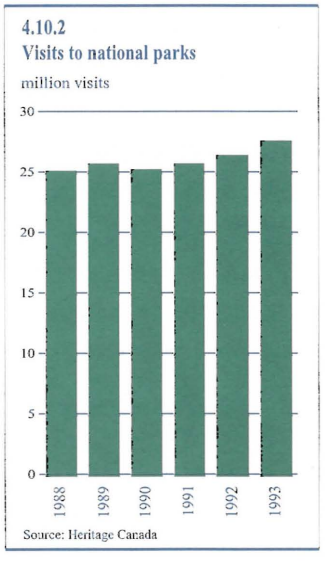
(annual indicator) What roles do forests play in satisfying the recreational needs of Canadians?

Forests offer many benefits to Canadians in addition to the traditional economic benefits that timber harvesting provides. For example, Canadians participate in a variety of outdoor recreation activities, such as hiking, camping, canoeing, hunting, fishing, cross-country skiing, and bird watching.



Canadians have always had access to forests for recreational use because the vast majority of the forests are under public ownership. With continued population growth, the value of wilderness will increase worldwide. As Canada evolves to a more urban society and a more service-based economy, it is expected that the recreational use of the forest will continue to grow. National information regarding the participation in outdoor recreation on forested lands is limited to provincial and federal parks, and does not reflect the considerable use of forest lands outside of parks.

Data on the use of Canada's national parks is presented as an indicator of the demand for outdoor recreational opportunities. The time period covered is not long enough to establish a long-term trend in park use. A number of visitors to Canada's national parks are from foreign countries. Generally, campground nights decline during recessionary periods and increase during recovery periods. Camping in Canada's national parks declined between 1979 and 1987, rose the following year and fell once again in 1989. The number of campers then increased in 1992 and 1993. In 1993, approximately 720 000 campsites were occupied ***(Graph 4.10.1)***. Between 1988 and 1993, the number of visitors to national parks increased from a little over 25 million to almost 28 million, despite the recession of the early 1990s *(Graph 4.10.2)*.



Partners Planting Trees

Tree Plan Canada (TPC) helps Canadians address global environmental problems by encouraging them to participate in community tree planting projects.

Through corporate sponsors and partners, there is a national effort to create an awareness of the importance of trees, to generate public commitment to the concept of stewardship, and to make communities greener and more environmentally healthy.

Grass Roots Take Hold

The National Community Tree Foundation relies on the cooperation of environmental, corporate and civic partners. The Canadian Forest Service provides technical and financial support for Tree Plan Canada through its regional offices. To date, more than 1 200 partners have worked with the Foundation to plant more than 40 million trees in rural and urban areas. In New Brunswick, red oaks have been reintroduced on sites where they had disappeared. Volunteers in the Rustico Watershed Enhancement Project in Prince Edward Island planted trees to create wildlife habitat and enhance areas along the watershed. This project was supported by a TPC partnership with the Hunter River Lions Club and the Central Queens Wildlife Federation.

Over the past two years, more than a million trees have been planted in Quebec under 180 projects. In one initiative, a bird watchers club in the lower St. Lawrence region, in partnership with TPC, planted 775 trees along the boundaries of the Pointe-au-Père National Wildlife Area on the shores of the St. Lawrence River. By doing so, they created a buffer zone between the road and the coastal marsh, protecting waterfowl nesting sites. In the Baie-de-l'Île-Verte National Wildlife Area, junior high school students planted 600 trees to form a shelterbelt and a new bird habitat.

In Saskatchewan, a camp for learning disabled children has created an educational tree farm. Children attending Tamarack Camp are assigned one or two trees to keep track of all summer long — to water and measure their growth. The children can return to camp for three years; when they leave, they must pass on their tree to a new camper who will continue the care.

Tree Plan Canada

Tree Plan Canada is managed by the National Community Tree Foundation — a non-profit, non-governmental organization that has charitable status.

Goals:

- Encourage the planting of trees to help reduce the effects of CO_2 emissions, which contribute to global warming.
- Educate the public on the environmental importance of trees.
- Promote conservation.
- Beautify the country.

The Rotary Club of Calgary–Olympic has helped rehabilitate a former oil refinery site in downtown Calgary. The newly planted area will create various wildlife habitats and be used for environmental education.

CORPORATIONS PITCH IN

Tree Plan Canada also works with corporate partners, such as Maclean's, Brita and others. Corporate sponsors contribute financial and/or in-kind resources toward community tree planting, public education and program awareness. Some donate financial resources; others, like IGA, participate in organizing community tree planting events. Sanyo Canada, another corporation, celebrated its 35th anniversary in Canada by planting more than 70 000 trees: willows, lodgepole pine and alders on a mine reclamation site in British Columbia; and trembling aspen, water birch, balsam poplar and other species in a conservation area outside Calgary.

NGOS ROOT FOR TREES

A number of NGOs (non-governmental organizations) promote tree planting in Canada: Scouts Canada; Evergreen Foundation; Watch it Grow, Canada; Global Releaf; Earth Day Canada; One Voice; Trees for Life; and Active Living. Each NGO brings a unique approach to the Tree Plan Canada program.

Global Releaf, affiliated with Friends of the Earth and credited as being Canada's first national, non-profit reforestation program, has been a TPC partner since 1992. Many of its programs focus on urban forests. Presently, with the help of many volunteers, it is conducting community tree inventories, planting memorial groves, providing multicultural communities with tree planting information, and recognizing the efforts of real estate developers who preserve trees. Through its 1994 activities with TPC, Global Releaf planted 35 000 trees.

The Evergreen Foundation was founded to respond to the growing concern regarding the deterioration of urban forests. One of its main initiatives is the School Ground Naturalization Program, which provides grants to educational centres. With the help of TPC, 70 000 trees were planted on Canada's school grounds in 1994.

Green Streets Canada

CITIES DIG IN

Green Streets Canada, an initiative of TPC, recognizes the important contribution of trees to the quality of life in Canada's urban centres. Tree Plan Canada helps municipalities expand their tree planting programs by matching funds on a 50-50 cost-sharing basis.

The City of Edmonton has been a particularly enthusiastic partner. Edmonton has a long history of urban tree planting, often with the help of hundreds of volunteers. Under Green Streets Canada, Edmonton's Department of Parks and Recreation planted 670 trees, such as Scots pine and northwest poplar, along the city's main roads in 1994. Strathcona Park in downtown Edmonton was further beautified with summit ash, Scots pine, Amur cherry and elms. As well, volunteers planted 900 trees — a mixture of spruce, northwest poplar, green ash, black ash and lodgepole pine — throughout city neighbourhoods.

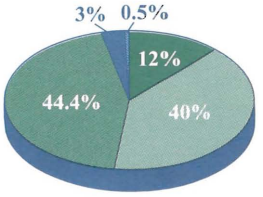
(For more information, see contact list on page 111.)

OVER THE PAST THREE YEARS, TREE PLAN CANADA PARTNERSHIPS HAVE CREATED ARBORETUMS, BEAUTIFIED ROADS, STABILIZED SHORELINES, REVITALIZED DEGRADED SITES, AND ENHANCED WILDLIFE HABITAT.

Commercial Forest Account – AREA

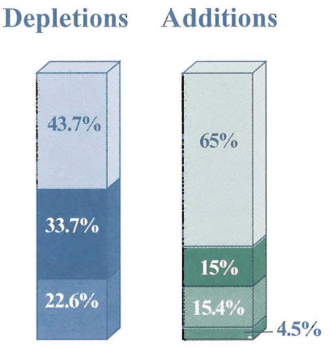
Changes between 1978 and 1992

	million hectares
COMMERCIAL FOREST AREA IN 1978	
Seedling stage	28.27
Young forest	93.93
Mature/old/mixed-aged	104.20
Area regenerating following fire or insects	7.00
Area not growing commercial species 10 years after harvesting	1.12
Total area in 1978	**234.53**



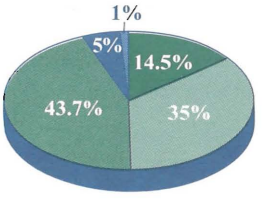
1978

CHANGES 1978-1992	
Depletions	
Area harvested	13.30
Area burned	10.25
Area affected by insects or disease	6.88
Total area	**30.43**
Additions	
Area regenerated naturally	19.80
Area planted or seeded	4.56
Area regenerating following fire or insects	4.69
Sub-total	29.05
Area not growing commercial species 10 years after harvesting	1.38
Total area	**30.43**



1978-1992

COMMERCIAL FOREST AREA IN 1992	
Seedling stage	34.06
Young forest	83.72
Mature/old/mixed-aged	102.56
Area regenerating following fire or insects	11.69
Area not growing commercial species 10 years after harvesting	2.50
Total area in 1992	**234.53**



1992

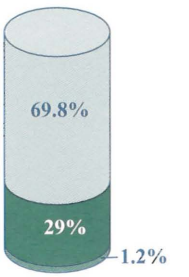
AREA HIGHLIGHTS

- Between 1978 and 1992, fire, insects and disease affected more area in the commercial forest than was harvested. Natural disturbances affected an average 1.14 million hectares annually, while harvesting depleted 887 000 hectares annually, or 0.4% of the commercial forest landbase.
- More than 4.5 million hectares were planted or seeded between 1978 and 1992. However, there was a net increase of 1.4 million hectares (approximately 93 000 ha/yr) in the area not growing commercial species more than 10 years after harvesting.

Commercial Forest Account – VOLUME

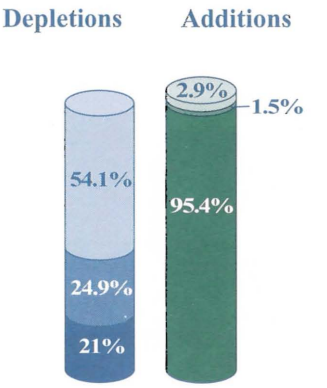
Changes between 1978 and 1992

	billion m^3
COMMERCIAL FOREST VOLUME IN 1978	
Seedling stage	0.30
Young forest	7.17
Mature/old/mixed-aged	17.22
Total volume in 1978	**24.68**



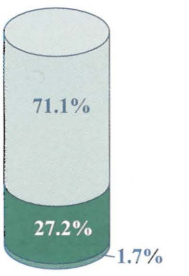
1978

CHANGES 1978-1992	
Depletions	
Volume harvested	2.45
Volume burned by fire	1.13
Volume lost to insects or disease	0.95
Total volume depleted	**4.53**
Additions	
Volume in new naturally regenerated areas	0.16
Volume in newly planted or seeded areas	0.08
Growth in standing timber	5.22
Total volume added	**5.47**



1978-1992

COMMERCIAL FOREST VOLUME IN 1992	
Seedling stage	0.43
Young forest	6.97
Mature/old/mixed-aged	18.22
Total volume in 1992	**25.62**
NET VOLUME INCREASE	**0.94**



1992

VOLUME HIGHLIGHTS

- Between 1978 and 1992, there was a net increase of 4% in the volume of trees growing in Canada's commercial forest.
- Harvesting accounted for more than 54% of the volume depleted from the commercial forest. An average 163 million m^3 were harvested annually, compared to the average 139 million m^3 consumed annually by fire, insects and disease.

SUMMARY

The Commercial Forest Account presents a broad overview of the changes that occurred in the composition of Canada's commercial forests between 1978 and 1992. Fire, insects, disease and harvesting are the only disturbances recorded within the commercial forest landbase. The account distinguishes between natural and human-caused disturbances. Fire, insects and disease are part of a forest's natural cycle of renewal. The principal human activity affecting forests is timber harvesting.

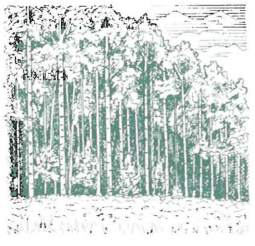
Seedling stage
Trees less than 1.3 m high.

AREA

The area account shows how the distribution of the commercial forest changed over time. The account assumes that the total commercial forest landbase remained constant at 234.53 million hectares. The account covers only the commercial forest landbase. There are an additional 2.2 million hectares of forest for which the age class has not yet been determined. Lands that may have changed status (i.e., from forests to farm lands, or from farm lands to forest lands) are not included in this account. Over the 15-year period, fire, insects and disease affected more area than harvesting. Natural disturbances affected an average 1.14 million hectares per year; the average area harvested was 887 000 hectares per year (0.4% of the commercial forest landbase.)

Young forest
Trees more than 1.3 m high.

More than 4.5 million hectares were planted or seeded, representing 34% of the area harvested. The remaining harvested areas were left to regenerate naturally — without planting — usually after some preparatory site treatment. Areas affected by fire, insects and disease also were generally left to regenerate naturally. There is an increasing trend toward natural regeneration to help maintain the natural diversity of the forest and to reduce costs. However, over the 15-year period, 1.4 million hectares (approximately 93 000 ha/yr) were added to the backlog of areas that had not regenerated to commercial species more than 10 years after harvesting.



Mature forest
Timber ready to be harvested.

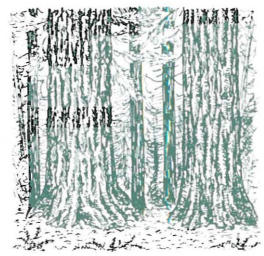
The area in the seedling stage increased by 5.79 million hectares or 20% over the 15-year period, reflecting the newly regenerated forests growing after harvesting or natural disturbances. (The area regenerating after recent harvesting was reported separately in last year's account.) The area of young forest decreased by 10.21 million hectares or 11% as these forests grew older and became mature, or were affected by such natural disturbances as fire. The area of mature, old or mixed-aged forest decreased slightly, by 1.6 million hectares or 1.6%. In 1992, however, older forests still comprised 44% of the

commercial forest. The area regenerating naturally following fire, insects or disease rose from 7 million to 11.69 million hectares, an increase of 67%.

Over the 15-year period, the area growing non-commercial species more than 10 years after harvesting increased from 1.12 million to 2.5 million hectares. (This figure is smaller than the area reported in last year's account and reflects the new provincial data on forest regeneration. *See page* 75.) This area has regenerated with a rich variety of plants, shrubs and trees, such as alder and willow, but does not contain sufficient quantities of commercial trees to be considered successfully regenerated for commercial purposes. This area represents roughly 1% of the total commercial forest landbase; nevertheless it is of concern.

The area is still considered part of the commercial forest landbase because it is capable of producing commercial timber. With time, natural succession will eventually reestablish commercial forest species in most areas. However, to successfully reestablish these species in the near future, some form of silvicultural treatment, such as weeding or thinning, will likely be required.

It is difficult to capture the dynamics of the commercial forest with a static snapshot in an account such as this. Over the 15-year period, young forests grew older; some areas were burned or killed by insects or disease; some mature, old and mixed-aged forests were harvested, and the cycle began again with newly regenerated stands of seedlings.



Old forest
Trees that have grown past the mature stage. The age of maturity varies for each species, from 80 years for jack pine, to 200 years for subalpine fir.

Volume

Over the 15-year period, there was a net increase of 940 million m^3, or 4%, in the volume of trees growing in Canada's commercial forests. The average annual harvest volume was 163 million m^3, compared with the 139 million m^3 consumed annually by fire or other natural disturbances. The volume of wood increased in the seedling stage by 130 million m^3 and decreased in the young forest stage by 200 million m^3. The reduction in the volume in young forests mirrors the decrease in the area in this age class. Because of the large area of mature, old and mixed-aged forest, the volume of wood in this class of forest increased by 1 billion m^3. Although older forests grow slowly, because they make up almost half of the commercial forest, they account for most of the forest growth and associated volume increase.

Mixed-aged forest
Forests in which trees differ markedly in age (usually more than 20 years).

CHAPTER FIVE

Forestry Profiles

FOCUS ON THE PLAYERS

CANADA (1994)

Population	**29.3** million
Total area	**997.0** million ha
Land area	**921.5** million ha
Forest land	**417.6** million ha
National parks	**21.7** million ha
Provincial parks	**22.9** million ha

FOREST RESOURCE (1993)

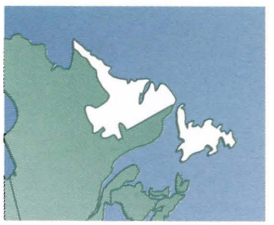
Ownership	Provincial	71%
	Federal	23%
	Private	6%
Forest type	Softwood	64%
	Hardwood	15%
	Mixedwood	21%
Allowable annual cut[a]		227 million m³
Harvest (volume) - industrial roundwood [b]		169.3 million m³
Harvest (area)		968 584 ha
Status of harvested Crown land[c] (1992)		
Stocked	11 191 837 ha	82%
Understocked	2 487 167 ha	18%
Insect defoliation[d]		20.5 million ha
Forest fires		1 967 388 ha

FOREST INDUSTRY

Value of exports (1993)	$26.7 billion
Softwood lumber	34%
Newsprint	23%
Wood pulp	17%
Major export markets (1993)	
United States	71%
Japan	12%
European Union	9%
Others	8%
Balance of trade (1993)	$+22.3 billion
Contribution to GDP (1993)	$+19.0 billion
Value of shipments (1992)	$44.2 billion
Sold domestically	48%
Exported	52%
Number of establishments (1992)	12 400
8 705 logging	
3 014 wood	
681 paper and allied	
Employment (1994) [e]	847 000
339 000 direct jobs	
508 000 indirect jobs	
1 job in 15	
Wages and salaries (1992) [f]	$9.6 billion
New investments (1993)	$5.8 billion

a, b, c, d, e, f *See pages 95-96.*

NEWFOUNDLAND AND LABRADOR



Black spruce *(Picea mariana)*

Population	**580 100**
Total area	**40.6 million ha**
Land area	**37.2 million ha**
Forest land	**22.5 million ha**
Provincial parks	**439 400 ha**

FOREST RESOURCE (1993)

Ownership	Provincial		99%
	Private		1%
Forest type	Softwood		94%
	Hardwood		1%
	Mixedwood		5%
Allowable annual cut[a]			3.0 million m³
Harvest (volume)[b]			2.2 million m³
Harvest (area)			20 640 ha
Status of harvested Crown land[c]			
Stocked		488 921 ha	78%
Understocked		136 433 ha	22%
Insect defoliation[d]			8 750 ha
Forest fires			26 998 ha

FOREST INDUSTRY

Value of exports (1993)		$455 million
	Newsprint	100%
Major export markets (1993)		
	United States	34%
	European Union	34%
	South and Central America	19%
Balance of trade (1993)		$+448 million
Value of shipments (1992)		not available
Number of establishments (1992)		128
	85 logging	
	37 wood	
	6 paper and allied	
Employment (1994)[e]		10 000
	6 000 direct jobs	
	4 000 indirect jobs	
	1 job in 19	
Wages and salaries (1992)[f]		not available
New investments (1993)		not available

a, b, c, d, e, f *See pages 95-96.*

PRINCE EDWARD ISLAND

Red oak *(Quercus rubra)*

Population	**135 100**
Total area	**0.57 million ha**
Land area	**0.57 million ha**
Forest land	**0.29 million ha**
Provincial parks	**1 500 ha**

FOREST RESOURCE (1993)

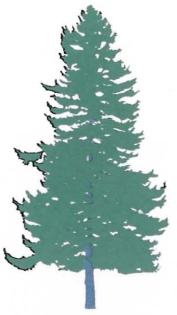
Ownership	Provincial		7%
	Federal		1%
	Private		92%
Forest type	Softwood		37%
	Hardwood		28%
	Mixedwood		35%
Allowable annual cut[a]			0.4 million m³
Harvest (volume)[b]			0.2 million m³
Harvest (area)			2 976 ha
Status of harvested Crown land[c]			
Stocked		27 018 ha	86%
Understocked		4 364 ha	14%
Insect defoliation[d]			42 843 ha
Forest fires			87 ha

FOREST INDUSTRY

Value of exports (1993)		$854 000
	Softwood lumber	53%
Major export markets (1993)		
	United States	100%
Balance of trade (1993)		$+785 000
Value of shipments (1992)		not available
Number of establishments (1992)		25
	11 logging	
	13 wood	
	1 paper and allied	
Employment (1994)[e]		not available
Wages and salaries (1992)[f]		not available
New investments (1993)		not available

a, b, c, d, e, f *See pages 95-96.*

NOVA SCOTIA



Red spruce *(Picea rubens)*

Population	**937 600**
Total area	**5.6 million ha**
Land area	**5.3 million ha**
Forest land	**3.9 million ha**
Provincial parks	**21 800 ha**

Forest Resource (1993)

Ownership	Provincial		28%
	Federal		3%
	Private		69%
Forest type	Softwood		46%
	Hardwood		31%
	Mixedwood		23%
Allowable annual cut[a]			5.3 million m³
Harvest (volume)[b]			4.2 million m³
Harvest (area)			42 780 ha
Status of harvested Crown land (1992)[c]			
Stocked		740 101 ha	81%
Understocked		136 246 ha	19%
Insect defoliation[d]			25 042 ha
Forest fires			368 ha

Forest Industry

Value of exports (1993)		$498 million
	Newsprint	53%
	Wood pulp	38%
Major export markets (1993)		
	United States	69%
	European Union	17%
Balance of trade (1993)		$+480 million
Value of shipments (1992)		$878 million
Number of establishments (1992)		554
	458 logging	
	84 wood	
	12 paper and allied	
Employment (1994)[e]		18 000
	11 000 direct jobs	
	7 000 indirect jobs	
	1 job in 21	
Wages and salaries (1992)		$206 million
New investments (1993)		not available

a, b, c, d, e *See pages 95-96.*

NEW BRUNSWICK

Balsam fir *(Abies balsamea)*

Population	**760 100**
Total area	**7.3 million ha**
Land area	**7.2 million ha**
Forest land	**6.1 million ha**
Provincial parks	**24 900 ha**

Forest Resource (1993)

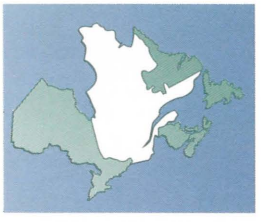
Ownership	Provincial		48%
	Federal		1%
	Private		51%
Forest type	Softwood		45%
	Hardwood		27%
	Mixedwood		28%
Allowable annual cut[a]			10.9 million m³
Harvest (volume)[b]			8.8 million m³
Harvest (area)			100 650 ha
Status of harvested Crown land[c]			
Stocked		431 798 ha	96%
Understocked		19 058 ha	4%
Insect defoliation[d]			196 355 ha
Forest fires			668 ha

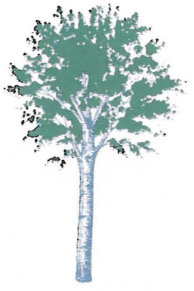
Forest Industry

Value of exports (1993)		$1.3 billion
	Wood pulp	30%
	Other paper and paperboard	25%
	Newsprint	21%
Major export markets (1993)		
	United States	69%
	European Union	16%
	Japan	8%
Balance of trade (1993)		$+1.2 billion
Value of shipments (1992)		$2.2 billion
Number of establishments (1992)		820
	669 logging	
	129 wood	
	22 paper and allied	
Employment (1994)[e]		20 000
	12 000 direct jobs	
	8 000 indirect jobs	
	1 job in 15	
Wages and salaries (1992)		$442 million
New investments (1993)		not available

a, b, c, d, e *See pages 95-96.*

QUEBEC





Yellow birch *(Betula alleghaniensis* Britton*)*

Population	**7 293 100**
Total area	**154.1 million ha**
Land area	**135.7 million ha**
Forest land	**83.9 million ha**
Provincial parks	**7.1 million ha**

Forest Resource (1993)

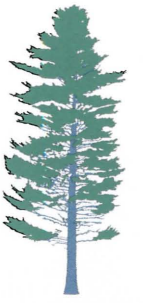
Ownership	Provincial	89%
	Private	11%
Forest type	Softwood	67%
	Hardwood	14%
	Mixedwood	19%
Allowable annual cut[a]		56.5 million m³
Harvest (volume)[b]		32.3 million m³
Harvest (area)		311 623 ha
Status of harvested Crown land[c]		
Stocked	3 769 565 ha	92%
Understocked	336 736 ha	8%
Insect defoliation[d]		57 238 ha
Forest fires		128 234 ha

Forest Industry

Value of exports (1993)		$6.5 billion
	Newsprint	41%
	Other paper and paperboard	19%
	Softwood lumber	15%
Major export markets (1993)		
	United States	86%
	European Union	8%
Balance of trade (1993)		$+5.7 billion
Value of shipments (1992)		$11.5 billion
Number of establishments (1992)		3 394
	2 043 logging	
	1 143 wood	
	208 paper and allied	
Employment (1994)[e]		183 000
	98 000 direct jobs	
	85 000 indirect jobs	
	1 job in 17	
Wages and salaries (1992)		$2.6 billion
New investments (1993)		$1.2 billion

a, b, c, d, e *See pages 95-96.*

ONTARIO



Eastern white pine *(Pinus strobus)*

Population	**10 992 300**
Total area	**106.9 million ha**
Land area	**89.1 million ha**
Forest land	**58.0 million ha**
Provincial parks	**6.3 million ha**

Forest Resource (1993)

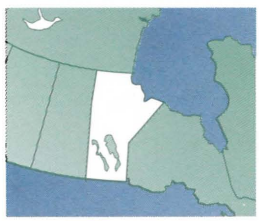
Ownership	Provincial	88%
	Federal	1%
	Private	11%
Forest type	Softwood	56%
	Hardwood	18%
	Mixedwood	26%
Allowable annual cut[a]		0.4 million ha
Harvest (volume)[b]		23.2 million m³
Harvest (area)		206 000 ha
Status of harvested Crown land (1992)[c]		
Stocked	2 820 438 ha	84%
Understocked	558 004 ha	16%
Insect defoliation[d]		18.6 million ha
Forest fires		104 705 ha

Forest Industry

Value of exports (1993)		$4.9 billion
	Newsprint	26%
	Other paper and paperboard	23%
	Softwood lumber	22%
Major export markets (1993)		
	United States	95%
Balance of trade (1993)		$+2.5 billion
Value of shipments (1992)		$10.3 billion
Number of establishments (1992)		2 565
	1 563 logging	
	695 wood	
	307 paper and allied	
Employment (1994)[e]		162 000
	83 000 direct jobs	
	79 000 indirect jobs	
	1 job in 30	
Wages and salaries (1992)		$2.4 billion
New investments (1993)		$1.1 billion

a, b, c, d, e *See pages 95-96.*

MANITOBA



White spruce *(Picea glauca)*

Population	**1 131 400**
Total area	**65.0 million ha**
Land area	**54.8 million ha**
Forest land	**26.3 million ha**
Provincial parks	**1.5 million ha**

Forest Resource (1993)

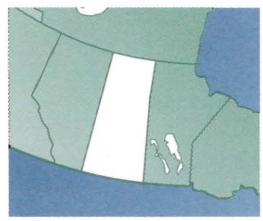
Ownership	Provincial		94%
	Federal		1%
	Private		5%
Forest type	Softwood		67%
	Hardwood		19%
	Mixedwood		14%
Allowable annual cut[a]			7.8 million m³
Harvest (volume)[b]			1.5 million m³
Harvest (area)			10 993 ha
Status of harvested Crown land[c]			
Stocked		189 511 ha	85%
Understocked		32 928 ha	15%
Insect defoliation[d]			17 400 ha
Forest fires			67 275 ha

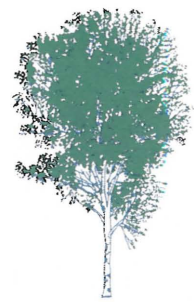
Forest Industry

Value of exports (1993)		$209 million
	Softwood lumber	46%
	Wrapping paper	32%
Major export markets (1993)		
	United States	95%
Balance of trade (1993)		$+51 million
Value of shipments (1992)		$570 million
Number of establishments (1992)		228
	138 logging	
	68 wood	
	22 paper and allied	
Employment (1994)[e]		11 000
	7 000 direct jobs	
	4 000 indirect jobs	
	1 job in 43	
Wages and salaries (1992)		$136 million
New investments (1993)		not available

a, b, c, d, e *See pages 95-96.*

SASKATCHEWAN





White birch *(Betula papyrifera)*

Population	**1 016 400**
Total area	**65.2 million ha**
Land area	**57.1 million ha**
Forest land	**28.8 million ha**
Provincial parks	**908 000 ha**

Forest Resource (1993)

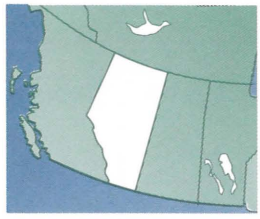
Ownership	Provincial		97%
	Federal		2%
	Private		1%
Forest type	Softwood		56%
	Hardwood		24%
	Mixedwood		20%
Allowable annual cut[a]			7.1 million m³
Harvest (volume)[b]			4.4 million m³
Harvest (area)			19 456 ha
Status of harvested Crown land[c]			
Stocked		150 475 ha	34%
Understocked		288 397 ha	66%
Insect defoliation[d]			398 400 ha
Forest fires			660 565 ha

Forest Industry

Value of exports (1993)		$272 million
	Wood pulp	53%
	Softwood lumber	21%
	Other paper and paperboard	14%
Major export markets (1993)		
	United States	69%
	European Union	11%
	Japan	9%
Balance of trade (1993)		$+231 million
Value of shipments (1992)		$446 million
Number of establishments (1992)		186
	126 logging	
	55 wood	
	5 paper and allied	
Employment (1994)[e]		8 000
	5 000 direct jobs	
	3 000 indirect jobs	
	1 job in 57	
Wages and salaries (1992)		$101 million
New investments (1993)		not available

a, b, c, d, e, f *See pages 95-96.*

ALBERTA



Lodgepole pine *(Pinus contorta)*

Population	**2 720 900**
Total area	**66.1** million ha
Land area	**64.4** million ha
Forest land	**38.2** million ha
Provincial parks	**1.25** million ha

Forest Resource (1993)

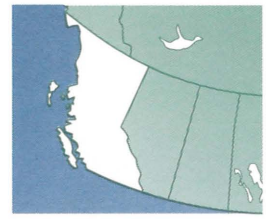
Ownership	Provincial	87%
	Federal	9%
	Private	4%
Forest type	Softwood	43%
	Hardwood	37%
	Mixedwood	20%
Annual allowable cut[a]		23.4 million m³
Harvest (volume)[b]		14.2 million m³
Harvest (area)		44 565 ha
Status of harvested Crown land[c]		
Stocked	204 019 ha	75%
Understocked	68 256 ha	25%
Insect defoliation[d]		65 500 ha
Forest fires		25 633 ha

Forest Industry

Value of exports (1993)		$749 million
	Wood pulp	54%
	Softwood lumber	16%
	Waferboard	13%
Major export markets (1993)		
	United States	53%
	Japan	22%
Balance of trade (1993)		$+638 million
Value of shipments (1992)		$2.3 billion
Number of establishments (1992)		559
	355 logging	
	172 wood	
	32 paper and allied	
Employment (1994)[e]		34 000
	19 000 direct jobs	
	15 000 indirect jobs	
	1 job in 38	
Wages and salaries (1992)		$448 million
New investments (1993)		$0.8 billion

a, b, c, d, e *See pages 95-96.*

BRITISH COLUMBIA



Western red cedar *(Thuya plicata)*

Population	**3 700 100**
Total area	**94.8** million ha
Land area	**93.0** million ha
Forest land	**60.6** million ha
Provincial parks	**5.34** million ha

Forest Resource (1993)

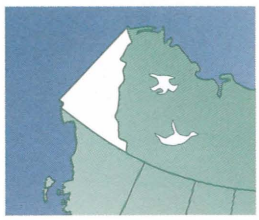
Ownership	Provincial	95%
	Federal	1%
	Private	4%
Forest type	Softwood	83%
	Hardwood	5%
	Mixedwood	12%
Annual allowable cut[a]		71.9 million m³
Harvest (volume)[b]		78.0 million m³
Harvest (area)		207 748 ha
Status of harvested Crown land[c]		
Stocked	2 245 763 ha	69%
Understocked	1 002 536 ha	31%
Insect defoliation[d]		990 966 ha
Forest fires		5 183 ha

Forest Industry

Value of exports (1993)		$11.8 billion
	Softwood lumber	56%
	Wood pulp	20%
	Newsprint	10%
Major export markets (1993)		
	United States	55%
	Japan	24%
	European Union	11%
Balance of trade (1993)		$+11.1 billion
Value of shipments (1992)		$15.6 billion
Number of establishments (1992)		3 933
	3 249 logging	
	618 wood	
	66 paper and allied	
Employment (1994)[e]		187 000
	98 000 direct jobs	
	89 000 indirect jobs	
	1 job in 9	
Wages and salaries (1992)		$3.3 billion
New investments (1993)		$2.2 billion

a, b, c, d, e *See pages 95-96.*

YUKON TERRITORY



The Yukon Territory has not officially adopted a tree.

Population	**29 900**
Total area	**48.3 million ha**
Land area	**47.9 million ha**
Forest land	**27.5 million ha**

FOREST RESOURCE (1993)

Ownership	Federal		100%
Forest type	Softwood		75%
	Hardwood		2%
	Mixedwood		23%
Allowable annual cut[a]			0.01 million m³
Harvest (volume)[b]			0.16 million m³
Harvest (area)			634 ha
Status of harvested Crown land (1992)[c]			
Stocked		3 269 ha	67%
Understocked		1 634 ha	33%
Insect defoliation[d]			27 000 ha
Forest fires			86 116 ha

a, b, c, d *See pages 95-96.*

NORTHWEST TERRITORIES

Jack pine *(Pinus banksiana)*

Population	**64 600**
Total area	**342.6 million ha**
Land area	**329.3 million ha**
Forest land	**61.4 million ha**

FOREST RESOURCE (1993)

Ownership	Federal		100%
Forest type	Softwood		29%
	Hardwood		5%
	Mixedwood		66%
Allowable annual cut[a]			0.30 million m³
Harvest (volume)[b]			0.17 million m³
Harvest (area)			519 ha
Status of harvested Crown land[c]			
Stocked		244 ha	7%
Understocked		3 422 ha	93%
Insect defoliation[d]			53 600 ha
Forest fires			858 557 ha

a, b, c, d *See pages 95-96.*

NOTES

Data Sources

The main sources for the data are Statistics Canada, Environment Canada, the Canadian Pulp and Paper Association, the Canadian Forest Service and the National Forestry Database. Most of the information was collected by provincial and territorial natural resource ministries.

Provincial Trees

An illustration of the tree species that has been designated or officially adopted as the arboreal emblem of each province and territory is included in the profiles on the preceding pages. The Yukon has not officially adopted a tree.

Forest Land

The data regarding Canada's forest land are based on the 1991 Canada Forest Inventory. The map on page 88 shows the forest land boundary.

Forest Resource

Ownership data are provided for the total forest land.

[a] ***Allowable annual cut:*** The level of harvest set by the provinces and territories for a certain length of time is called the "allowable annual cut" (AAC). AAC figures include data for both softwoods and hardwoods. The AAC figures for Newfoundland, Prince Edward Island, Nova Scotia, New Brunswick, Quebec and Manitoba include federal, provincial and private lands. Given the differences outlined below, a national AAC can not be calculated by simply adding the provincial and territorial AACs. *(See Timber Supply Chapter for more information.)*

- The national AAC figure that appears on page 88 was arrived at by estimating some data for private and federal lands, and converting the Ontario area figures into volume figures.
- Ontario provides figures for AAC (which it refers to as the "maximum allowable depletion") in hectares only.
- Saskatchewan and Alberta do not include figures for private lands in their AACs.
- British Columbia does not include all private lands in its AAC.
- The Yukon's AAC only includes federal lands.
- The Northwest Territories's AAC includes territorial and federal lands.

[b] ***Harvesting:*** The national and provincial figures for harvesting volume include data for industrial roundwood only. Provincial harvest levels for fuelwood or firewood may range as high as 2.3 million m^3.

- Although the AAC for British Columbia does not include all private lands, the harvest figure does include them. The yearly harvest rate for British Columbia may fluctuate, and in some cases, it may exceed the AAC. Over a five-year period, however, the harvest figure would be equal to or lower than the AAC.

c ***Status of harvested Crown land:*** This year's report presents new, cumulative data on the state of regeneration on provincial Crown land harvested since 1975. Data for private lands are not included. The "stocked" term refers to land where the forest cover meets certain timber-production standards established by forest management agencies in each province and territory. The "understocked" term refers to harvested land that requires forest management treatments, such as site preparation, planting, seeding or weeding, to meet established standards. This category also includes land that has not yet been surveyed.

d ***Insect defoliation:*** The data relating to insects were provided by provincial and territorial agencies, and include moderate-to-severe defoliation only. Defoliation does not always imply mortality; for example, stands with moderate defoliation often recover and may not lose much growth. Defoliation is mapped on an insect-by-insect basis, and a given area may be afflicted by more than one insect at a time. This may result in double and triple counting in areas affected by more than one insect, exaggerating the extent of the total area defoliated.

Forest Industry

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

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

f ***Wages and salaries:*** Some provinces only have a few mills, therefore the provincial data for wages and salaries are confidential and not available.

CANADA (1994)

Population	**29.3 million**
Land area	**921.5 million ha**
Forest land	**417.6 million ha**
Forest ownership	**71% provincial**
	23% federal
	6% private
Major exports (1993)	
Softwood lumber	34%
Newsprint	23%
Wood pulp	17%
Employment in forestry	339 000 direct jobs
Industrial roundwood production (1993)	169.3 million m^3

USA (1993)

Population	**257.6 million**
Land area	**916.6 million ha**
Forest land	**298.0 million ha**
Forest ownership	**68% private**
	32% public
Major exports	
Wood pulp	23%
Logs	17%
Packaging paper and board	17%
Lumber	14%
Employment in forestry	1 393 000 direct jobs
Industrial roundwood production	402.5 million m^3

CHILE (1992)

Population	**13.6 million**
Land area	**75.7 million ha**
Forest land	**16.0 million ha**
Plantations	**1.7 million ha**
Forest ownership	**95% private**
	5% public
Major exports (1992)	
Pulp	44%
Logs and chips	26%
Lumber	17%
Industrial roundwood production	17.7 million m^3

BRAZIL (1992)

Population	**158.7 million**
Land area	**845.7 million ha**
Forest land	**566.6 million ha**
Plantations	**3.8 million ha**
Major exports	
Paper and paperboard	41%
Wood pulp	37%
Wood-based panels	13%
Employment in forestry (1991)	141 681 jobs
Industrial roundwood production	77.7 million m^3

SWEDEN (1992)

Population	**8.8 million**
Land area	**40.8 million ha**
Forest land	**22.9 million ha**
Forest ownership	**74% private**
	26% public
Major exports	
Paper and paperboard	54%
Lumber	19%
Wood pulp	14%
Employment in forestry	140 249 direct jobs
Industrial roundwood production	49.1 million m^3

NEW ZEALAND (1992)

Population	**3.4 million**
Land area	**27.1 million ha**
Forest land	**7.5 million ha**
Plantations	**1.2 million ha**
Major exports	
Wood pulp	22%
Paper and paperboard	20%
Logs	20%
Lumber	16%
Employment in forestry	20 114 direct jobs
Industrial roundwood production	15.0 million m^3

Statistical Highlights

Ten-Year Trends

Summary Figures

Allowable Annual Cut

1993

227 million m^3 ▼

Harvesting

1993

968 584 hectares ▲

Fire

1993

1 967 388 hectares ▲

Planting and Seeding

1993

451 965 hectares ▼

Site Preparation and Stand Tending

1993

765 160 hectares ▲

Forest Management Expenditures

1993

$2.4 billion ▼

Employment

1994

847 000 direct and indirect jobs ▲

Wages and Salaries

1992

$9.6 billion ▲

Exports

1993

$26.7 billion ▲

Value of Shipments

1992

$44.2 billion ▲

Forest Products Contribution to Balance of Trade

1993

$22.3 billion ▲

Capital and Repair Expenditures

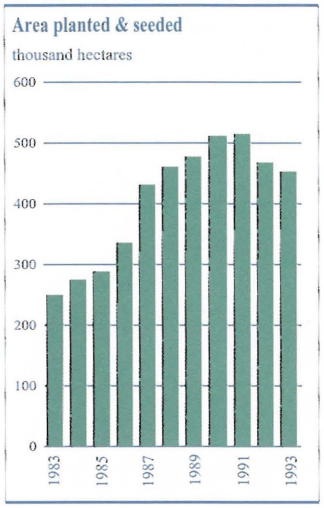
1993

$5.8 billion ▼

Notes: Some of these statistics are detailed on the following pages.
▲ indicates an increase over the previous year
▼ indicates a decrease over the previous year

Area Planted and Seeded (1993)

Throughout the 1980s, the federal-provincial/territorial forest resource development agreements resulted in a significant increase in the amount of replanting and seeding carried out in Canada. Most of the efforts were concentrated in areas that had been disturbed by fire, insects, disease or harvesting, and had not regenerated. Since 1992, the level of planting and seeding has been decreasing slightly. Most of the provinces now rely more on natural regeneration.



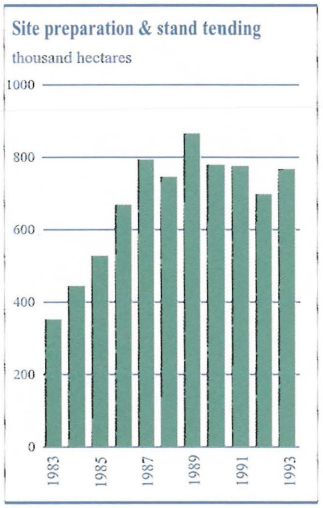
1993	hectares	annual % change 1 year	10 years
Area planted & seeded	451 965	-3.2	+6.6

Source: Canadian Forest Service

Site Preparation and Stand Tending (1993)

Thinning, fertilizing and pruning recently planted forests improves the growth and quality of young trees.

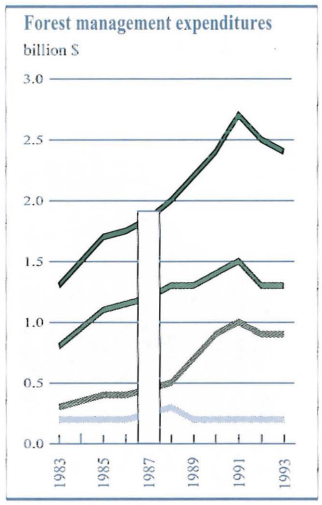
The level of site preparation and stand tending activities in Canada rose from 350 000 hectares in 1983, to 863 300 hectares in 1989. Then, from 1989 to 1992, the level of site preparation and stand tending fell by 19%, as did planting and seeding. In 1993, however, these silvicultural activities increased by 10%.



1993	hectares	annual % change 1 year	10 years
Site preparation & stand tending	765 160	+10.0	+9.0

Source: Canadian Forest Service

Forest Management Expenditures (1993)



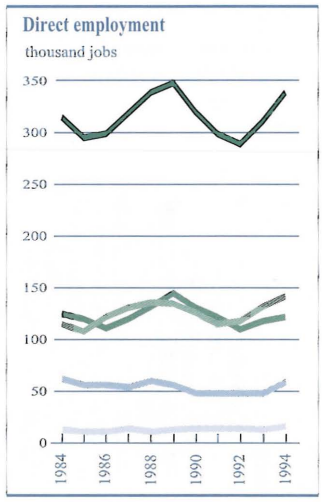
During the past decade, more of the responsibility for regenerating and managing Canada's forests has been assigned to the companies harvesting forest lands. Forest management expenditures doubled between 1981 and 1990, but have since been decreasing slightly.

1993	billion $	annual % change 1 year	10 years
Provincial	1.3	-3.0	+7.4
Industry	0.9	-1.1	+15.8
Federal	0.2	-21.3	+3.4
Total expenditures	2.4	-3.9	+9.0

* 1987 data not available

Sources: Canadian Pulp & Paper Association/Canadian Forest Service

Direct Employment (1994)



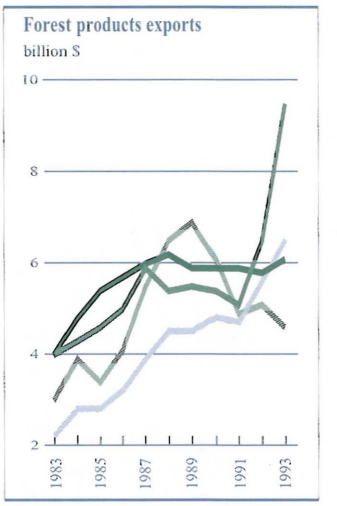
In the past few years, the forest sector in Canada has installed new processing equipment and adopted less labour-intensive technologies. As a result, employment opportunities for lower-skilled workers have declined, while the demand for higher-skilled workers has increased. The overall employment level rose from 311 000 direct jobs in 1993, to 339 000 jobs in 1994. There were substantial increases in the logging industry and forestry services. Forest-sector employment now accounts for 1 job in every 15 in Canada.

1994	thousand direct jobs	annual % change 1 year	10 years
Wood industries	142	+7.6	+2.4
Paper & allied industries	122	+3.4	+0.08
Logging industry	59	+22.9	-0.02
Forestry services	16	+23.1	+3.2
Total industries	339	+9.0	+0.9

Source: Statistics Canada

Forest Products Exports (1993)

In 1993, the total value of Canadian forest products exports rose 16% to reach $26.7 billion. The increase was most noticeable for lumber exports, which shot up 44.3% as a result of increased demand and prices. Exports of other forest products also grew substantially. While the value of pulp exports decreased 8.4%, the volume exported actually increased 9% over 1992 levels. This discrepancy reflects the decline in pulp prices attributed to continuing world overcapacity. Newsprint exports increased slightly, from $5.8 billion in 1992 to $6.1 billion in 1993.

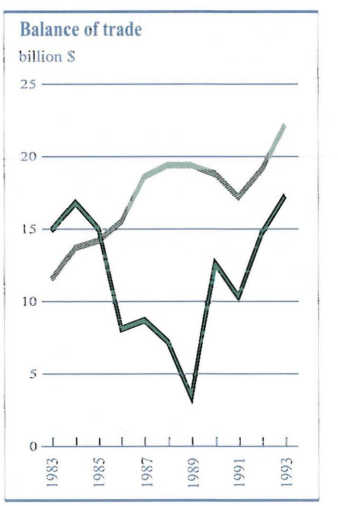


1993	billion $	annual % change 1 year	10 years
Lumber	9.5	+44.3	+10.0
Newsprint	6.1	+5.4	+4.6
Other forest products	6.5	+16.0	+11.6
Wood pulp	4.6	-8.4	+5.8
Total exports	26.7	+16.0	+7.6

Source: Statistics Canada

Balance of Trade (1993)

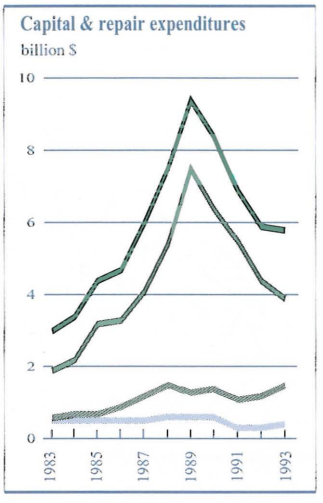
Canada's standard of living is closely linked to the export of forest products. The majority of our forest products exports are sold to the United States (71%); the European Union buys 9%; and Japan purchases roughly 12%. In 1993, forest products exports contributed $22.3 billion to Canada's balance of trade. That level surpasses the record contribution recorded in 1989. Softwood lumber was the major contributor, with higher prices, as well as increased export volumes.



1993	billion $	annual % change 1 year	10 years
Forest products' contribution	22.3	+16.2	+7.1
Total balance of trade	17.4	+17.5	+19.8

Source: Statistics Canada

Capital and Repair Expenditures (1993)



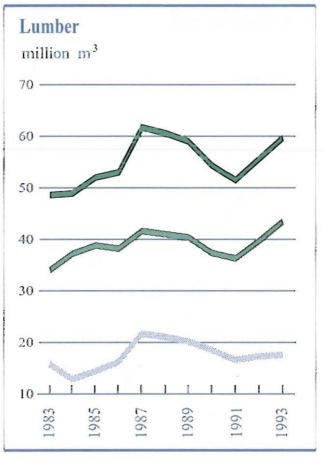
In 1993, capital and repair expenditures decreased slightly, reflecting the continuing low profitability of pulp and paper companies in particular. Capital expenditures by the forest industry is cyclical. Expenditures were up slightly for both the logging and wood industries sectors.

Additions to capacity were substantially lower in 1993, compared with the boom that occurred between 1988 and 1991. Most of the expenditures were to finalize projects initiated in earlier years.

1993	billion $	annual % change 1 year	10 years
Paper & allied industries	3.9	-10.5	+10.0
Wood industries	1.5	+25.6	+10.5
Logging industry	0.4	+19.2	+0.1
Total expenditures	5.8	-1.7	+8.3

Source: Statistics Canada

Lumber (1993)



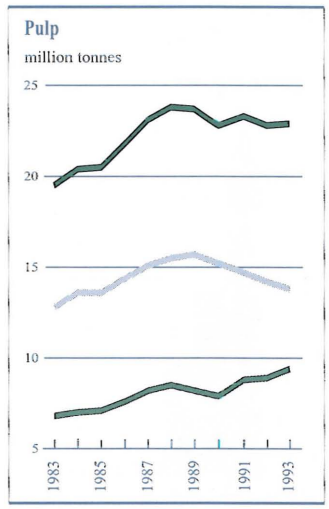
Canada's production and export levels for lumber increased in 1993, continuing the improvement seen in 1992, and reversing the gradual decline that had begun during the global recession. Exports in 1993 rose by 9.5% in terms of quantity and by 44% in terms of value. Lumber companies experienced significantly improved profits as prices increased and housing demands strengthened. Softwood lumber exports to the USA accounted for 82% of all exports in 1993. Lumber prices remained high in 1994.

1993	million m^3	annual % change 1 year	10 years
Production	59.8	+7.3	+2.3
Exports	43.6	+9.5	+2.7
Consumption	17.6	+1.8	+1.9

Source: Statistics Canada

Pulp (1993)

The pulp sector is highly cyclical, with large swings in prices and production levels over time. In 1993, the production of pulp in Canada increased very slightly, while domestic consumption levels decreased. Although the volume of exports increased, lower pulp prices worldwide reduced the value of these exports by 8% over 1992 levels. However, in 1994 pulp prices increased substantially.



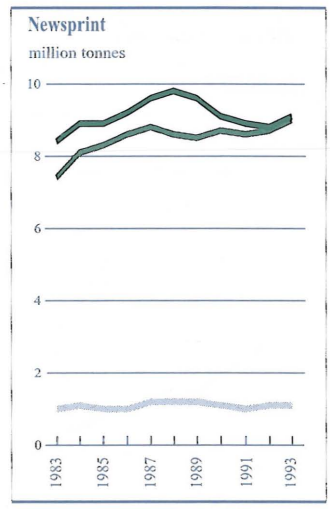
1993	million tonnes	annual % change 1 year	10 years
Production	22.9	+0.2	+1.7
Consumption	13.8	-3.1	+0.8
Exports	9.4	+5.8	+3.4

Source: Statistics Canada

Newsprint (1993)

Demand for newsprint has been slow to recover from the recession of the early 1990s. Newsprint prices in 1993 were very low, and the sector continued to incur net losses. Domestic consumption increased slightly in 1993, while production and exports increased for the first time since the late 1980s. However, the dramatic increase in prices recorded since the beginning of 1994 should improve profitability.

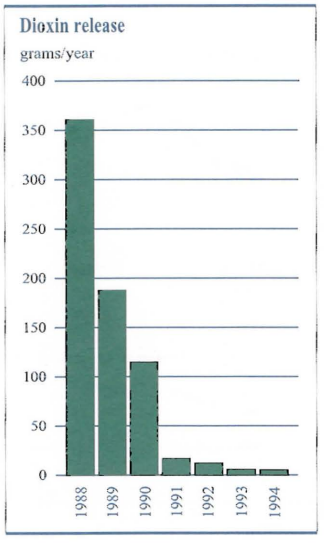
The use of recycled fibre continued to increase in 1993, with several new de-inking plants beginning operations. However, as a result of skyrocketing prices for old newspapers, construction of some de-inking plants has been delayed.



1993	million tonnes	annual % change 1 year	10 years
Production	9.1	+4.4	+0.9
Exports	9.0	+3.7	+2.1
Consumption	1.1	+5.1	+1.8

Sources: Canadian Pulp & Paper Association/Canadian Forest Service

Dioxin Release (1994)

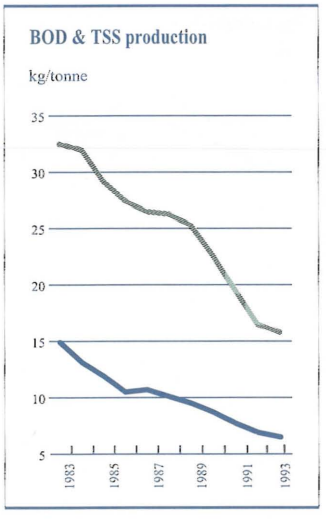


New government regulations and the use of new technologies have resulted in significant environmental improvements to pulp and paper mills over the past seven years. Between 1988 and 1994, there was a reduction of 98.5% in the release of dioxins and furans. Research is ongoing to find environmentally safe bleaching agents. The production of elemental chlorine free pulp (ECF) is growing faster than all other types of bleached pulp. In less than four years, the production of Canada's ECF pulp has grown to 5.5 million tonnes and now accounts for roughly half the domestic bleached chemical pulp production.

1994	grams/ year	annual % change 1 year	5 years
Dioxin release	5.4	-8.5	-42.4

Sources: Pulp & Paper Research Institute of Canada/Environment Canada

Discharge Levels (1993)



Environmental quality is a major concern in the 1990s, and its influence has affected the decisions and expenditures of Canada's forest industries. Environmental projects now account for roughly a quarter of the total capital expenditures in the pulp and paper industries — a marked increase from a decade earlier. Roughly 75% of the expenditures targeted improvements in water quality.

In addition, amendments to the federal Fisheries Act have substantially reduced the level of BOD (Biochemical Oxygen Demand) in the water, as well as the level of TSS (Total Suspended Solids), which may deposit on the bottom of rivers and lakes.

1993	kg/ tonne	annual % change 1 year	10 years
BOD production	15.8	-4.2	-6.8
TSS production	6.5	-5.8	-7.9

Source: Canadian Pulp & Paper Association

GLOSSARY

ACID RAIN: Refers to the deposition on Earth of a variety of acidic pollutants in either wet (e.g., rain, fog or snow) or dry forms (e.g., gas or dust particles).

AREA NOT GROWING COMMERCIAL SPECIES: Areas that were harvested more than 10 years ago and have not yet regenerated to commercial species.

AREA REGENERATING: Includes areas that have been harvested recently (less than 10 years ago), and areas depleted by such natural disturbances as fire, insects and disease.

ARBORETUM: A botanical tree garden where trees are maintained for display purposes.

CANOPY: The more or less continuous cover of branches and foliage formed collectively by the crowns of adjacent trees.

CLEARCUTTING: A forest management method that involves felling and removing a stand of trees. Clearcutting may be done in blocks, strips or patches.

COMMERCIAL FOREST: Forest land that is able to grow commercial timber within an acceptable time frame.

CUTOVER: An area of forest from which some or all of the timber has recently been cut.

ECOSYSTEM: A dynamic system of plants, animals and other organisms, together with the non-living components of the environment, functioning as an interdependent unit.

ECOSYSTEM INTEGRITY: The quality of a natural unmanaged or managed ecosystem in which the natural ecological processes sustain the function, composition and structure of the system.

ECOZONE: A broad-scale ecological unit that is based on patterns in geographical and ecological diversity. There are 15 ecozones in Canada.

EDGE HABITAT: A loosely defined type of habitat that occurs at the boundary between two different habitat types. Typically, edge habitats share characteristics with both adjacent habitat types and have particular transitional characteristics that are important to wildlife.

ENDANGERED SPECIES: A species that is threatened with imminent extinction or extirpation throughout all or a significant portion of its Canadian range.

EXTIRPATION: A species or subspecies disappearing from an area without becoming extinct throughout its range.

FALLDOWN: A situation in which second-growth forests provide less timber than the original forests.

FEATURED-SPECIES MANAGEMENT: A type of wildlife management that does not attempt to manage for all species, but selects a few species of particular concern or interest (e.g., big game species or endangered species) and aims management programs at them. With respect to habitat, it is generally assumed that providing habitat for these species provides habitat for other species as well.

FELLER-BUNCHER: A self-propelled machine used to fell trees by shearing them off near the ground using a hydraulic apparatus. Some models also strip limbs and bunch the logs for later pickup.

FRAGMENTATION: A term used to describe a landscape where areas of forest have been removed in such a way that the remaining forest exists as "islands" of trees in a cutover environment. The major concern

with fragmentation is the effect of the loss of contiguous forest cover on species movement and dispersal.

Girdling: The removal of a ring of bark from around a tree, leading to its death.

Group selection: The removal of clumps of trees.

Guild management: A method of management by which species are assembled into groups based on similarities in their habitat requirements. One species is selected to indicate the group; conserving the habitat of that particular species ensures the conservation of other members of the guild.

Habitat: The environment in which a population or individual lives; includes not only the place where a species is found, but also the particular characteristics of the place (e.g., climate or the availability of suitable food and shelter) that make it especially well suited to meet the life cycle needs of that species.

Hardwoods: Trees that lose their leaves in autumn. They belong to the botanical group Angiospermae.

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

Home-range size: An individual species' requirement for space. Both the size of an organism and its lifestyle determine its space requirements.

Integrated forest resource management: A holistic approach to forest management involving preservation, protection, extraction and development, which includes managing two or more resources in the same general area, such as water, soil, timber, grazing land, fish, wildlife and recreation.

Landscape: Areas of land that are distinguished by differences in landforms, vegetation, land use, and aesthetic characteristics.

Microorganisms: Microscopic one- or multi-celled organisms, such as bacteria, viruses, yeasts, algae, fungi and protozoans.

Minimum viable population (MVP): The minimum number of breeding individuals necessary to sustain a population.

Mixedwoods: Trees belonging to either of the botanical groups Gymnospermae or Angiospermae that are substantially intermingled in stands.

Niche environment: The unique environment used to sustain the existence of an organism or species.

Old-growth forests: A stand of mature or overmature trees relatively uninfluenced by human activity. The stand can contain multiple layers of tree canopies, and various ages and species of vegetation.

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

Oriented strand board (OSB): Panels made from narrow strands of fibre oriented lengthwise and crosswise in layers, with a resin binder. Depending on the resin used, OSB can be suitable for interior or exterior applications.

Overstorey: The upper canopy of a forest, typically formed by the branches and leaves of trees.

Patch cutting: The removal of all of the trees in a stand. The same as clearcutting, except that the area involved is smaller.

Pathogen: A microscopic organism or virus directly capable of causing disease.

Population: A group of organisms of the same species inhabiting a particular geographical area at a particular time.

Protection forests: Proposed name for forests protected from harvesting by policy. These forests usually protect sensitive

sites, such as watersheds and steep slopes.

Provenance: The geographical area or place of origin of a collection of genetic material (generally in the form of seed, pollen or cuttings) for which the process of natural selection has resulted in some common or shared population characteristics.

Riparian forest: At a large scale, it is the band of forest that has a significant influence on a stream ecosystem or is significantly affected by the stream. At a smaller scale, it is the forest at the immediate water's edge, where some specialized plants and animals form a distinct community.

Rotation: The cycle of regeneration, growth and harvesting of a single crop.

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

Seed banks: Storage facilities where seedlots (or bags of seed) are stored.

Seed orchards: A plantation of trees (pre-selected on the basis of their superior genetic traits) that has been isolated from genetically inferior outside sources, and intensively managed to improve the genotype and produce abundant seed crops.

Seed tree cutting: Leaving a scattered number of trees on a site to provide a portion of the seeds needed for regeneration.

Shelterwood (even-aged) cutting: A method of harvesting that involves two cuts; the first leaves stems or groups of trees at intervals to provide the crown closure and species required for regeneration; the second harvests the new crop of trees (which are all the same age) established on the site.

Shipment: Includes all shipping of goods within or outside Canada. Excludes product inventories.

Shortwood harvesting: A harvesting method by which a tree is cut down, delimbed and cut into 1.3-, 2.6-, 3.2-, or 4.8-metre lengths before being transported to a mill.

Single tree selection: The selection of individual trees for harvesting.

Snag: A dead, but standing tree from which the leaves and most of the branches have fallen.

Softwoods: Cone-bearing trees with needles or scale-like leaves. They belong to the botanical group Gymnospermae.

Spruce budworm: An insect that damages spruce and fir trees. Eggs of the spruce budworm are laid on branches by an adult moth. Young budworms feed primarily on the new growth of the tree branch, but also eat older needles. Defoliation results, killing the tree.

Stocked forest: Land supporting tree growth. In this context, tree growth includes seedlings and saplings.

Stumpage fee: The fee paid by companies or individuals for the right to harvest timber on Crown land.

Succession: Changes in the species composition of an ecosystem over time, often in a predictable order.

Threatened species: A species that is likely to become endangered in Canada if the factors affecting its vulnerability are not reversed.

Understorey: The lower level of vegetation in a forest. Usually formed by ground vegetation (mosses, herbs and lichens), herbs and shrubs, but may also include subdominant trees.

Vertical diversity: A term used to describe forest structure, proceeding vertically through a forest canopy.

Vertical structure: The structure formed by different layers of vegetation in a forest.

Vulnerable species: A species that is particularly at risk because of low or declining numbers, a small range, or for some other reason, but is not threatened.

Watershed: An area of land that drains naturally into a stream or other waterway.

CONTACTS

The following organizations can provide you with more information about Canada's forest resources and commitment to achieving sustainable forests.

NATIONAL FOREST STRATEGY COALITION

SECRETARIAT
National Forest Strategy Coalition
580 Booth Street
Ottawa ON K1A 0E4
Phone: (613) 995-0947

Alberta Forest Products Association
20 – 11738 Kingsway Avenue
Edmonton AB T5G 0X5
Phone: (403) 452-2841
Fax: (403) 455-0505

Association of University Forestry Schools of Canada
c/o School of Forestry
Lakehead University
955 Oliver Road
Thunder Bay ON P7B 5E1
Phone: (807) 343-8511
Fax: (807) 343-8116

Canadian Federation of Woodlot Owners
88 Prospect Street
Fredericton NB E3B 5P8
Phone: (506) 459-2990
Fax: (506) 459-3515

Canadian Forest Service
Natural Resources Canada
580 Booth Street
8th floor
Ottawa ON K1A 0E4
Phone: (613) 947-7400
Fax: (613) 947-7396

Canadian Forestry Association
203 – 185 Somerset Street West
Ottawa ON K2P 0J2
Phone: (613) 232-1815
Fax: (613) 232-4210

Canadian Institute of Forestry
1005 – 151 Slater Street
Ottawa ON KlP 5H3
Phone: (613) 234-2242
Fax: (613) 234-6181

Canadian Nature Federation
520 – 1 Nicholas Street
Ottawa ON KlN 7B7
Phone: (613) 562-3447
Fax: (613) 562-3371

Canadian Pulp and Paper Association
19th floor, Sun Life Building
1155 Metcalfe Street
Montreal QC H3B 4T6
Phone: (514) 866-6621
Fax: (514) 866-3035

Canadian Silviculture Association
c/o Brinkman and Associates Reforestation
520 Sharpe Street
New Westminster BC V3M 4R2
Phone: (604) 521-7771
Fax: (604) 520-1968

Canadian Wildlife Federation
2740 Queensview Drive
Ottawa ON K2B 1A2
Phone: (613) 721-2286
Fax: (613) 721-2902

Council of Forest Industries
1200 – 555 Burrard Street
Vancouver BC V7X 1S7
Phone: (604) 684-0211
Fax: (604) 687-4930

Department of Agriculture,
Fisheries and Forestry
Government of
Prince Edward Island
P.O. Box 2000
Jones Building
11 Kent Street
Charlottetown PE C1A 7N8
Phone: (902) 368-4830
Fax: (902) 368-4846

Department of Environment
and Resource Management
Government of Saskatchewan
3211 Albert Street
Regina SK S4S 5W6
Phone: (306) 787-2930
Fax: (306) 787-2947

Department of Environmental
Protection
Government of Alberta
9915 - 108 Street
Edmonton AB T5K 2C9
Phone: (403) 427-3552
Fax: (403) 422-6305

Department of Natural Resources
Government of Newfoundland
and Labrador
P.O. Box 8700
5th floor, Confederation
Building, West Block
St. John's NF A1B 4J6
Phone: (709) 729-2356
Fax: (709) 729-0059

Department of Natural Resources
Government of Manitoba
327 Legislative Building
Winnipeg MB R3C 0V8
Phone: (204) 945-3785
Fax: (204) 948-2403

Department of Natural Resources
Government of Nova Scotia
P.O. Box 698
7th floor, Founder's Square
1701 Hollis Street
Halifax NS B3J 2T9
Phone: (902) 424-4121
Fax: (902) 424-7735

Department of Natural Resources
Government of Ontario
Whitney Block
99 Wellesley Street West
Toronto ON M7A 1W3
Phone: (416) 314-2150
Fax: (416) 314-2159

Department of Natural
Resources and Energy
Government of New Brunswick
P.O. Box 6000
Fredericton NB E3B 5H1
Phone: (506) 453-2614
Fax: (506) 457-4881

Department of Renewable
Resources
Government of the
Northwest Territories
P.O. Box 1320
Yellowknife NT X1A 2L9
Phone: (403) 873-7420
Fax: (403) 873-0114

Department of Renewable
Resources
Government of the Yukon Territory
P.O. Box 2703
10 Burns Road
Whitehorse YT Y1A 2C6
Phone: (403) 667-5460
Fax: (403) 667-2438

IWA-Canada
500 – 1285 West Pender Street
Vancouver BC V6E 4B2
Phone: (604) 683-1117
Fax: (604) 688-6416

Maritime Lumber Bureau
P.O. Box 459
Amherst NS B4H 4A1
Phone: (902) 667-3889
Fax: (902) 667-0401

Ministry of Forests
Government of British Columbia
1450 Government Street
Victoria BC V8W 3E7
Phone: (604) 387-1285
Fax: (604) 387-6267

National Aboriginal
Forestry Association
875 Bank Street
Ottawa ON KlS 3W4
Phone: (613) 233-5563
Fax: (613) 233-4329

National Round Table on the
Environment and the Economy
1500 – 1 Nicholas Street
Ottawa ON K1N 7B7
Phone: (613) 995-7519
Fax: (613) 992-7385

Ontario Forest Industries
Association
1700 – 130 Adelaide Street West
Toronto ON M5H 3P5
Phone: (416) 368-6188
Fax: (416) 368-5445

Prince Edward Island Nature Trust
P.O. Box 265
Charlottetown PE C1A 7K4
Phone: (902) 892-7513
Fax: (902) 628-6331

Wildlife Habitat Canada
200 – 7 Hinton Avenue North
Ottawa ON K1Y 4P1
Phone: (613) 722-2090
Fax: (613) 722-3318

Model Forests

Long Beach Model Forest
P.O. Box 1119
243 Main Street
Ucluelet BC V0R 3A0
Phone: (604) 726-7263
Fax: (604) 726-7269

McGregor Model Forest
P.O. Box 9000
6677 Indian Reserve Road
Prince George BC V2L 4W2
Phone: (604) 962-3549
Fax: (604) 962-3364

Foothills Model Forest
P.O. Box 6330
1176 Switzer Drive
Hinton AB T7V 1X6
Phone: (403) 865-8329
Fax: (403) 865-8266

Prince Albert Model Forest
P.O. Box 2406
77 – 11th Street West
Prince Albert SK S6V 7G3
Phone: (306) 992-1944
Fax: (306) 763-6456

Manitoba Model Forest
P.O. Box 10
Mill Road
Pine Falls MB R0E 1M0
Phone: (204) 367-8895
Fax: (204) 367-8897

Lake Abitibi Model Forest
P.O. Box 550
1 Park Street
Iroquois Falls ON P0K 1E0
Phone: (705) 258-4278
Fax: (705) 258-3350

Eastern Ontario Model Forest
P.O. Bag 2111
Concession Road
Kemptville ON K0G 1J0
Phone: (613) 258-8241
Fax: (613) 258-3920

Lower St. Lawrence Model Forest
284, rue Potvin
Rimouski QC G5L 7P5
Phone: (418) 722-7211
Fax: (418) 723-6045

Fundy Model Forest
R.R. #4
Aiton Road
Sussex NB E0E 1P0
Phone: (506) 432-2806
Fax: (506) 432-2807

Western Newfoundland Model Forest
89 West Valley Road
Corner Brook NF A2H 2X4
Phone: (709) 634-6383
Fax: (709) 634-0255

Tree Plan Canada Coordinators

CFS – Pacific and Yukon Region
506 West Burnside Road
Victoria BC V8Z 1M5
Phone:(604) 363-6034
Fax:(604) 363-0797

CFS – Northwest Region
5320-122nd Street
Edmonton AB T6H 3S5
Phone: (403) 435-7270
Fax: (403) 435-7356

CFS – Ontario Region
P.O. Box 490
1219 Queen Street East
Sault Ste. Marie ON P6A 5M7
Phone: (705) 759-5711
Fax: (705) 759-5712

CFS – Quebec Region
P.O. Box 3800
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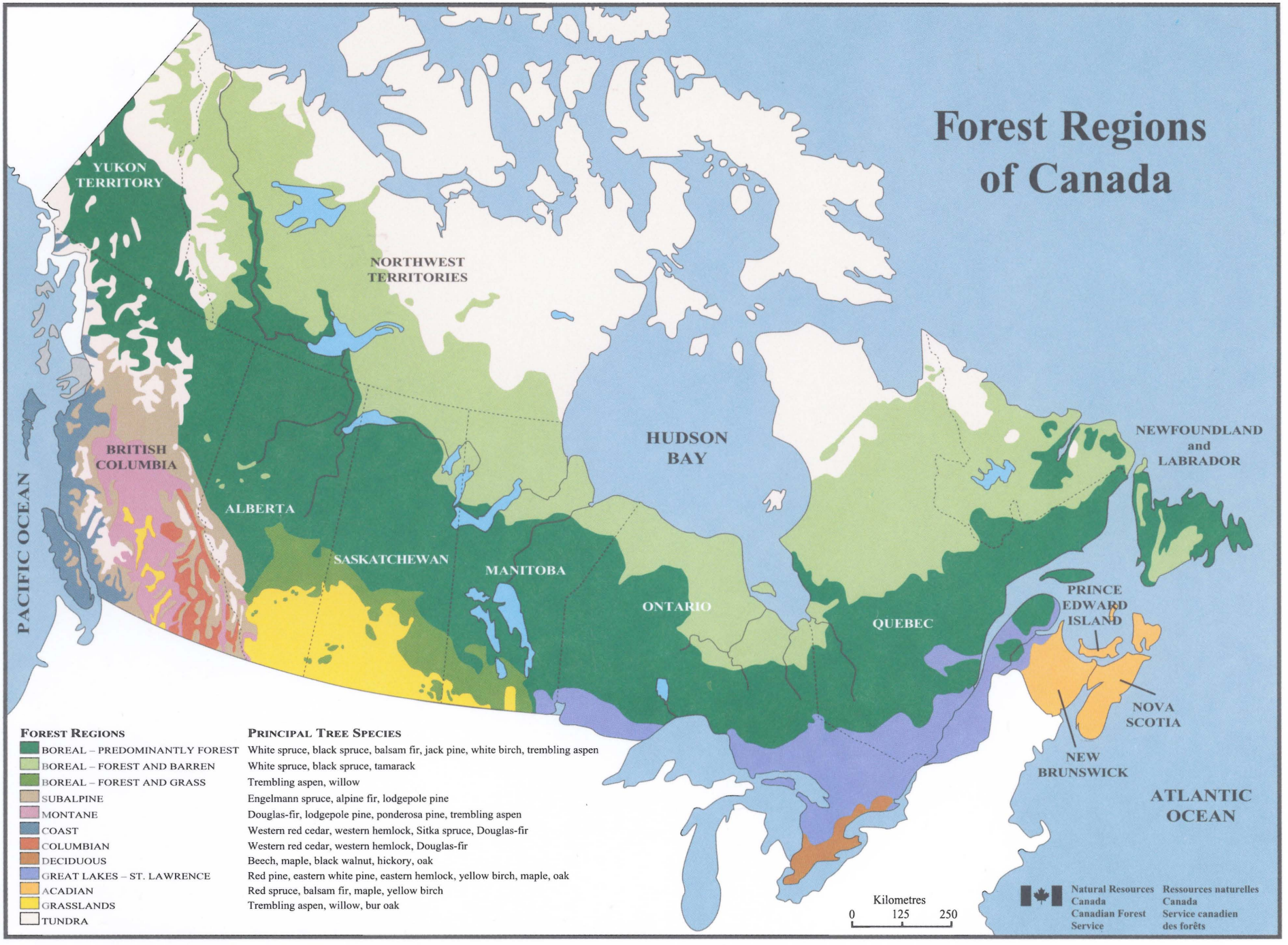
Sainte-Foy QC G1V 4C7
Phone: (418) 648-7149
Fax: (418) 648-5849

CFS – Maritime Region
P.O. Box 4000
Fredericton NB E3B 5P7
Phone: (506) 452-3959
Fax: (506) 452-3065

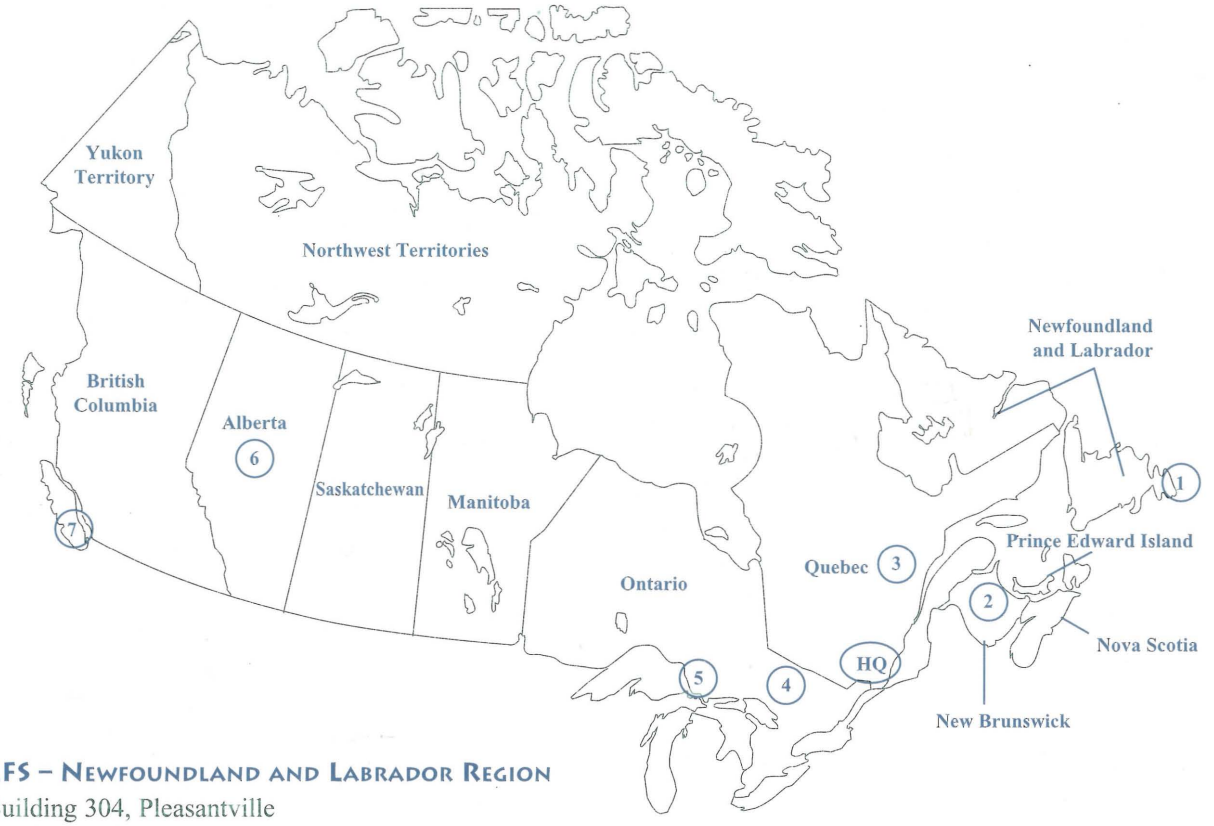
CFS – Newfoundland and Labrador Region
P.O. Box 6028
Building 304, Pleasantville
St. John's NF A1C 5X8
Phone: (709) 772-2311
Fax: (709) 772-5451

NOTES



Forest Regions	Principal Tree Species
BOREAL – PREDOMINANTLY FOREST	White spruce, black spruce, balsam fir, jack pine, white birch, trembling aspen
BOREAL – FOREST AND BARREN	White spruce, black spruce, tamarack
BOREAL – FOREST AND GRASS	Trembling aspen, willow
SUBALPINE	Engelmann spruce, alpine fir, lodgepole pine
MONTANE	Douglas-fir, lodgepole pine, ponderosa pine, trembling aspen
COAST	Western red cedar, western hemlock, Sitka spruce, Douglas-fir
COLUMBIAN	Western red cedar, western hemlock, Douglas-fir
DECIDUOUS	Beech, maple, black walnut, hickory, oak
GREAT LAKES – ST. LAWRENCE	Red pine, eastern white pine, eastern hemlock, yellow birch, maple, oak
ACADIAN	Red spruce, balsam fir, maple, yellow birch
GRASSLANDS	Trembling aspen, willow, bur oak
TUNDRA	

Canadian Forest Service Establishments



1 CFS – Newfoundland and Labrador Region
Building 304, Pleasantville
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St. John's NF A1C 5X8
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2 CFS – Maritimes Region
P.O. Box 4000
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3 CFS – Quebec Region
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4 CFS – Petawawa National Forestry Institute
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5 CFS – Sault Ste. Marie
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