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Annual Statistics 2005

Feature Article

Solid Waste in Canada

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Note of Appreciation

Canada owes the success of its statistical system to a long-standing partnership between Statistics Canada, the citizens of Canada, its businesses, governments and other institutions. Accurate and timely statistical information could not be produced without their continued co-operation and good will.

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Symbols

The symbols described in this document apply to all data published by Statistics Canada from all origins including surveys, censuses and administrative sources, as well as straight tabulations and all estimations.

.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
p	preliminary
r	revised
x	suppressed to meet the confidentiality requirements of the *Statistics Act*
E	use with caution
F	too unreliable to be published

Prefixes of the Metric System

Prefix	Abbreviation	Multiplication factor
exa	E	10^{18}
peta	P	10^{15}
tera	T	10^{12}
giga	G	10^{9}
mega	M	10^{6}
kilo	k	10^{3}
hecto	h	10^{2}
deca	da	10^{1}
deci	d	10^{-1}
centi	c	10^{-2}
milli	m	10^{-3}
micro	µ	10^{-6}
nano	n	10^{-9}
pico	p	10^{-12}
femto	f	10^{-15}
atto	a	10^{-18}

Equivalences

1 hectare	=	1 km^2 / 100
1 km^2	=	100 hectares
1 tonne	=	1 000 kilograms

Abbreviations

^oC	degree Celsius
CH_4	methane
cm	centimetre
CO	carbon monoxide
CO_2	carbon dioxide
g	gram
GDP	gross domestic product
GHG	greenhouse gas
GJ	gigajoule
GW	gigawatt
GWh	gigawatt hour
h	hour
ha	hectare
kg	kilogram
km	kilometre
km^2	square kilometre
km^3	cubic kilometre
kt	kilotonne
kW	kilowatt
L	litre
m^2	square metre
m^3	cubic metre
MJ	megajoule
mm	millimetre
Mt	megatonne
MW	megawatt
MWh	megawatt hour
N_2O	nitrous oxide
NAICS	North American Industry Classification System
NO_x	nitrogen oxides
PCB	polychlorinated biphenyl
PJ	petajoule
PM	particulate matter
s	second
SO_2	sulphur dioxide
SO_x	sulphur oxides
t	tonne
t-km	tonne kilometre
TEQ	toxic equivalency
TJ	terajoule
VOC	volatile organic compound
yr	year

Preface

Canadians recognize the importance of a clean and healthy environment. We understand that the capacity of the environment to supply materials and absorb wastes is finite. But to be effective at reducing our collective impact on the environment we need systematic, accessible and relevant information. Without such information, we are unable to understand and respond to environmental change.

The annual *Human Activity and the Environment* publications meet this need with a collection of environmental statistics, brought together from many sources. These annual reports provide a statistical picture of Canada's environment with special emphasis on human activity and its relationship to natural systems—air, water, soil, plants and animals.

Human Activity and the Environment: Annual Statistics 2005 is the fourth annual environment statistics compendium produced by Statistics Canada. Many of the statistics presented are revised on a biennial, annual and even quarterly basis.

Annual statistics

The Annual Statistics section is designed to serve as a general reference document for environmental statistics in Canada. It is organized using the pressure-state-response framework, in which information is classified as measuring the pressure placed on the environment by human activities, the state of the environment at a point in time, or the socio-economic response to environmental conditions.

The Annual Statistics section includes 76 data tables, 15 figures and 7 maps. Data highlights, which are interspersed throughout the Annual Statistics section, briefly describe notable developments in relation to human activity and the environment.

This publication also includes a feature article, "Solid Waste in Canada." Future editions will examine other current environmental issues of concern to Canadians and will provide additional updated data.

Data for *Human Activity and the Environment* come from a variety of sources, including various divisions within Statistics Canada and other federal and provincial government departments.

Acknowledgements

Human Activity and the Environment: Annual Statistics 2005 has been prepared by the Environment Accounts and Statistics Division under the direction of Robert Smith (Director). Murray Cameron served as editor and project manager and Laurie Jong was the database manager. Hélène Trépanier was the publication's technical editor. Major contributions to the statistics and analysis presented in the report have been made by:

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- **Transport Canada** (Surface and Marine Statistics and Forecasts)
- **Canadian Council of Forest Ministers**
- **Canadian Council of Ministers of the Environment**

How to Use this Publication

Human Activity and the Environment: Annual Statistics 2005 is a printed publication which includes a CD-ROM containing electronic versions of the statistics presented in the report. The report features an in-depth article along with an extensive Annual Statistics section which includes data highlights. This annual publication is intended to provide users with quick access to relevant environment statistics using a variety of presentation formats that are convenient and easy to read.

The publication's CD-ROM contains

- a reproduction of the printed publication in Adobe Acrobat format; and
- a database of the statistical tables found in the printed publication, accessible through Microsoft Excel, Microsoft Excel Viewer (included on the CD-ROM), or other spreadsheet software packages (for example, Lotus and QuattroPro).

The CD-ROM is found in the plastic pouch attached to the inside back cover of the printed publication.

Statistical tables linked electronically

To aid users in locating the electronic statistical tables, links have been established between an HTML interface and Excel (or Excel Viewer).

Each table name in the HTML interface contains a link that can be clicked with your mouse to go directly to the data associated with that table. Simply by clicking on the table name that you are most interested in, you can automatically launch Excel (or Excel Viewer), with that particular table open for viewing.

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Solid Waste in Canada

Waste has always been a by-product of human activity. Indeed, all aspects of our lives—working, playing, eating—generate some form of waste.

Managing it has been a challenge for millennia, more so since the Industrial Revolution of the 19th century gave rise to unprecedented industrialization and urbanization. In many parts of the world, this industrial expansion greatly increased the scale and complexity of the economy and, with it, the quantities and types of wastes produced. More wastes were released directly into waterways, new factories freely emitted airborne pollutants and solid waste was often dumped wherever it was most convenient.

Over the past few decades, governments and citizens have become especially aware and concerned about how wastes are managed. The issue has even worked its way into the lexicon of modern society—garbage is now referred to as waste and dumps are now called landfills. Recycling and composting are terms that have been attached to activities that have been practised in various ways for generations.

What is waste?

Waste can be simply defined as materials that are unwanted by their producer. These materials may be by-products of a production process, such as fly ash from an industrial furnace. They might be products whose value has been consumed—a newspaper that has been read or a package that has been opened and emptied of its contents are examples.

Wastes may be solid, liquid or gaseous. They can be hazardous or non-hazardous. Other ways to classify wastes are by source (residential, commercial, institutional, industrial) or by composition (organic, paper, glass, metal, plastic). The physical and chemical properties of waste materials differ based on these and other classifications. Every material has a unique life cycle, from raw material to final disposal, which affects its impact on the environment.

This article focuses on the non-hazardous solid waste generated by our communities. This includes wastes from residential, commercial, construction, renovation and demolition and some institutional and industrial sources (Table 1.1).

Canadians are concerned today about many waste-related issues. These include:

- The generation of waste—how much garbage is produced in Canada, and is production going up or down?
- The impact of waste on the environment—has the way we deal with garbage changed over the years?
- What are governments and others doing to address these concerns?

This article examines these issues by creating a statistical portrait of solid waste in Canada.

Table 1.1
Solid waste generated by source, province and territory, 2000 and 2002

Province/territory	Residential sources		Industrial, commercial and institutional sources		Construction, renovation and demolition sources		Total generation	
	2000	2002	2000	2002	2000	2002	2000	2002
	tonnes							
Newfoundland and Labrador	x	231 291	x	x	x	x	441 828	414 979
Prince Edward Island	x	x	x	x	x	x	x	x
Nova Scotia	246 792	252 012	x	x	x	x	532 616	558 918
New Brunswick	243 300	256 190	x	216 432	x	63 941	529 954	536 563
Quebec[1]	3 175 000	3 471 000	3 581 000	3 196 000	589 200	619 800	7 345 200	7 286 800
Ontario	4 191 337	4 388 239	5 962 868	6 514 191	1 139 271	1 158 701	11 293 476	12 061 131
Manitoba	501 921	494 535	x	566 750	x	86 151	1 130 182	1 147 436
Saskatchewan	305 901	321 069	x	x	x	x	971 989	941 731
Alberta	994 555	1 159 697	x	1 642 843	x	677 395	3 172 598	3 479 935
British Columbia	1 292 999	1 354 177	x	1 933 387	x	562 457	3 709 451	3 850 021
Yukon Territory, Northwest Territories and Nunavut	x	x	x	x	x	x	x	x
Canada	**11 242 405**	**12 008 338**	**14 776 041**	**15 075 307**	**3 288 961**	**3 371 880**	**29 307 405**	**30 455 524**

Notes:
Figures may not add up to totals due to rounding.
These data exclude solid waste and/or recyclable materials that are managed on-site by the households, businesses or government units that generate them.
1. These data are derived from a survey administered by RECYC-QUÉBEC, which is a public corporation charged with promoting reduction, reuse and recycling of Quebec's waste. To make these data comparable with other provincial data, some waste quantities generated by the construction, renovation and demolition sector have been removed from the RECYC-QUÉBEC totals.
Source:
Statistics Canada, 2004, *Waste Management Industry Survey: Business and Government Sectors, 2002*, Catalogue no. 16F0023XIE, Ottawa.

1 How much solid waste?

Just over 30.4 million tonnes of solid waste was generated in Canada in 2002, up slightly from 2000 (Table 1.1). Generation per capita amounted to 971 kg per person in 2002.

Household sources accounted for 39% of total waste generation in 2002. Industrial, commercial and institutional waste producers, and construction, renovation and demolition projects accounted for the rest.

Canadian households generated 12 million tonnes of waste in 2002, or 383 kg per capita—4.9% more per capita than in 2000 (Table 1.2). Ontario and Quebec accounted for 65% of the residential wastes generated in Canada in 2002.

Non-hazardous solid waste

The materials in non-hazardous solid waste generated by households tend to be fairly consistent across the country; waste from other sources is more variable in composition (Text Box 1.1). Studies conducted in cities across Canada reveal the composition of residential waste collected and managed by municipalities. By weight, organic materials originating from kitchens and yards make up the largest component of household waste. Newspapers and other paper fibres make up the second highest portion (Figure 1.1).

Text Box 1.1
Sources of non-hazardous solid waste

Non-hazardous solid waste comes from these sources:

- **residential**—waste from primary and seasonal dwellings, including all single family, multi-family, high-rise and low-rise residences.
- **construction, renovation and demolition**—includes materials such as concrete, brick, painted wood, rubble, drywall, metal, cardboard, doors, windows and wiring. It excludes materials from land clearing on areas not previously developed.
- **industrial, commercial and institutional**—waste generated by commercial operations such as shopping centres, restaurants and offices; and institutional waste generated by schools, hospitals and government facilities.

Source:
Statistics Canada, 2004, *Waste Management Industry Survey, 2002—Business and Government Sectors Survey Guide,* www.statcan.ca/english/sdds/2009.htm (accessed January 28, 2005).

1.1 Waste flow

Waste is generated across the economy—during extraction, production, distribution, and consumption activities (Figure 1.2). The waste may include emissions to air and water, as well as solid waste that is eventually landfilled or otherwise disposed of.

Solid wastes are dealt with in different ways depending on the source of the waste and the material involved. Wastes produced from primary production—agriculture, forestry, fisheries, mining and quarrying—are normally managed by these industries. Industrial waste from production activities ranging from food processing to computer manufacturing may be managed on-site or through contracts with private waste firms.

Distribution and commercial activities produce wastes that are normally managed through private contracts, but occasionally these wastes pass through municipally managed systems. Wastes from households include durable and non-durable goods such as old refrigerators, furniture, food waste and paper.

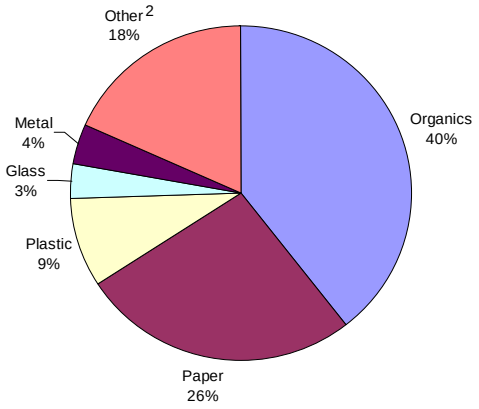
Preventing the initial generation of waste is the first step to minimizing the amount of waste going to disposal. Activities to reduce waste generation include re-designing

Table 1.2
Residential solid waste generated by province and territory, 2000 and 2002

Province/territory	2000	2002	2000	2002
	tonnes		kg per capita	
Newfoundland and Labrador	x	231 291	x	445
Prince Edward Island	x	x	x	x
Nova Scotia	246 792	252 012	262	270
New Brunswick	243 300	256 190	322	342
Quebec[1]	3 175 000	3 471 000	430	466
Ontario	4 191 337	4 388 239	359	363
Manitoba	501 921	494 535	438	428
Saskatchewan	305 901	321 069	299	323
Alberta	994 555	1 159 697	330	372
British Columbia	1 292 999	1 354 177	319	329
Yukon Territory, Northwest Territories and Nunavut	x	x	x	x
Canada	**11 242 405**	**12 008 338**	**365**	**383**

Notes:
Figures may not add up to totals due to rounding.
These data exclude solid waste and/or recyclable materials that are managed on-site by the households, businesses or government units that generate them.
1. These data are derived from a survey administered by RECYC-QUÉBEC, which is a public corporation charged with promoting reduction, reuse and recycling of Quebec's waste. To make these data comparable with other provincial data, some waste quantities generated by the construction, renovation and demolition sector have been removed from the RECYC-QUÉBEC totals.
Source:
Statistics Canada, 2004, *Waste Management Industry Survey: Business and Government Sectors, 2002*, Catalogue no. 16F0023XIE, Ottawa.

Figure 1.1
Composition of solid waste by weight, generated by households[1]



Notes:
1. This figure does not represent the composition for any identifiable Canadian community. Rather it is a national average of various municipal waste composition studies performed across Canada.
2. The other wastes category includes materials such as animal waste, textiles, tires and wood.

Source:
Statistics Canada, Environment Accounts and Statistics Division.

manufacturing processes to produce less waste and buying durable, long-lasting goods. Reusing products by repairing them or donating used clothing extends product life and decreases waste. Recycling takes used items that would otherwise be placed in landfills or incinerated, and remanufactures them to create new materials or products.

1.2 What drives waste generation?

Many factors affect waste production. As the population increases, total waste production also increases.

Rising incomes and consumption of more goods can lead to more waste.[1] Studies show that amount of waste generated often increases along with gross domestic product (GDP). Decoupling waste generation from economic growth is a goal of environmental policy.[2]

1. Orians, Carlyn E. and Marina Skumanich, 1997, *The Population–Environment Connection,* U.S. Environmental Protection Agency, www.seattle.battelle.org/Services/ES/pop-env/ch05.htm (accessed February 1, 2005).
2. Organisation for Economic Co-operation and Development, 2004, *Towards Waste Prevention Performance Indicators,* Environment Directorate.

Figure 1.2
Solid waste flows

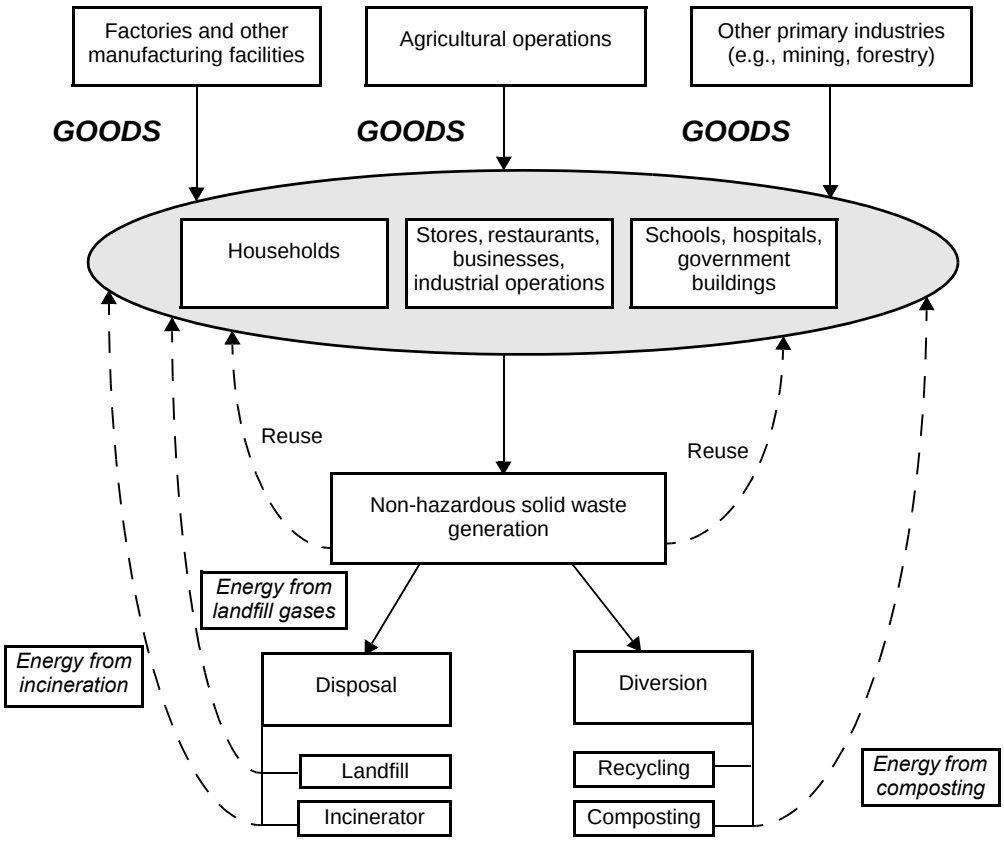
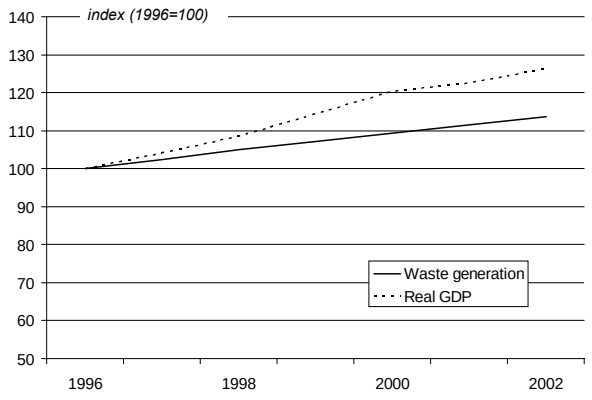


Figure 1.3
Solid waste generation and real GDP, 1996 to 2002



Source:
Statistics Canada, Income and Expenditure Accounts Division and Environment Accounts and Statistics Division.

While growth in the Canadian economy has certainly influenced the nation's production of solid waste, GDP over the 1996 to 2002 period grew slightly faster than waste generation (Figure 1.3).

Changes in the structure of the economy, such as growth in activities that are less waste-intensive than others, may lead to less waste production. For example, service industries typically produce less waste than manufacturing or primary sector industries such as agriculture, mining and forestry. The type of waste produced also differs.

Richer countries tend to generate more waste than poorer countries. A 1995 study on municipal waste showed that high-income countries produced one-quarter of the world's municipal waste, but accounted for only one-sixth of the world's population.[1]

Another driver of waste generation is changes in society, such as the trend toward fewer people per household. Census data show that in 1981 households consisting of one or two people represented 49% of all households; by 2001, they accounted for 58%.[2] All households, regardless of size or composition, consume certain basic goods such as furniture, appliances, newspapers and other products. When there are fewer members in each household to share these goods, per capita consumption and waste generation tend to go up.

Changing consumer preference for disposable and convenience items can also make for more waste. From plastic bags, paper plates and polystyrene cups to disposable diapers and facial wipes, disposable products quickly end up in the trash. Packaging wastes, including cardboard boxes, bags, plastic trays, and plastic film, are also thrown out.

Other products become obsolete soon after production and must be replaced. Affordability coupled with expiry dates, technological obsolescence, and newer styles in everything from running shoes to televisions reflect our "disposable society". It's usually cheaper to buy new than to repair or upgrade.

Concern for the environment has resulted in new legislation, government and industry waste minimization programs, and public effort in reducing and re-using, which can all contribute to reducing the amount of waste being produced (see section 3, **Response**).

1. Beede, David N. and David E. Bloom, 1995, *Economics of the Generation and Management of Municipal Solid Waste*, National Bureau of Economic Research, Working Paper No 5116.

2. Statistics Canada, 2002, "Profile of Canadian families and households: Diversification continues," *2001 Census*, www.12.statcan.ca/english/census01/Products/Analytic/companion/fam/contents.cfm (accessed January 7, 2005).

2 Solid waste management activities and impacts

2.1 Solid waste management

Solid waste is managed in one of several ways: formally, by waste management firms or local government bodies, or on-site by the waste generator (e.g., disposal facilities owned and operated by industry, backyard composting or barrel burning).

How solid waste is managed—whether it is landfilled, incinerated, recycled, composted or exported—will depend on the source and type of waste involved. Waste management may also differ depending on who is providing the service, the type and capacity of waste facilities, government policies, legislation and other factors. Text Box 2.1 lists elements that can be included in a solid waste management system. Not all systems contain all these elements.

Residential solid waste

More than 12 million tonnes of residential solid waste were generated by Canadian households in 2002 (Table 2.1). Of this, 2.5 million tonnes were diverted,[1] and 9.5 million tonnes were disposed of in landfills or incinerators—about 302 kg of household waste for each Canadian, an increase of more than 2% from 2000 (Figure 2.1).

Text Box 2.1
Elements of a solid waste management system

Waste generation: Unwanted materials and products enter the waste stream.

Waste handling, separation and storage at source: Waste and recyclable materials are sorted, placed in bags or containers, stored until collection, then transported to the collection point.

Collection, transfer and transport: Wastes and recyclable materials are collected from homes, businesses, institutions, industry and other places, then taken to materials recovery facilities (MRFs), transferred onto larger vehicles at transfer stations, or taken directly to disposal facilities.

Separation and processing: Commingled waste is separated, recyclables are recovered and separated waste is processed further at MRFs, transfer stations, incinerators, and landfills.

Final disposal: Collected wastes are transported to landfills and incinerators and disposed of. Residual materials from MRFs and composting facilities, as well as ash from incineration are also disposed of.

Source:
Tchobanoglous, George, Frank Kreith, and Marcia E. Williams, 2002, "Chapter 1 Introduction", in *Handbook of Solid Waste Management*, George Tchobanoglous and Frank Kreith (eds.), 2nd ed., New York: McGraw-Hill.

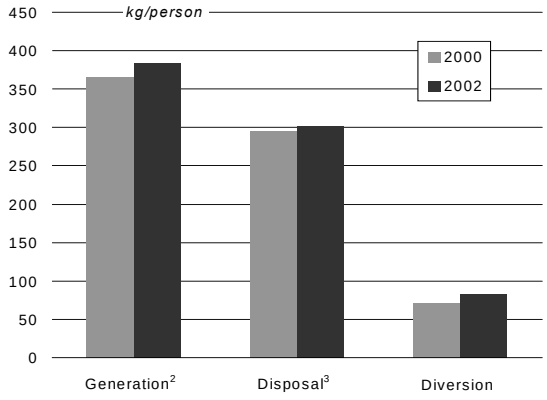
1. Waste diversion refers to waste that has been diverted from disposal. It includes all materials processed for recycling or reuse at an off-site recycling or composting facility. It does not include diversion carried out separately by producers through deposit-return schemes and other programs.

Table 2.1
Generation, disposal and diversion of residential solid waste by province and territory, 2000 and 2002

Province/territory	Generation[1]		Disposal[2]		Diversion	
	2000	2002	2000	2002	2000	2002
	tonnes					
Newfoundland and Labrador	x	231 291	x	216 218	x	15 073
Prince Edward Island	x	x	x	x	x	x
Nova Scotia	246 792	252 012	171 627	169 649	75 165	82 363
New Brunswick	243 300	256 190	198 603	203 506	44 697	52 685
Quebec[3]	3 175 000	3 471 000	2 679 000	2 876 000	496 000	595 000
Ontario	4 191 337	4 388 239	3 318 478	3 438 408	872 859	949 830
Manitoba	501 921	494 535	451 505	412 612	50 416	81 923
Saskatchewan	305 901	321 069	272 104	278 692	33 797	42 376
Alberta	994 555	1 159 697	824 990	866 398	169 565	293 300
British Columbia	1 292 999	1 354 177	890 789	936 774	402 209	417 403
Yukon Territory, Northwest Territories and Nunavut	x	x	x	x	x	x
Canada	**11 242 405**	**12 008 338**	**9 069 170**	**9 455 204**	**2 173 236**	**2 553 134**

Notes:
Figures may not add up to totals due to rounding.
These data exclude solid waste and/or recyclable materials that are managed on-site by the households, businesses or government units that generate them.
1. Generation equals the sum of disposal and diversion.
2. The total amount of non-hazardous waste disposed of in public and private waste disposal facilities; this includes waste that is exported out of the source province or the country for disposal.
3. These data are derived from a survey administered by RECYC-QUÉBEC, which is a public corporation charged with promoting reduction, reuse and recycling of Quebec's waste. To make these data comparable with other provincial data, some waste quantities generated by the construction, renovation and demolition sector have been removed from the RECYC-QUÉBEC totals.
Source:
Statistics Canada, 2004, *Waste Management Industry Survey: Business and Government Sectors, 2002*, Catalogue no. 16F0023XIE, Ottawa.

Figure 2.1
Per capita generation, disposal and diversion of residential solid waste, 2000 and 2002[1]



Notes:

These data exclude solid waste and/or recyclable materials that are managed on-site by the households, businesses or government units that generate them.
1. The Quebec component of these data was derived from a survey administered by RECYC-QUÉBEC, which is a public corporation charged with promoting reduction, reuse and recycling of Quebec's waste. To make these data comparable with other provincial data, some waste quantities generated by the construction, renovation and demolition sector have been removed from the RECYC-QUÉBEC totals.
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Source:
Statistics Canada, 2004, *Waste Management Industry Survey: Business and Government Sectors, 2002*, Catalogue no. 16F0023XIE, Ottawa.

Non-residential waste

Non-residential solid waste includes waste from industrial, commercial, institutional and construction, renovation and demolition sources. Some commercial waste may be picked up along residential collection routes, but most is collected by private companies who contract with the waste generators.

Most construction, renovation and demolition (CR&D) waste, including asphalt, wood, metals, gypsum, roofing and other materials, is managed in special CR&D landfills. Small amounts of CR&D waste from home renovation projects may also be included in the residential waste stream.

Non-residential sources generated more than 18 million tonnes of waste material in 2002 (Table 2.2). Refuse from industrial, commercial and institutional sources disposed of off-site in landfills or incinerators accounted for 11.6 million tonnes of this waste; 3.5 million tonnes (23%) were diverted. While over 16% of CR&D waste was diverted, more than 2.8 million tonnes were landfilled or incinerated.

2.2 Landfills

Landfilling—the disposal of waste on the surface of the earth—is the most common way to dispose of waste in Canada.

Table 2.2
Generation, disposal and diversion of non-residential solid waste by source, province and territory, 2000 and 2002

	Generation				Disposal[1]				Diversion			
	Industrial, commercial and institutional		Construction, renovation and demolition		Industrial, commercial and institutional		Construction, renovation and demolition		Industrial, commercial and institutional		Construction, renovation and demolition	
Province/territory	2000	2002	2000	2002	2000	2002	2000	2002	2000	2002	2000	2002
	tonnes											
Newfoundland and Labrador	x	x	x	x	146 843	140 377	x	19 999	x	x	x	x
Prince Edward Island	x	x	x	x	x	x	x	x	x	x	x	x
Nova Scotia	x	x	x	x	x	176 625	x	42 921	x	x	x	x
New Brunswick	x	216 432	x	63 941	x	154 812	x	55 288	x	61 620	x	8 653
Quebec[2]	3 581 000	3 196 000	589 200	619 800	2 655 000	2 261 000	472 200	406 800	926 000	935 000	117 000	213 000
Ontario	5 962 866	6 514 191	1 139 271	1 158 701	4 606 409	5 193 240	1 006 714	1 013 985	1 356 460	1 320 952	132 557	144 716
Manitoba	x	566 750	x	86 151	x	405 954	x	77 990	x	160 796	x	8 161
Saskatchewan	x	x	x	x	x	441 109	x	75 323	x	x	x	x
Alberta	x	1 642 843	x	677 395	x	1 380 306	x	643 590	x	262 537	x	33 805
British Columbia	x	1 933 387	x	562 457	1 264 056	1 346 669	426 490	461 458	x	586 719	x	100 999
Yukon Territory, Northwest Territories and Nunavut	x	x	x	x	x	x	x	x	x	x	x	x
Canada	**14 776 041**	**15 075 307**	**3 288 961**	**3 371 880**	**11 203 613**	**11 563 999**	**2 896 087**	**2 816 528**	**3 572 428**	**3 511 308**	**392 874**	**555 352**

Notes:
Figures may not add up to totals due to rounding.
These data exclude solid waste and/or recyclable materials that are managed on-site by the households, businesses or government units that generate them.
1. The total amount of non-hazardous waste disposed of in public and private waste disposal facilities; this includes waste that is exported out of the source province or the country for disposal.
2. These data are derived from a survey administered by RECYC-QUÉBEC, which is a public corporation charged with promoting reduction, reuse and recycling of Quebec's waste. To make these data comparable with other provincial data, some waste quantities generated by the construction, renovation and demolition sector have been removed from the RECYC-QUÉBEC totals.
Source:
Statistics Canada, 2004, *Waste Management Industry Survey: Business and Government Sectors, 2002*, Catalogue no. 16F0023XIE, Ottawa.

Table 2.3
Total solid waste disposed of by selected disposal facility characteristics,[1] by province and territory, 2000

Province/territory	Ownership		Presence of a leachate collection system	
	Public	Private	Yes	No
	tonnes			
Newfoundland and Labrador	x	x	x	x
Prince Edward Island	x	x	x	x
Nova Scotia	281 859	109 968	280 062	111 764
New Brunswick	x	x	x	x
Quebec[2]	2 148 579	3 657 621	4 636 767	1 169 433
Ontario	4 860 052	4 071 548	7 754 783	1 176 817
Manitoba	692 698	221 813	759 205	155 306
Saskatchewan	x	x	110 565	711 381
Alberta	1 890 380	859 624	1 717 563	1 032 441
British Columbia	1 349 161	1 232 175	1 720 222	861 114
Yukon Territory, Northwest Territories and Nunavut	x	x	x	x
Canada	**12 914 010**	**10 254 860**	**17 412 932**	**5 755 938**

Notes:
1. The total amount of non-hazardous waste disposed of in public and private waste disposal facilities; this includes waste that is exported out of the source province or the country for disposal.
2. These data are derived from a survey administered by RECYC-QUÉBEC, which is a public corporation charged with promoting reduction, reuse and recycling of Quebec's waste. To make these data comparable with other provincial data, some waste quantities generated by the construction, renovation and demolition sector have been removed from the RECYC-QUÉBEC totals.

Source:
Statistics Canada, Waste Management Industry Survey: Business and Government Sectors, 2000.

Canada's landfills accepted 23 million tonnes of waste in 2000, 95% of the total amount disposed of at waste disposal facilities (the remaining 5% was incinerated). Although 83% of all waste disposal facilities in Canada are publicly run, such facilities dispose of only 56% of waste. Privately-run facilities dispose of the other 44% (Table 2.3). Landfills are located in every province and territory (Map 2.1).

While some landfills have been in use for decades, such older facilities are gradually being replaced with modern ones. In 2000, 30% of landfills reported having an expected remaining life of between zero and ten years. More than half of all waste landfilled in 2000 was disposed of in these facilities.[1]

Impacts of landfills

Modern landfills are designed to protect human health and the environment. Vastly different from old-style dumps, landfills are designed with liners to control leachate and gas emissions. Most importantly, they are sited carefully with regard to the natural conditions of the area.

Some landfills still have significant environmental impacts and may continue to affect the environment long after they have been retired. In 2000, 35% of Canadian landfills were more than 20 years old.[2] These landfills managed 44% of waste disposed of in all landfills.

1. Statistics Canada, Waste Management Industry Survey: Business and Government Sectors, 2000.
2. *Ibid*.

Landfill siting must take into account soil conditions, hydrology and topography, climate, local environmental issues, hauling distances, land use patterns, public opinion, and other issues. Balancing conflicting considerations may be difficult. While one area may provide an ideal landfill location from a geological point of view, public concerns over land use and other impacts may make the area selected unsuitable.

Leachate

Two major environmental concerns with regard to landfills are leachate and landfill gases. Leachate, a mixture of water and dissolved solids, is produced as water passes through waste and collects at the bottom of a landfill. While the exact composition of leachate depends on the type of waste and its stage of decomposition, leachate may contain a variety of toxic and polluting components, in large or trace amounts.[3] If managed improperly, leachate can contaminate ground and surface water.

New sanitary landfills incorporate liners to prevent leachate from moving into groundwater, as well as collection and treatment systems for leachate. In the year 2000, 46% of landfills reported that they had a landfill liner and 18% reported having a leachate collection system in place. These facilities managed approximately three-quarters of the waste disposed of in landfills.[4]

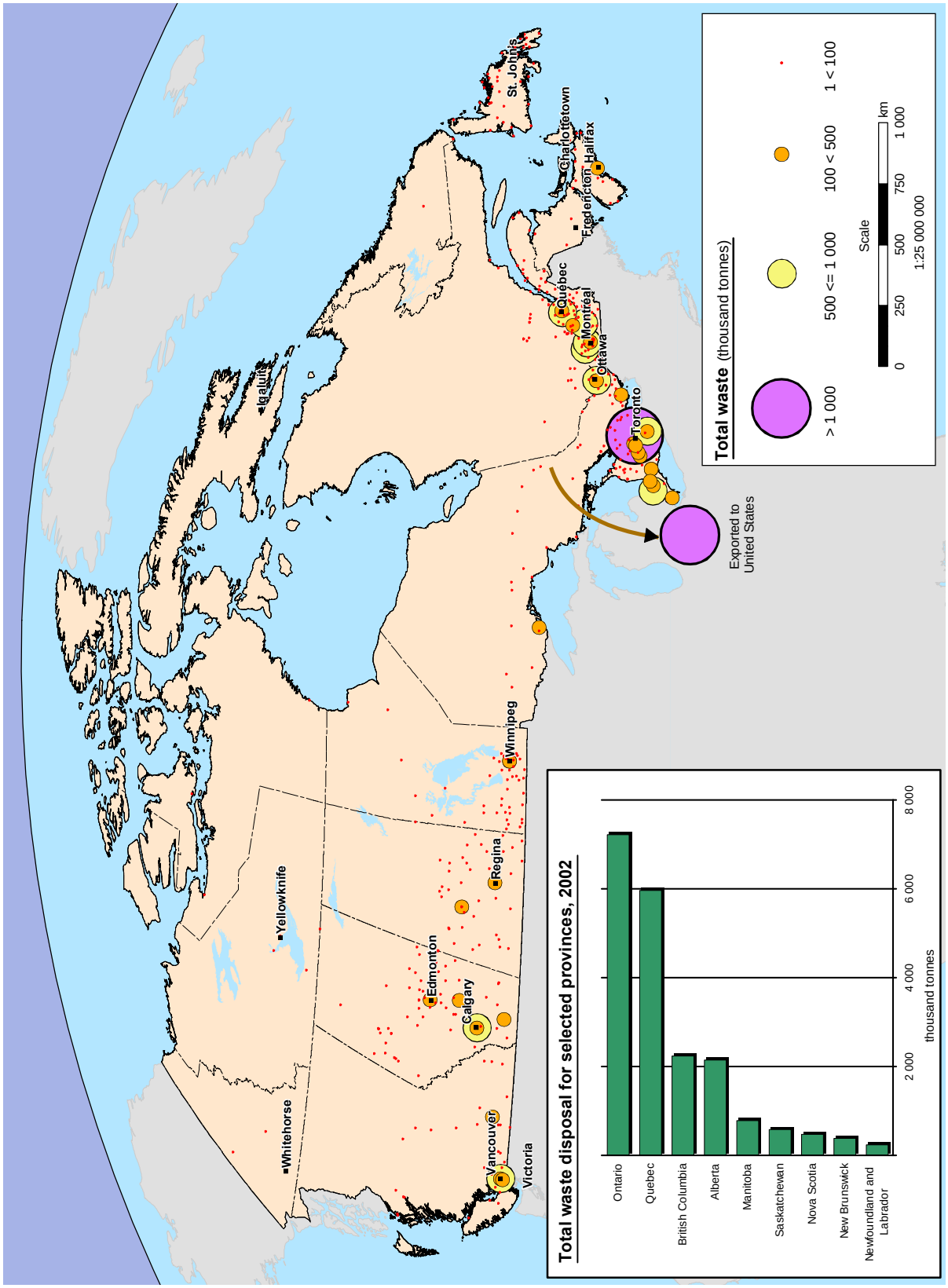
Landfill gas

Biodegrading waste in landfills produces landfill gas, a mixture of carbon dioxide and methane, small amounts of nitrogen and oxygen, and trace amounts of a wide range of other gases such as benzene, toluene, and vinyl chloride. Some components of landfill gas may be toxic or explosive; other components can include ammonia, hydrogen sulphide and other organo-sulphur compounds, which produce the characteristic bad odour associated with landfills.[5]

Landfill gas production depends on the waste composition—the more organic waste present, the more gas is produced by bacterial decomposition. Other factors such as temperature, moisture content, and the age of the waste also affect production.[6]

3. O'Leary, Philip R. and George Tchobanoglous, 2002, "Landfilling," in *Handbook of Solid Waste Management*, George Tchobanoglous and Frank Kreith (eds.), 2nd ed., New York: McGraw-Hill.
4. Statistics Canada, Waste Management Industry Survey: Business and Government Sectors, 2000.
5. Cheremisinoff, Nicholas P., 2003, *Handbook of Solid Waste Management and Waste Minimization Technologies,* Amsterdam: Butterworth Heinemann.
6. Agency for Toxic Substances and Disease Registry, November 2001, *Landfill Gas Primer, An Overview for Environmental Health Professionals,* www.atsdr.cdc.gov/HAC/landfill/html/toc.html (accessed October 9, 2004).

Map 2.1
Approximate location of landfills



Source:
Statistics Canada, Environment Accounts and Statistics Division

Landfill gas is also a greenhouse gas (GHG). In 2002, solid waste disposal on land produced 22 megatonnes of emissions, accounting for 3% of all GHGs produced in Canada.[1]

In some cases, landfill gas is flared to reduce odour and convert methane into carbon dioxide, a less potent greenhouse gas. In other cases, landfill gases are collected and can be used as a substitute fuel or to generate electricity. In 2001, 41 landfills captured landfill gas.[2] Some of Canada's largest landfill gas projects are listed in Text Box 2.2.

Landfill closure

Environmental monitoring of landfills is important, both while they are operating and after they have closed. Closed landfills are covered to prevent water entry, limit the migration of landfill gases, and to prevent the growth of disease-spreading organisms.

Landfills are an important component of a waste management system. Other methods of dealing with waste, such as incineration and recycling, produce their own waste, which must also be landfilled. Landfills can become a resource, not only for gas recovery, but also as a recreational area after closure. The recovery of valuable recyclable materials placed in landfills, called landfill mining, may also be a future option.

Text Box 2.2
Some landfill gas projects in Canada

Canadian landfills are beginning to implement gas-to-energy and gas utilization projects to make use of landfill gas. The following are some of the larger projects:

Keele Valley Landfill Site: Landfill gas is collected, cleaned, and used to produce electricity at this Toronto landfill. The project is one of the largest of its type in the world. In 2001, 119 million m^3 of methane were captured.

Brock West Landfill Site: The first landfill gas electricity generation project in Canada, this Toronto landfill captured 40.6 million m^3 of methane in 2001.

Saint Michel Landfill Site: Landfill gas is captured and used to generate electricity at this Montreal landfill. In 2001, 74.7 million m^3 of methane were captured.

Lachenaie Landfill Site: Landfill gas is collected and combusted in power generation stations to produce electricity for sale to Hydro-Quebec. In 2001, 33 million m^3 of methane were captured.

Vancouver Landfill Site: Electricity is generated using landfill gas for sale to BC Hydro. Heat is also produced for nearby greenhouses. In 2001, 13.6 million m^3 of methane were captured.

Clover Bar Landfill Site: Gas is collected, treated, and transported to the Clover Bar Generating Station near Edmonton, where it is used, along with natural gas, to generate electricity. In 2001, 12.5 million m^3 of methane were captured.

Source:
Environment Canada, 2003, *Landfill gas utilization, www.ec.gc.ca/nopp/lfg/* (accessed November 26, 2004).

2.3 Incineration

Incineration includes a wide range of practices, from low-tech open burning—which emits pollutants directly into the air—to controlled combustion processes using mass burn systems,[3] refuse-derived fuel (RDF)[4] systems and other types of modern incinerators using pollution control devices.

In 2000, 21 incinerators disposed of 1.1 million tonnes of solid waste, only 5% of the total amount of waste disposed of in Canada.[5] This total does not include incineration at the site of waste production, such as that done by the forest and wood products industries, hospitals, and other industries and institutions.

Open burning at dumps and burning in backyard barrels were once common forms of waste disposal in North America. However, these practices have been discouraged over concern for their impact on health and the environment. Although new technologies have been developed, modern incinerators, fitted with pollution abatement equipment, require high capital investment.

Although less frequently used in Canada, incineration is a common waste management practice in some European and Asian countries, where space for landfills is at a premium.

Impacts of incineration

While incineration has the benefit of reducing the volume of waste to be disposed of, a major concern is for its impact on health and the environment—especially the impact caused by air pollution.

Modern incinerators are designed to burn waste at very high temperatures, often over 1 000°C, and are equipped with pollution abatement devices. Older incinerators and open burning emit more pollutants per unit of waste handled.

1. Environment Canada, 2004, *Canada's Greenhouse Gas Inventory, 1990-2002,* www.ec.gc.ca/pdb/ghg/1990_02_report/1990_02_report_e.pdf (accessed October 26, 2004).
2. Environment Canada, 2003, *Landfill Gas,* www.ec.gc.ca/nopp/lfg/en/index.cfm (accessed January 20, 2005).
3. Mass burn systems incinerate solid waste without separating out recyclables or processing the waste before burning.
4. Refuse-derived fuel (RDF) systems process waste, separating out non-combustibles and sometimes compressing it into pellets, before burning.
5. Statistics Canada, Waste Management Industry Survey: Business and Government Sectors, 2000.

Air emissions

Incineration produces various types of pollutants, some of which if not captured by a pollution abatement system, are emitted into the atmosphere.

Particulate matter, a category of air pollutants that consists of small solids and liquids of varying size and chemical composition, is commonly a by-product of incineration. In 2000, municipal incineration released into the atmosphere: 578 tonnes of particulate matter; 1 596 tonnes of sulphur oxides (SOx); 695 tonnes of nitrogen oxides (NOx); 989 tonnes of volatile organic compounds (VOCs); and 3 421 tonnes of carbon monoxide (CO).[1]

Sulphur dioxide and NOx contribute to acid rain. Nitrogen oxides also react with VOCs in the presence of sunlight to form ground-level ozone, a major component of smog. Metals such as lead, cadmium, mercury, chromium, zinc, and nickel may be released as ash, to be deposited over surrounding areas. Organic pollutants, such as dioxins and furans, which are highly toxic, are also products of incineration.

In 2002, greenhouse gas emissions from waste incineration including solid waste and sewage sludge, reached 350 kilotonnes.[2]

Waste from incineration

Metals and other contaminants are found in fly ash captured by pollution abatement systems and in bottom ash left over from the incineration process. Separating out non-combustibles, such as metals and glass, from solid waste can help reduce the production of toxic gases and ash.

Ash left over from the incineration process is collected, and can be used for other purposes if tests show that it contains low levels of contaminants. Contaminated ash must be carefully disposed of to prevent pollution. Bottom ash is often disposed of in landfills or used as landfill cover, and can sometimes be recycled into aggregate and similar products.

Wastewater is also generated during incineration, mainly from gas treatment processes. It may be contaminated with metals and other materials, requiring further cleanup.[3]

Waste-to-energy systems

Another potential benefit of incinerating waste is energy production. Waste-to-energy systems use the heat produced through the combustion of solid waste to power operations, heat buildings or generate electricity.

However, incineration—and waste-to-energy combustion in particular—requires waste with sufficient heating value that it will burn without using additional fuel. Diverting highly combustible materials from incineration, such as paper and plastics, lowers incinerator performance and can reduce energy output.[4]

2.4 Recycling

Recycling involves collection, separation and processing of materials for manufacture into raw materials or new products. Recyclable materials must be collected and sorted before being sold. Contaminating recyclable materials, by including papers tainted with food waste or even by mixing different colors of glass, reduces the quality of the material.

The amount of material recycled fluctuates from year to year. It is affected by changing economic factors such as growth and consumption as well as the price of raw materials and recyclables. Changes in recycling programs, industry commitment and public awareness may also affect the amount of material recycled.

Recycling is not just putting materials in a box at the curb: collection is only the start of the process. Markets must exist for recyclable materials and buyers for products made with recycled materials must be found.

Recycling in Canada

Recycling in Canada has grown over the past 20 years to the point where it is a widespread and accepted part of waste management services. In 2002, 6.6 million tonnes of non-hazardous waste materials were prepared for recycling by local waste management organizations and companies. Mixed paper and organic material[5] made up the bulk of material recycled, accounting for 23% and 18% respectively of the 2002 total (Table 2.4). Industrial, commercial and institutional sources provided just over one-half of the materials prepared for recycling. Households accounted for 39% of the materials prepared for recycling in 2002. These figures do not include recycling carried out separately by producers through deposit-return schemes and other programs.

1. Environment Canada, Pollution Data Branch, 2004, *Criteria Air Contaminant Emission Summaries,* www.ec.gc.ca/pdb/ape/ape_tables/canada2000_e.cfm (accessed February 4, 2005).
2. Environment Canada, 2004, *Canada's Greenhouse Gas Inventory, 1990-2002,* www.ec.gc.ca/pdb/ghg/1990_02_report/1990_02_report_e.pdf (accessed October 26, 2004).
3. Williams, P.T., 2002, "Emissions from Solid Waste Management Activities," in *Environmental and Health Impact of Solid Waste Management Activities,* R.E. Hester and R.M. Harrison (eds.), Cambridge: The Royal Society of Chemistry.
4. Cheremisinoff, Nicholas P., 2003, *Handbook of Solid Waste Management and Waste Minimization Technologies,* Amsterdam: Butterworth Heinemann.
5. Recycling of organic material is carried out through composting, and is discussed in section 2.5, **Composting**.

Table 2.4
Materials prepared for recycling by type, province and territory, 2002

Type of material	N.L.	P.E.I.	N.S.	N.B.	Que.[1]	Ont.	Man.	Sask.	Alta.	B.C.	Y.T., N.W.T. and Nvt.	Canada 2000[r]	Canada 2002
							tonnes						
Newsprint	x	x	22 131	6 764	..[2]	544 752	45 165	15 564	57 201	104 065	x	…	…
Cardboard and boxboard	x	x	12 476	12 231	..[2]	407 325	x	18 207	46 230	178 251	x	…	…
Mixed paper	x	x	2 627	4 265	946 000[2]	328 443	4 245	14 194	28 466	190 047	x	…	…
Glass	x	x	2 824	x	71 000	173 905	2 619	x	x	34 231	x	342 928	339 132
Ferrous metals	x	x	2 775	x	111 000	267 254	x	x	x	127 925	x	715 216	808 596
Copper and aluminum	x	x	x	x	11 000	19 927	x	x	x	1 965	x	54 585	44 070
Other metals	x	0	x	x	..	49 071	x	x	10 595	40 376	x	167 857	117 560
Plastics	x	x	1 560	1 038	52 000	42 770	2 548	910	8 280	34 100	x	170 637	152 266
Construction, renovation and demolition	0	x	53 359	30 153	213 000	225 282	581	x	x	162 168	0	494 683	702 202
Organics	0	x	62 341	62 725	246 000	293 328	16 261	x	261 069	198 996	x	979 787	1 170 790
Other materials	x	0	1 117	1 262	93 000	63 442	9 067	x	41 730	32 997	x	281 679	259 321
Total	**38 386**	**x**	**169 724**	**122 957**	**1 743 000**	**2 415 498**	**250 880**	**146 607**	**589 642**	**1 105 121**	**x**	**6 138 536**	**6 619 794**

Notes:
Figures may not add up to totals due to rounding.
These data exclude solid waste and/or recyclable materials that are managed on-site by the households, businesses or government units that generate them.
1. These data are derived from a survey administered by RECYC-QUÉBEC, which is a public corporation charged with promoting reduction, reuse and recycling of Quebec's waste. To make these data comparable with other provincial data, some waste quantities generated by the construction, renovation and demolition sector have been removed from the RECYC-QUÉBEC totals.
2. All paper fibres prepared for recycling in Quebec, including newsprint, cardboard and boxboard, are reported under mixed paper.
Source:
Statistics Canada, 2004, *Waste Management Industry Survey: Business and Government Sectors, 2002*, Catalogue no. 16F0023XIE, Ottawa.

An estimated 2 698 kilotonnes of waste paper were recycled by Canadian paper mills in 2003. Since 1995, over 40% of waste paper has been recycled each year, compared with only 26% in 1990 (Figure 2.2).

Impacts of recycling

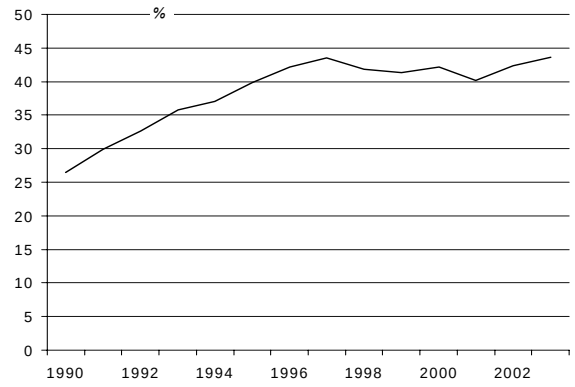
Throughout the 1980s and 1990s, concerns over landfill capacity and pollution from landfills and incinerators inspired interest in ways of reducing the amount of waste going for disposal. The public quickly embraced recycling as a favourite method of reducing the amount of waste going to landfills.

Resource use

Concerns over waste disposal encouraged people to recycle. But the main environmental benefits of recycling may in fact come from reducing extraction and production of virgin resources. Text Box 2.3 lists various products created using recycled materials.

Recycling generally has less impact on the environment than does manufacturing new materials into usable products. For example, studies have shown that producing paper from recycled materials uses less energy and creates fewer air and water emissions and less solid waste.[1]

Figure 2.2
Total waste paper recycled, 1990 to 2003



Source:
Statistics Canada, Environment Accounts and Statistics Division

Recycling aluminum and other metals also reduces the amount of waste generated by mining and materials processing. Recycling aluminum cans saves 95% of the energy that would have been required to produce the same aluminum from virgin bauxite.[2]

However, recycling is not impact-free—recycling operations require energy and water and can produce dust particles, waste water and other emissions. As well, process residues left over from recycling must be disposed of.

1. Williams, P.T., 2002, "Emissions from Solid Waste Management Activities," in *Environmental and Health Impact of Solid Waste Management Activities,* R.E. Hester and R.M. Harrison (eds.), Cambridge: The Royal Society of Chemistry.

2. United States Environmental Protection Agency, 2004, *Frequently asked questions about recycling and waste management,* www.epa.gov/epaoswer/non-hw/muncpl/faq.htm (accessed November 19, 2004).

Text Box 2.3
Recycled products

The following table lists examples of some of the many products produced from recycled waste materials:

Material	Post-recycled product
Anti-freeze	Recycled anti-freeze
Batteries	Lead, plastic
Cardboard	Boxboard, linerboard
Fluorescent lamps	Mercury, aluminum
Glass	Arts and crafts, bottles, jars, architectural blocks and tiles, drainage rock
Gypsum wallboard	Remanufactured gypsum wallboard
Laser toner cartridges	Remanufactured cartridges
Mattresses	Remanufactured mattresses
Metal	Cans, auto parts, steel beams, industrial products
Newspaper	Newsprint, telephone books, insulation
Styrofoam packing chips	Reused packing material
Tires	Rubber mats, paving bricks, running tracks, playground surfaces
Used oil	Re-refined motor oil
Paper	Recycled writing paper, photocopy and tissue paper, linerboard, egg cartons, roofing paper, low-grade writing paper
Plastic	Non-food containers, auto parts, carpets, fleece jackets, plastic wood products, clothing, furniture, clipboards, arts and crafts materials, plastic play structures
Used oil filters	Re-refined motor oil, metal, rubber

Sources:
University of British Columbia Waste Management Program, n.d., *Our Recycled Products,* www.recycle.ubc.ca/where.html (accessed November 18, 2004).
Amazing Recycled Products Inc., 2005, *General Product Line List,* www.amazingrecycled.com/genlprod.html (accessed January 12, 2005).
The American Plastics Council, n.d., *Recycled Plastic Products Directory,* www.plasticsresource.com/s_plasticsresource/index.asp (accessed November 18, 2004).

Costs of recycling

Establishing recycling programs entails start-up costs to buy collection vehicles, distribute containers to participants and build materials recovery facilities. As a rule, programs aim to offset operating costs through the sale of recovered materials. However, since prices for recyclables can fluctuate widely with changing market conditions, some recycling programs have found it difficult to cover these costs. [1]

It can be argued that, due to the volatility of the recyclables market, recycling can be more expensive than traditional disposal. However, fair comparisons must also consider the costs of maintaining landfills and incinerators as well as the costs of building new landfills and monitoring those that have been closed. In addition, the environmental impacts—emissions to air, water and land—must also be factored in when comparing a recycling program to disposing of recyclable materials in landfills.

1. Corporations Supporting Recycling, n.d., *The Price Sheet,* www.csr.org/pricesheet/pricesheet.htm (accessed June 20, 2005).

Text Box 2.4
Vermicomposting

For people who wish to compost, but who don't have a large backyard or access to centralized composting, vermicomposting (composting with worms) may be an option. Red wriggler worms, *Eisenia foetida* and *lumbricus rubellus,* are stored in a worm bin and transform organic material into a rich compost.

For household use, a 53 L plastic storage bin, with holes added for aeration and drainage, is commonly used. Raw food wastes such as fruit and vegetable peelings are placed in the bin and covered with bedding material (moistened shredded newspaper, cardboard, leaves, sawdust, dried grass clipping, and some dirt or sand). Over time, the worms eat the bedding and food wastes and produce worm castings, which can be used as a soil amendment or fertilizer for gardening.

Source:
Greater Vancouver Regional District, 2001, *Guide to Composting with Worms*, www.gvrd.bc.ca/recycling-and-garbage/composting.htm (accessed November 22, 2004).

Other methods of comparing costs can be used to determine the environmental impact of recycling versus manufacturing products from virgin materials. Life cycle approaches try to account for how much energy and raw materials are used and how much solid, liquid and gaseous wastes are generated at each stage of a product's life.

2.5 Composting

Composting is a process whereby organic wastes are decomposed by micro-organisms such as bacteria and fungi, as well as by worms (Text Box 2.4) and insects. Micro-organisms eat the carbon and nitrogen in organic waste materials. As waste is digested, heat is produced, helping to kill pathogens. The final product is a stable humus or compost, which can be used for landscaping, gardening, or other purposes.

Organic waste including kitchen waste, yard waste, agricultural waste, biosolids and other types of waste can all be composted successfully using different methods.

Composting in Canada

While gardeners everywhere are familiar with backyard composting, composting is also done on a much larger scale in Canada.[2] Centralized composting facilities have become more common since the early 1990s. These are used by households and commercial establishments alike. As well, some businesses and other organizations in the industrial, commercial and institutional sectors use on-site composting facilities.

2. Large-scale composting technologies include windrows, static aerated piles, and in-vessel systems. Wastes can also be digested in an oxygen-free environment using anaerobic digesters.

Table 2.5
Number of centralized composting facilities, 2000 and 2002

Province/territory	2000	2002
	number	
Newfoundland and Labrador	3	11
Prince Edward Island	x	x
Nova Scotia	16	20
New Brunswick	9	12
Quebec[1]	43	37
Ontario	79	99
Manitoba	21	33
Saskatchewan	21	28
Alberta	32	64
British Columbia	29	41
Yukon Territory, Northwest Territories and Nunavut	x	x
Canada	**255**	**351**

Note:
1. Figures are derived from the results of surveys conducted by the province.
Source:
Statistics Canada, Waste Management Industry Survey: Business and Government Sectors, 2000 and 2002.

In 2002, 1.2 million tonnes of organic waste were composted at centralized composting facilities (Table 2.4). The amount of organic waste diverted through backyard composters or composted on-site by industry is not available.

In 2002, 351 centralized facilities composted organic waste, compared with 255 in 2000 (Table 2.5). Figures from the Composting Council of Canada, though not directly comparable, show approximately 160 centralized composting facilities operating a decade ago in Canada.[1]

Impacts of composting

Composting offers several benefits:

- It reduces pressure on landfill space by diverting organic waste away from landfills;
- It means that less organic material is going into landfills, and therefore less leachate and odour are being produced;
- It can provide a valuable resource. For example, when added to soil, compost can improve the soil's organic matter content, water-holding capacity and fertility.

However, composting must be managed properly so as not to cause disagreeable odours or attract pests. If compost piles are allowed to become too wet or are infrequently turned, anaerobic digestion may take over, generating odours as well as methane.

Large-scale compost facilities need to take into account leachate production and run-off to ensure that contaminants do not enter groundwater or surface water.

1. Composting Council of Canada, n.d., *25 Questions and Answers about Composting,* www.compost.org/qna.html, 1995 (accessed October 13, 2004).

Health issues

Concern has been voiced over potential health problems such as allergy or infection caused by exposure to compost micro-organisms at large-scale composting facilities. While precautions should be taken, studies of compost workers show a low incidence of serious negative health effects.[2]

Airborne bacteria, fungi and other micro-organisms have been found in higher concentrations in and around large-scale composting facilities, especially during shredding, turning or screening operations. However, concentrations quickly drop to background levels within a short distance.[3] As well, pathogenic bacteria that may be present in compost, especially compost containing animal manures or biosolids, are normally destroyed by the heat generated by the composting process.[4]

Using compost

High quality finished compost is used in agriculture, horticulture, forestry, landscaping and home gardening. The quality of finished compost depends on several factors including the maturity, organic matter content, nutrient and trace element content, moisture content, pH and the presence of contaminants.

Compost contaminated with metals, plastics or glass has limited uses. Lower quality composts can still be used for erosion control, land reclamation, or as landfill cover.

2.6 Movement of waste

In some areas of Canada, there is no longer sufficient space in existing landfills to accommodate more waste. Rather than building new landfills and incinerators, waste can be transported to other regions or provinces, or even exported.

Approximately 16% of the solid waste generated in the Greater Vancouver Regional District is sent to the Cache Creek Landfill 330 km northeast of the city.[5] All waste materials from the city of Kenora in northern Ontario, except construction, renovation and demolition materials and materials that can be re-used, recycled or composted, are transported out of province to a Winnipeg landfill.[6] In 2002, 1.6 million tonnes of waste were exported out of the

2. Swan, J.R.M., B. Crooke, and E.J. Gilbert, 2002, "Microbial Emissions from Composting Sites," in *Environmental and Health Impact of Solid Waste Management Activities,* R.E. Hester and R.M. Harrison (eds.), Cambridge: The Royal Society of Chemistry.
3. Composting Council of Canada, n.d., *25 Questions and Answers about Composting,* www.compost.org/qna.html (accessed October 13, 2004).
4. Composting Council of Canada, n.d., *Setting the Standard: A Summary of Compost Standards in Canada,* www.compost.org/standard.html (accessed October 9, 2004).
5. Greater Vancouver Regional District, April 2002, *Solid Waste Facts—Cache Creek Landfill*, www.gvrd.bc.ca/recycling-and-garbage/pdfs/cache-creek_brochure.pdf (accessed May 4, 2005).
6. City of Kenora, 2002, *The Kenora Area Solid Waste Transfer Facility,* www.city.kenora.on.ca/city_of_kenora/waste_mgt_recycling/transfer_station.html (accessed November 25, 2004).

country.[1] Several municipalities in southern Ontario, including Toronto, ship waste across the border to landfills in Michigan.

Some countries regulate the types of waste materials that they will accept. However, waste is treated as a good under the North American Free Trade Agreement (NAFTA), and can therefore be imported and exported between Canada, the United States and Mexico. Hazardous wastes can also be transported across the border. Hazardous wastes entering, passing through and leaving Canada are tracked by Environment Canada[2] (Text Box 2.5).

Impacts of transporting waste

Transporting waste away from where it was generated can have a range of impacts, both positive and negative. Whether or not waste is transported depends on economic, social and environmental considerations. For some jurisdictions, exporting waste can be more economical than constructing new landfills.

As well, waste disposal away from urban centres satisfies the large number of people who want waste management services but do not want waste facilities close to their homes. A waste facility's location can affect surrounding property values. Facilities themselves can create noise, dust and odours, and can attract birds and pests.

Smaller centres may benefit from job creation when landfills are built to accommodate waste from large cities. Still, rural and small town residents have many of the same concerns regarding landfill siting as urban residents.

In some cases, it may make environmental sense to transport waste from one area to another. For example, areas that receive little rain and have clay soils offer superior environmental protection because leachate movement will be lower. However, higher transportation costs, including more traffic, more air emissions of dust, nitrous oxides and sulphur dioxides, and the risk of soil and water contamination from accidental leaks or spills must also be considered.[3]

When it comes to waste, the adage “out of sight, out of mind” just does not apply. Sending waste for disposal may rid one jurisdiction of its waste problem, but the waste still needs to be managed and disposed of elsewhere. Environmental and health impacts can still result in other areas from poorly managed waste.

1. Statistics Canada, Waste Management Industry Survey: Business and Government Sectors, 2002.
2. Environment Canada, 2002, *International Commerce in Hazardous Industrial Waste,* www.atl.ec.gc.ca/enforcement/hazardous_waste.html (accessed December 12, 2004).
3. Strange, Kit, *2002,* “Overview of Waste Management Options: Their Efficacy and Acceptability,” in *Environmental and Health Impact of Solid Waste Management Activities,* R.E. Hester and R.M. Harrison (eds.), Cambridge: The Royal Society of Chemistry.

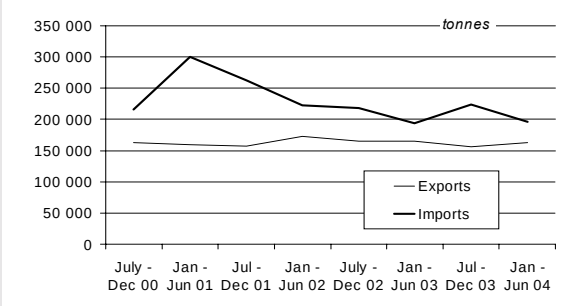
Text Box 2.5
Hazardous wastes

Importing hazardous wastes into Canada

Hazardous wastes are materials that may be hazardous to human health or the environment due to their nature or quantity. Some examples are ammonia, asbestos, chlorine, fuel oils, hydrogen peroxide, lead, mercury, nickel, PCBs, uranium and zinc. Hazardous wastes require special handling techniques specified in the *Transportation of Dangerous Good Regulations* (1985), the *Canadian Environmental Protection Act* (1988), the *Basel Convention* (1989), or the *Export and Import of Hazardous Waste Regulations* (1992).

Canada is a net importer of hazardous wastes. In the first six months of 2004, Canada imported 196 177 tonnes of hazardous waste, 21% more than was exported (Figure 2.3). The top types of waste imported into Canada are listed in Table 2.6. Transboundary movement of hazardous waste is governed by the *Basel Convention*, an international agreement that came into effect in May 1992. The agreement requires countries to regulate and monitor the shipments of hazardous waste crossing international borders. Since 2001, imports of hazardous waste to Canada have been declining.

Figure 2.3
Semi-annual imports and exports of hazardous waste, 2000 to 2004



Source:
Environment Canada, June 2001 to December 2004, *Resilog, Newsletter of the Transboundary Movement Branch*, Vols. 14-19, www.ec.gc.ca/tmb/resilog/eng/resinews.htm (accessed January 4, 2005).

Table 2.6
Hazardous wastes included in exports and imports by category, January to June 2004

Hazardous waste category	As a share of total hazardous waste exports	As a share of total hazardous waste imports
	%	
Environmental hazards[1]	40	11
Corrosive liquids	15	28
Battery wastes	12	5
Flammable liquids	11	8
Metal and mineral wastes	5	27
Other	17	21

Note:
1. Liquid and solid wastes (e.g., sodium, silver nitrate, toluene).
Source:
Environment Canada, 2004, *Resilog, Newsletter of the Transboundary Movement Branch*, Vol. 19, No. 1, www.ec.gc.ca/tmb/resilog/eng/dec04e.htm (accessed January 4, 2005).

Why not treat these wastes on-site and avoid their transportation altogether? These decisions are influenced by various factors such as cost, capacity to treat waste, type of waste and proximity to an appropriate treatment facility. On-site treatment may not be feasible for small firms who produce only small quantities of hazardous waste. Therefore shipment of these materials to an outside facility is the best option.

Treatment of hazardous wastes

Incineration, solidification, stabilization and hydrometallurgy are some of the methods used to treat, process or recycle hazardous wastes. The method of treatment employed depends on the type of waste. PCB wastes, for example, must be incinerated at 1 100°C to be destroyed.[1] Solidification can be used to lock or encapsulate contaminants by converting them into a synthetic material similar to rock. Stabilization is a process that immobilizes contaminants using clays, alumina, and activated carbon. Hydrometallurgy is a process whereby metals such as gold, nickel, copper, zinc and lead are extracted using aqueous solutions.

Household hazardous waste

Look around your house, garage or storage shed, and you will likely find products which, when disposed of, fall into the category of waste materials called Household Hazardous Wastes (HHW). These wastes are solid or liquid materials, or containers for materials that have been consumed or are no longer wanted, that require special treatment before disposal or recycling. These materials may be flammable, corrosive, explosive or toxic. Aerosol cans, paint, cleaning products, batteries and motor oil are examples of HHW.

What is common to all of these materials is that they are not suitable for collection in standard residential recycling programs or waste management systems. To address health and safety concerns about the handling and storage of these materials, and to minimize their environmental impacts, these wastes are chemically treated and/or incinerated before being disposed of.

Many municipalities offer HHW disposal programs for residents. Some cities and towns have built special HHW depots or drop-off centres, usually centrally located. Another approach is to organize one-day drop-offs at central points.

1. Environment Canada, 2002, *Transporting Hazardous Waste*, www.atl.ec.gc.ca/epb/factsheets/transport.html (accessed November 25, 2004).

3 Response

Realizing the potential health, environmental, financial and political impacts of solid waste, governments, industries, producers and the general public are all trying to minimize it and manage it better. Initiatives include enacting and enforcing legislation, developing landfill standards, introducing diversion programs, redesigning production processes and changing consumption choices.

3.1 Government response

Local government

In Canada, waste management services are usually the responsibility of public bodies such as local government or waste management boards or commissions who co-ordinate these services.

Until fairly recently, municipalities were free to choose the waste management programs that best suited their needs and budgets. Then, beginning in the late 1980s, provincial governments became more involved in local-level waste management. Concern over landfill space led to research into other kinds of disposal. The new programs[1] that resulted, and the funding that made them happen, launched the waste management system that operates today.

Funding

There are three main sources of funding for local-level waste services: property taxes, transfers from other governments and user fees. The extent to which each of these funding sources is used varies across Canada.

Property taxes are collected by municipalities, usually based on the assessed value of homes or business owners' properties. They are the main revenue source for local governments.

The most significant source of intergovernmental transfers is from provinces to municipalities. These transfers may be program-specific—to cover the costs of a centralized composting operation, for example—or they may be more general in nature, such as funding for a recycling program. Provinces may also partner with industry in supporting some of these programs. Packaging stewardship initiatives underway in Manitoba, Ontario and Quebec are examples of programs that are jointly funded and/or administered by both the provincial governments and private industry.

The second significant source of transfer funding is between the municipalities themselves. Local governments may belong to larger waste management boards or commissions in order to provide services that are common to each of them. Each member municipality contributes to the operation of the group, with the level of funding usually based on population.

User fees are the third funding mechanism available to local governments. For example, they include government user fees[2] such as tipping fees that are paid for the privilege of using another municipality's landfill or incinerator. The amount paid can depend on the quantity of waste disposed or the type of waste – some municipalities will charge different fees for different types of materials.

Many jurisdictions impose fees on the final user of the waste management service – households and small businesses, for example. Some households are charged for garbage pick-up directly through a per bag fee (bag tags). As well, households and businesses must usually pay disposal fees if they transport waste to a facility themselves. These fees may be based on the quantity or the type of waste being discarded.

Municipal expenditures

Municipal governments spent more than $1.5 billion on waste management services in 2002. More than 40% of this money was spent collecting waste and recyclable material. A further 25% was spent operating disposal facilities, and 10% was spent running recycling and composting facilities.

Spending on waste management services varies widely from province to province, because of the type and mix of services offered. Municipalities in some provinces allocate as much as 6% of total spending to waste services, while local governments in other provinces spend less than 2% (Figure 3.1). Although the amount of recyclable materials that is diverted from landfills is closely related to the level of funding for waste management services, other factors also play a role – such as citizens' willingness to participate in recycling programs.

Private contracts

Privately run waste management services are not a new phenomenon. Many modern waste management companies in North America find their roots in the 19th century waste scavenger or "rag-man".[3]

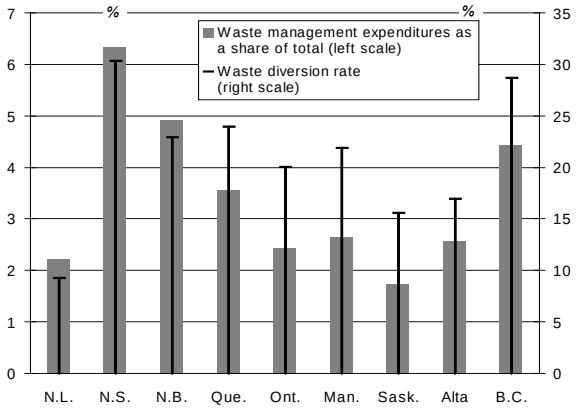
Today, many municipalities contract out some or all of their waste management services to private firms. In larger cities, different companies may serve different districts. A few municipalities accommodate both public and private sector collection forces (Ottawa, Toronto, Winnipeg and Vancouver).

1. Examples are the blue box and blue bag recycling programs that sprang up across the country.

2. Disposal or tipping fees are fees that are paid to the owner, lessor or operator of a landfill for the right to dispose of waste in that landfill.

3. Crooks, Harold, 1993, *Giants of Garbage: the Rise of the Global Waste Industry and the Politics of Pollution Control*, James Lorimer & Company, Toronto.

Figure 3.1
Waste diversion rate versus waste management expenditures as a share of total municipal expenditures, 2002



Note:
PEI is not included due to the confidentiality provisions of the Statistics Act.
Source:
Statistics Canada, Environment Accounts and Statistics Division.

Some see the private provision of waste management services as more cost effective than having municipalities provide these services directly. In 2002, 56% of all waste management spending went to private companies.

Programs and approaches to reduce waste disposal

Some municipalities have policies or measures in place that control or influence the demand for waste services, in an attempt to reduce costs and environmental impacts. By limiting disposal, raising its price or providing other options, local governments can encourage residents to produce less waste.

Regulatory instruments

Municipalities can enact by-laws covering many aspects of waste storage, collection and disposal; including, nuisance issues such as waste burning and odours; specifications for maximum garbage container sizes and weights, pick-up locations, proper packaging of waste materials, acceptable materials for pick-up; and waste facility licensing, monitoring, inspections, fees and equipment requirements.

Regulatory measures commonly used to reduce or limit waste going for disposal include landfill bans and bag limits. For example, in 2001, the Regional District of Kootenay Boundary, which includes the cities of Trail, Rossland and Grand Forks, B.C., banned from landfills all materials that are accepted for recycling, including yard and garden waste.[1]

Table 3.1
Tipping fees for selected sites, 2005

Site	Tipping fee
	$/tonne
Otter Lake landfill, Halifax, Nova Scotia	115.00
Saint-Lambert-de-Lauzon landfill, Lévis, Quebec	80.00
Vancouver landfill, Vancouver, British Columbia	65.00
Clover Bar landfill, Edmonton, Alberta	42.00
Saskatoon landfill, Saskatoon, Saskatchewan	30.00
Brady Road landfill, Winnipeg, Manitoba	22.50

Sources:
Halifax Regional Municipality, 2005, The Otter Lake Waste Management Facility, www.halifax.ca/wrms/facilities.html (accessed February 21, 2005).
City of Vancouver, 2004, Vancouver Landfill & Vancouver South Transfer Station Rates, www.city.vancouver.bc.ca/engsvcs/solidwaste/landfill/rates.htm (accessed February 21, 2005).
Régie intermunicipale de gestion des déchets des Chutes-de-la-Chaudière, n.d., Services offerts, www.chaudiere.com/regie-dechets/services.html (accessed February 22, 2005).
City of Edmonton, n.d., Landfill Disposal Rates, www.edmonton.ca/portal/server.pt/gateway/PTARGS_0_2_271_213_0_43/http%3B/CMSServer/COEWeb/environment+waste+and+recycling/waste/facilities/landfilldisposalrates.htm (accessed January 5, 2005).
City of Saskatoon, n.d., Landfill Information, www.saskatoon.ca/org/environmental_compliance/landfill.asp (accessed February 21, 2005).
City of Winnipeg, 2005, Brady Road Landfill, www.winnipeg.ca/waterandwaste/garbage/bradyroad.stm (accessed February 28, 2005).

Bag limits were implemented in Peterborough, Ont., in 1995. Over time, the limit was lowered from six containers to two. Garbage that exceeds the limit is not picked up, and must be stored until a subsequent collection or brought to the landfill for a minimum charge of $5. This initiative led to a 49% increase in recycling between 1993 and 2001.[2]

Economic instruments

Disposal fees reflect the costs of managing and maintaining a landfill. Costs increase as space in existing landfills fills up, while transporting waste to other landfills or building new landfills can also push up costs. Rising disposal fees often prompt municipalities to implement a waste reduction/diversion strategy.

The City of Toronto is one example. For 30 years, the city's garbage was hauled to the Keele Valley landfill. When the landfill closed in 2002, the cost for waste disposal jumped from $18 per tonne to $53 per tonne because garbage had to be transported to Michigan for disposal.[3] In 2001, the city created the Waste Diversion Task Force. Its goal is to achieve 100% diversion, or “Zero Waste”, by 2010.

A schedule of tipping fees may list prices by weight, by waste type (garbage and household waste, furniture and renovation material, yard waste, tires or appliances), or by the size of vehicle dropping off waste (e.g., industrial packer, large truck, small trailer, pickup trucks or cars). Tables 3.1 and 3.2 show examples of different tipping fees.

1. Regional District of Kootenay Boundary, 2003, *Resource Recovery,* www.rdkb.com/siteengine/activepage.asp?PageID=64 (accessed January 13), 2005.
2. City of Toronto, Solid Waste Management Services, 2002, *Pay-as-you-throw Consultation,* www.toronto.ca/garbage (accessed December 20, 2004).
3. *Ibid.*

Table 3.2
Tipping fees for Windsor landfill, 2005

	Residential tipping fees	Commercial tipping fees
Garbage and household waste	<100 kg: free >100 kg: $7.70/100 kg	$53.00/tonne
Furniture and renovation material	<100 kg: free >100 kg: $7.70/100 kg	$53.00/tonne
Yard waste (tree trimmings, grass clippings and leaves)	<100 kg: free >100 kg: $3.85/100 kg	$38.50/tonne
Fridge, freezer and air conditioning units	$10.00/unit	$10.00/unit
Recyclable material, appliances and scrap metal	Free	Free
Tires	Car: $3.00 Light truck: $4.50 Medium truck: $15.00	Car: $3.00 Light truck: $4.50 Medium truck: $15.00
Household chemical waste	Free at household chemical waste depot	Not accepted from commercial or industrial generators

Source:
City of Windsor, n.d., The Public Drop Off Depot, www.citywindsor.ca/000605.asp (accessed February 21, 2005).

User-pay programs

User-pay programs require residents to pay for waste collection based on the volume or weight of materials disposed of, rather than as a flat fee rolled into property taxes.

Economists argue that a per-unit charge for garbage collection helps reduce generation of garbage, because a charge presents a financial incentive to produce less waste. A maximum bag size or weight must also be specified.

When households are faced with paying for each bag of garbage generated, their efforts to reduce, re-use and recycle literally pay off. Most communities that adopt user-pay programs see less waste disposal and more diversion to recycling and composting.[1]

Bag tags are one method of implementing a user-pay program in order to minimize residential solid waste. Municipalities may require that all garbage be tagged. Another option is to set a limit on the number of bags that can be left out each week: all bags beyond the limit must have a tag to be picked up.

Other forms of user-pay require residents to use specific containers and then charge based on the size or number of containers put out for collection.

In 1997, the City of Orillia, Ont., implemented a user-pay program. All bags must be tagged to be picked up: each household is given 40 free tags each year and extra tags must be purchased for $1.50 each. By 2001, the amount of material diverted to recycling rose 31% from 1996.[2]

Victoria sets a one-bag limit per week. Tags, which cost $3.50 each, are required for each additional bag.[3]

Starting in 2005, Vancouver will begin adopting a user-pay system using specialized containers distributed to residents with scheduled waste collection for garbage and yard waste. Fees will be charged based on the container sizes requested.[4]

Municipal programs

Municipalities operate waste diversion programs to reduce the amount of waste sent to landfills or incinerators. Many municipalities offer a number of collection services, either using their own personnel or a contractor or both. Aside from waste and recyclables, municipalities may separately collect: organic material; yard waste; bulky items (e.g., furniture); white goods (e.g., refrigerators); Christmas trees; and batteries.

Education is a key means of encouraging the public to reduce, reuse and recycle. Educational activities can include: distributing pamphlets, fact sheets, calendars and posters; creating websites and videos; presenting in schools or to the public; and operating demonstration sites.

Waste collection

Urban areas often have curbside collection—waste pick-up from residences. Collection vehicles travel along mapped routes on predetermined schedules and pick up household garbage. The waste is then taken to a transfer facility or a disposal site such as a landfill or incinerator.

In rural areas and small towns, curbside collection may not be available. To make a curbside collection viable, the population base must be large enough to fund the system. Smaller centres may set up central waste storage bins where residents must drop off their waste. These bins act as transfer facilities, storing waste until there is enough collected to haul the bin to a disposal facility.

Recyclables collection

Curbside collection of recyclable materials is the most visible form of municipal waste diversion. Vehicles pick up metals, plastics, glass and paper materials that are included in the collection program. Collected materials are hauled to a transfer facility or to a material recovery facility (MRF). At the MRF, recoverable materials are processed to facilitate transportation.

1. Dewees, Donald N., 2002, "Pricing Municipal Services: The Economics of User Fees," *Canadian Tax Journal,* Vol. 50, no. 2. www.ctf.ca/pdf/ctjpdf/2002ctj2_dewees.pdf (accessed January 13, 2005).
2. City of Toronto, Solid Waste Management Services, 2002, *Pay-as-you-throw Consultation,* www.toronto.ca/garbage (accessed December 20, 2004).
3. City of Victoria, 2005, *Garbage Disposal,* www.city.victoria.bc.ca/residents/utilities_san.shtml (accessed March 18, 2005).
4. City of Vancouver, January 8, 2004, *Automated Collection of Solid Waste,* www.vancouver.ca/ctyclerk/cclerk/20040129/cs3.htm (accessed March 18, 2005).

Collection systems for recyclable materials are not always economically feasible - especially in smaller centres. Residents in smaller centres take their recyclables to central transfer facilities and place materials into the appropriate bins. When the bins are full, they are hauled to a MRF.

Composting

Approximately 30% to 40% of typical residential solid waste is made up of organic materials such as food and yard waste, according to waste characterization studies.[1,2] Municipalities across Canada encourage the public to divert organic materials to composting. In some regions, organic waste is collected from residences and composted at central locations.

The types of organic material collected and the material separation techniques vary. For example, Halifax residents separate organic material including food waste, yard waste, boxboard and soiled paper for composting.[3] Residents of Moncton, N.B., separate wet materials such as food, yard waste and soiled items for composting.[4] Other municipalities are testing organics collection.

Other municipalities, such as Hamilton[5] and Québec City[6] collect residential yard waste as part of their composting programs. Yard waste is accepted at drop-off depots in Saskatoon[7] and other municipalities.

Other regions encourage residents to compost organic waste at home, by offering manuals and pamphlets on the subject, as well as instructions or workshops on building compost bins. Some may also operate compost demonstration sites or partner with local organizations to offer composting information. Many local governments offer subsidized compost bins.

Some notable waste management programs in Canada, and their special features, are listed in Text Box 3.1.

1. City of Toronto, 2000, *Waste Composition Study 2000/2001,* www.city.toronto.on.ca/wes/techservices/involved/swm/net/pdf/4_2_finalrep.pdf, (accessed January 17, 2005).
2. Sperling Hansen Associates, December 4, 2001, *Summary of Phase 1 and 2 Solid Waste Composition Study,* Capital Regional District, www.crd.bc.ca/es/hartland/documents/waste_comp_study_2001.pdf (accessed January 17, 2005).
3. Halifax Regional Municpality, 1999, *Organics Green Cart,* www.halifax.ca/wrms/newgreen.html (accessed January 13, 2005).
4. Westmorland-Albert Solid Waste Corporation, 2004, *Success is in our Community,* http://www.westmorlandalbert.com/index.cfm (accessed January 17, 2005).
5. City of Hamilton, 2004, *Leaf and Yard Waste, Fast Facts,* www.city.hamilton.on.ca/public-works/Waste-Management/Leaf-and-Yard-Waste/fastfacts.asp (accessed February 21, 2005).
6. Ville de Québec, 2005, *Collecte des végétaux,* www.ville.quebec.qc.ca/fr/ma_ville/reglementation/environnement/vanier/collecte_des_vegetaux1490.shtml, (accessed February 21, 2005).
7. City of Saskatoon, n.d., *Recycling in Saskatoon—Shop and Yard,* www.city.saskatoon.sk.ca/org/environmental_engineering/recycling/shop_yard.asp (accessed May 4, 2005).

Provincial governments

Provincial governments have jurisdiction over matters of local interest, including health and social services, rights of property and local institutions. While municipal solid waste management is a provincial jurisdiction, operational control is mostly delegated to lower levels of government, regional districts and municipalities which often make by-laws relating to issues of waste collection and disposal. Prince Edward Island is one exception—the Island Waste Management Corporation[8] is responsible for day-to-day waste services.

Regulatory instruments

Solid waste issues are managed chiefly through environmental and municipal laws and regulations. Several provinces and territories, including British Columbia, Ontario, Manitoba and the Yukon also have legislation to deal specifically with waste (Table 3.3).

Provincial legislation and regulations concerning waste often establish standards for the construction and operation of waste disposal sites and waste management systems, providing specifications or guidelines for landfills, incinerators and other waste disposal facilities. As well, legislation may create waste management boards, commissions, or corporations to administer waste and/or diversion programs. The provinces also co-ordinate or institute regulations governing extended producer responsibility (EPR).

Policy instruments

Defining the direction and objectives of municipal waste management is usually the responsibility of provincial governments. Several provinces have established waste management strategies or plans, identifying diversion goals, improving standards, and implementing various programs and mechanisms in order to reach those targets.

For example, Nova Scotia's Solid Waste-Resource Management Strategy, released in 1996, committed to achieving 50% waste diversion by 2000, implementing new disposal standards, and increasing regional co-operation and economic opportunities.[9]

8. Island Waste Management Corporation, February 2005, *IWMC,* www.iwmc.pe.ca/ (accessed February 21, 2005).
9. Nova Scotia Environment and Labour, 2004, *Status Report 2004 of Solid Waste-Resource Management in Nova Scotia,* www.gov.ns.ca/enla/emc/wasteman/docs/status04.pdf (accessed, December 14, 2004).

Text Box 3.1
Notable waste management programs in Canada

Edmonton, Alberta:[1] The Alberta capital has one of the most comprehensive waste management strategies in the country. Established in the early 1990s, the plan calls for 70% diversion in the city. It is funded by tax levies, flat monthly fees on utility bills and revenue from tipping fees and sale of recyclable materials. In 2003, 43% of waste was diverted through recycling programs and composting.

Residents of single-family dwellings put all recyclables in a transparent plastic blue bag. The bags are placed on the curb for pick-up with regular garbage and sorted at the material recovery facility. In 2002, 84% of single-family households participated in this program. For multi-family residences, such as apartments and condominiums, a large blue bin is provided for recyclables. Other services include recycling depots, at which materials can be dropped off by small businesses or individuals and “eco stations” for disposal of household hazardous waste.

Edmonton's composting facility is the largest of its type in North America. The facility is 3.7 hectares in size and has a capacity of 200 000 tonnes of municipal solid waste and 22 500 tonnes of dry biosolids per year. Non-recyclable waste is co-composted with sewage biosolids. Mechanical processes are used to screen out non-biodegradable materials from the finished compost. In 2003, close to 46 000 tonnes of compost were produced and sold to farmers, landscapers and soil bioremediation firms. Backyard composting is also promoted.

Public education and awareness are key to the success of Edmonton’s waste management program. School programs, public meetings and information campaigns encourage participation. The City also runs a waste hotline to answer questions and information requests.

Prince Edward Island:[2,3]Local waste management services are managed by the Island Waste Management Corporation. The Crown agency is responsible for operating and overseeing the East Prince Waste Management Facility and central composting facility, managing the energy from waste (incineration) facility and operating waste watch drop-off centres.

Separating waste at the source is the key to PEI's goal of 65% diversion. Recyclables such as plastic, metal and glass are placed in a transparent blue plastic bag and recyclable paper is placed in a second blue bag. Organic materials such as food scraps, non-recyclable paper, boxboard, and yard trimmings are placed in a green cart. Waste such as textiles and non-recyclable plastic, glass and ceramic are placed in a black cart.

Guelph, Ontario:[4] The waste management program in the City of Guelph is a three-stream program called Wet-Dry Plus, which features source separation similar to that practiced in P.E.I. Dry garbage such as plastics, glass, aluminum cans and paper are put in a transparent blue bag. Food scraps and other items such as napkins and diapers for example, are placed in a transparent green bag and sent for composting. In 2003, 4 380 tonnes of composted material were sent to market.

Other waste, such as textiles, aerosol cans and non-recyclable paper and plastic, is set out in a clear plastic bag for disposal. A depot is open year-round to accept household hazardous waste items. In 2003, composting and recycling enabled the city to achieve a 74% diversion rate.

1. City of Edmonton, n.d., *2003 Waste Management Branch Annual Review,* http://www.edmonton.ca/Environment/WasteManagement/PDF/2003%20Annual%20Review.pdf (accessed May 4, 2005).
2. Prince Edward Island, February 2005, *Island Waste Management*, www.gov.pe.ca/tpw/iwmc-info/index.php3 (accessed February 4, 2005).
3. Island Waste Management Corporation, February 2005, *Sorting Guides*, www.iwmc.pe.ca/sorting.htm (accessed February 21, 2005).
4. City of Guelph, 2004, *2003 Annual Report*, www.guelph.ca/uploads/ET_Group/wetdry/WD-Annual-Report-2003.pdf (accessed January 5, 2005).

In 2002, Newfoundland and Labrador announced plans to increase diversion, develop modern standards and technologies, establish waste management regions, maximize economic and employment opportunities, and educate the public regarding waste issues.[1]

Other provincial goal-setters include Ontario, which recently announced its plan to divert 60% of waste from disposal by 2008[2]; Alberta, with plans to decrease the amount of material sent to landfills to 500 kg per capita by 2010[3]; and Quebec, which has set out recovery targets for various residual materials and an overall target of recovering 65% of residuals each year.[4]

Provincial programs also promote public awareness, community involvement and provide education regarding waste minimization, diversion, and other topics. Some programs provide grants and funding for studies, pilot projects and solid waste and recycling infrastructure.

1. Newfoundland and Labrador, Department of Environment, April 2002, *Newfoundland and Labrador Waste Management Strategy,* www.gov.nf.ca/publicat/wastemanagement (accessed December 14, 2004).
2. Ontario Ministry of the Environment, June 10, 2004, *Ontario’s 60% Waste Diversion Goal —A Discussion Paper,* PIBS 4651e, www.ene.gov.on.ca/programs/4651e.htm (accessed December 14, 2004).
3. Alberta Environment, August 2004, *Alberta’s Municipal Waste Action Plan 2004-2006,* www3.gov.ab.ca/env/waste/aow/publications/index.html (accessed December 23, 2004).
4. Environnement Québec, 2004, *Québec Residual Materials Management Policy, 1998-2002, www.menv.gouv.qc.ca/matieres/mat_res-en/* (accessed December 23, 2004).

Table 3.3
Selected federal, provincial and territorial legislation on waste-related issues

Jurisdiction	Legislation
Federal	Antarctic Environmental Protection Act; Arctic Waters Pollution Prevention Act; Canada National Marine Conservation Areas Act; Canada Oil and Gas Operations Act; Canada Shipping Act; Canada Water Act; Canadian Environmental Protection Act, 1999; Chemical Weapons Convention Implementation Act; Fisheries Act; Hazardous Products Act; Health of Animals Act; Mackenzie Valley Resource Management Act; Navigable Waters Protection Act; Northwest Territories Waters Act; Nunavut Waters and Nunavut Surface Rights Tribunal Act; Nuclear Fuel Waste Act; Nuclear Liability Act; Nuclear Safety and Control Act; Transportation of Dangerous Goods Act, 1992; Yukon Act
Newfoundland and Labrador	Dangerous Goods Transportation Act; Environmental Protection Act; Executive Council Act; Fire Prevention Act, 1991; Food and Drug Act; Forestry Act; Health and Community Services Act; Highway Traffic Act; Meat Inspection Act; Mining Act; Municipal Authorities Amendment Act, 1991; Municipalities Act, 1999; Occupational Health and Safety Act; Petroleum and Natural Gas Act; Regional Service Boards Act; Water Resources Act
Prince Edward Island	Environmental Protection Act; Farm Practices Act; Highway Traffic Act; Mineral Resources Act; Municipalities Act; Oil and Natural Gas Act; Pesticides Control Act; Recreation Development Act; Real Property Tax Act; Roads Act; Trails Act; Unsightly Property Act
Nova Scotia	Beaches Act; Dangerous Goods Transportation Act; Environment Act; Farm Practices Act; Forests Act; Metalliferous Mines and Quarries Regulation Act; Mineral Resources Act; Motor Vehicle Act; Municipal Government Act; Provincial Parks Act; Public Highways Act; Trails Act; Unsightly Premises Act; Wilderness Areas Protection Act
New Brunswick	Agricultural Land Protection and Development Act; Agricultural Operation Practices Act; Beverage Containers Act; Bituminous Shale Act; Clean Air Act; Clean Environment Act; Clean Water Act; Highway Act; Livestock Operations Act; Mining Act; Motor Vehicle Act; Municipalities Act; New Brunswick Municipal Finance Corporation Act; Occupational Health and Safety Act; Oil and Natural Gas Act; Pesticides Control Act; Public Health Act; Transportation of Dangerous Goods Act; Unsightly Premises Act
Quebec	Environment Quality Act; Food Products Act; Forest Act; Mining Act; An Act respecting occupational health and safety; Watercourses Act
Ontario	Adams Mine Lake Act, 2004; Dangerous Goods Transportation Act; Environmental Assessment Act; Environmental Protection Act; Fire Protection and Prevention Act, 1997; Highway Traffic Act; Mining Act; Municipal Act, 2001; Municipal Affairs Act; Northern Services Boards Act; Nutrient Management Act, 2002; Oil, Gas and Salt Resources Act; Ontario Water Resources Act; Pesticides Act; Planning Act; Waste Diversion Act, 2002; Waste Management Act, 1992
Manitoba	Animal Diseases Act; Contaminated Sites Remediation Act; Dangerous Goods Handling and Transportation Act; Energy Act; Environment Act; Farm Practices Protection Act; High-level Radioactive Waste Act; Manitoba Hazardous Waste Management Corporation Act; Mines and Minerals Act; Mining and Metallurgy Compensation Act; Municipal Act; Northern Affairs Act; Oil and Gas Act; Ozone Depleting Substances Act; Planning Act; Public Health Act; Regional Waste Management Authorities Act; Sustainable Development Act; Waste Reduction and Prevention Act; Wildfires Act
Saskatchewan	Agricultural Operations Act; Cities Act; Clean Air Act; Dangerous Goods Transportation Act; Environmental Assessment Act; Environmental Management and Protection Act, 2002; Freehold Oil and Gas Production Tax Act; Highway Traffic Act; Litter Control Act; Northern Municipalities Act; Oil and Gas Conservation Act; Parks Act; Pest Control Products (Saskatchewan) Act; Planning and Development Act, 1983; Prairie and Forest Fires Act, 1982; Regional Parks Act, 1979; Rural Municipality Act, 1989; Saskatchewan Water Corporation Act; Urban Municipality Act, 1984
Alberta	Agricultural Operation Practices Act; Coal Conservation Act; Dangerous Goods Transportation and Handling Act; Environmental Protection and Enhancement Act; Forest and Prairie Protection Act; Meat Inspection Act; Municipal Government Act; Oil and Gas Conservation Act; Public Health Act; Public Lands Act; Radiation Protection Act; Water Act
British Columbia	Drinking Water Protection Act; Environment Management Act; Farm Practices Protection (Right to Farm) Act; Food Safety Act; Health Act; Highway Scenic Improvement Act; Land Act; Local Government Act; Mines Act; Park Act; Pesticide Control Act; Petroleum and Natural Gas Act; Transport of Dangerous Goods Act; Waste Management Act; Water Act; Wildlife Act
Yukon Territory	Dangerous Goods Transportation Act; Environment Act; Fire Prevention Act; Forest Protection Act; Municipal Act; Occupational Health and Safety Act; Oil and Gas Act; Public Health and Safety Act; Wildlife Act
Northwest Territories	Area Development Act; Environmental Protection Act; Environmental Rights Act; Fire Prevention Act; Forest Protection Act; Mine Health and Safety Act; Pesticide Act; Public Health Act; Safety Act; Transportation of Dangerous Goods Act, 1990; Waste Reduction and Recovery Act
Nunavut	Area Development Act; Environmental Protection Act (Nunavut); Environmental Rights Act; Fire Prevention Act; Forest Protection Act; Mine Health and Safety Act (Nunavut); Pesticide Act; Public Health Act; Safety Act; Transportation of Dangerous Goods Act, 1990

Source:
Department of Justice of Canada, n.d., Canadian Legislation, www.legis.ca/en/index.html (accessed December 1, 2004).

Federal

The federal government is responsible for waste issues crossing interprovincial and/or international borders. The federal government's response involves regulating the movement of hazardous wastes and promoting and developing national standards and initiatives for waste prevention and management.

Regulatory instruments

The 1999 *Canadian Environmental Protection Act* (CEPA) is a key component of federal environmental legislation. It is aimed at preventing pollution and protecting the environment and human health. Other laws that cover various aspects of waste-related issues are listed in Table 3.3.

CEPA regulates waste issues such as interprovincial movements, imports and exports of hazardous wastes, waste disposal at sea, management and control of toxic substances, and the National Pollutant Release Inventory. In 2003/04, 4 413 CEPA inspections were carried out (Table 3.4).

As well, guidelines and codes of practice such as the *Operating and Emissions Guidelines for Municipal Solid Waste Incinerators* are issued under the CEPA legislation.

Policy instruments

Canadian Council of Ministers of the Environment

The Canadian Council of Ministers of the Environment (CCME) promotes intergovernmental co-operation and a co-ordinated approach to environmental issues. It establishes consistent environmental standards, strategies and objectives. Although the council may propose changes, adoption of these changes is voluntary. The CCME has no authority to implement or enforce legislation.

Several CCME initiatives involve waste issues. For example, the CCME recognizes that minimizing or avoiding the creation of pollutants and wastes can be more effective than treating them or cleaning them up. Thus, the CCME promotes pollution prevention and has established a Pollution Prevention Awards Program for businesses and organizations.

Table 3.4
Selected statistics on *Canadian Environmental Protection Act* enforcement activities, 2003-04[1]

Regulation	On-site inspections	Off-site inspections	Investigations	Warnings	Directions	Prosecutions	Convictions
				number			
Total enforcement activities	2 334	2 079	32	672	8	8	14
Disposal at sea regulations	24	8	1	0	0	0	0
Export and import of hazardous waste	589	265	6	53	0	0	0
Interprovincial movement of hazardous waste	11	41	3	0	0	0	0
National Pollutant Release Inventory	16	213	2	150	0	0	0
Ocean dumping, 1988	20	1	0	0	0	2	1
PCB waste export	5	57	0	0	0	0	0

Note:
1. Data is based on the federal government "fiscal year" which is from April 1 to March 31.
Source:
Environment Canada, 2004, *Environment Law Enforcement Program — Reports and Statistics — CEPA (1999) — National Statistics, 2003-2004*, www.ec.gc.ca/ele-ale/stats/cepa/cepa_natl_2003_2004_e.asp (accessed December 21, 2004).

The CCME is also involved in providing guidance for hazardous waste management, and promoting Canada-wide principles for electronics products stewardship to assist the development of e-waste programs (see Text Box 3.2).

In 1989, the CCME endorsed the National Packaging Protocol, a voluntary agreement with industry to reduce the amount of packaging waste disposed of by 50% by 2000. This result was achieved in 1996, four years ahead of schedule.

As well, the CCME has worked on the development of Canada-wide standards for reducing emissions of dioxins and furans, which are toxic, persistent, and bioaccumulative pollutants, that result mainly from human activity (Table 3.5).

To date, industry-specific standards have been developed for some of the main sources of dioxin and furan releases including incineration (of solid waste, hazardous waste, sewage sludge and medical waste), burning salt laden wood in coastal pulp and paper boilers, iron sintering, electric arc furnace steel manufacturing, and conical waste combustion in Newfoundland and Labrador. Further work is being conducted to reduce residential waste combustion, another major source of dioxin and furan emissions.[1]

Table 3.5
Atmospheric releases of dioxins and furans by source, 1999[1]

Source	Quantity	Share of total
	TEQ g/yr	%
Conical waste burners	44	22.6
Waste incinerators	41	21.0
On-site burning of household waste[2]	20 to 40	15.4
Open burning of municipal waste[2]	13 to 24	9.7
Electric arc furnace steel manufacturing	11	5.6
Diesel fuel combustion	9	4.6
Residential and agricultural fuel combustion	7	3.6
Iron sintering	6	3.1
Burning saltladen wood	5	2.6
Electric power generation	5	2.6
Residential wood burning	3	1.5
Base metals smelting	3	1.5
Beehive burners	3	1.5
Cement kilns	2	1.0
Other releases	7	3.6
Total[3]	**195**	**100.0**

Notes:
1. From 1999 National Inventory of Releases except on-site burning of household waste and open burning of municipal waste.
2. Midpoint identified to calculate total and share of total.
3. Testing and research are still required to determine emissions from other sources, including asphalt plants, magnesium production, chemical production, secondary aluminum smelting, petroleum refineries, crematoriums, and copper wire recycling.
Source:
Canadian Council of Ministers of the Environment, Dioxins and Furans CWS Development Committee, October 2004, *Status of Activities Related to Dioxins and Furans Canada-Wide Standards,* www.ccme.ca/assets/pdf/d_f_2004_sector_status_rpt_e.pdf (accessed December 23, 2004).

Environment Canada's National Office of Pollution Prevention

Environment Canada's Sustainable Consumption Division,[2] in the National Office of Pollution Prevention, promotes the lessening of environmental impacts associated with the use and release of toxic substances and the development of life cycle analysis for managing risk and preventing pollution.

The Product Policy Program develops and promotes extended producer responsibility (EPR),[3] life cycle management (LCM),[4] eco-labelling[5] and eco-efficiency[6] policies.

1. Gartner Lee Limited, February, 2004, *Approaches to Reducing On-Site Residential Waste Combustion,* Canadian Council of Ministers of the Environment, www.ccme.ca/assets/pdf/df_rwc_gartner_lee_rpt_e.pdf, (accessed December 14, 2004.)
2. Environment Canada, 2002, *National Office of Pollution Prevention, Sustainable Consumption Division,* www.ec.gc.ca/NOPP/scd/en/index.cfm?par_OrgID=6&par_Org=1 (accessed February 21, 2005).
3. A policy where producers accept significant responsibility for the treatment and disposal of post-consumer products.
4. A process to identify and reduce a product's environmental impact at all stages of its life cycle from raw material extraction, transportation, manufacturing, use and disposal.
5. Labelling to help consumers identify products that have less impact on the environment.
6. Processes to maximize the efficiency of production, while minimizing negative environmental impacts.

Text Box 3.2
E- waste

Have you replaced your computer, television, stereo or cellphone lately? Some household electronic items quickly become obsolete as technology advances and new products are developed. This has created a burgeoning stream of e-waste.

E-wastes contain toxic materials such as lead, mercury, arsenic, and chromium—all of which are known or suspected to harm wildlife and human health. According to Environment Canada, an estimated 140 000 tonnes of e-waste are discarded annually in Canadian landfills and this number continues to increase.[1]

The increasing demand for e-waste recycling and re-use present business opportunities and spinoff economic benefits such as job creation and local development. Valuable materials such as glass, plastic, aluminum, copper and even gold can be salvaged from used electronics. E-waste re-use organizations and recyclers are active in most provinces.[2] As demand grows for these services, they will likely continue to expand. In 2000, Ontario was home to 4 companies in the business of information technology (IT) recycling: by 2004, there were 14 such companies.[3]

Growing concern over e-waste has led to several initiatives. Electronic Product Stewardship Canada (EPS Canada) was established to take the lead on implementing an extended producer responsibility (EPR) program for e-waste. The program seeks to encourage consumers to recycle and re-use items such as computers and televisions. Additionally, the Information Technology Association of Canada, the industry group representing the IT and telecommunication industry, has proposed that it assume the transportation and processing costs of e-wastes by adding a fee to their products at the point of sale. For example, consumers would pay an additional $20 to $25 up front when purchasing a computer or television.[4]

What can consumers do to minimize improper e-waste management and disposal? [5]

- Encourage vendors and brand owners to subscribe to take-back and recycling programs for electronic products they sell or make.
- Update or repair electronic products where feasible instead of replacing them with new ones.
- Donate old equipment to charitable organizations such as Computers for Schools. [6]
- Check with your municipality for reuse, recycling and disposal options for electronics.

1. Environment Canada, 2003, "Mounting Concerns Over Electronic Waste", *EnviroZine,* Issue 33, www.ec.gc.ca/EnviroZine/english/issues/33/feature1_e.cfm (accessed November 15, 2004).
2. Enviros RIS, October 2000. *Information Technology and Telecommunication Waste in Canada,* Environment Canada, National Office of Pollution Prevention, Ottawa.
3. Ontario Ministry of the Environment, October 26, 2004, *Province Acts to Keep Electronics From Landfills,* www.ene.gov.on.ca/envision/news/2004/102601.htm (accessed January 21, 2005).
4. Environment Canada, 2003, "Mounting Concerns Over Electronic Waste", *EnviroZine,* Issue 33, www.ec.gc.ca/EnviroZine/english/issues/33/feature1_e.cfm (accessed November 15, 2004).
5. Ibid.
6. Industry Canada, 2005, *Computers for Schools*, cfs-ope.ic.gc.ca (accessed May 16, 2005).

The Waste Prevention Program focuses on sustainable management of solid non-hazardous waste. Initiatives include developing national programs for waste prevention and management, and promoting landfill gas capture and utilization. The amount of gas captured at Canadian landfills rose by 17% from 1997 to 2001 (Table 3.6).

Table 3.6
Landfill gas recovery in Canada, 1997 to 2001

Year	Methane	CO_2 equivalent
	kilotonnes	megatonnes
1997	292	6.1
1999	286	5.9
2001	342	7.2

Source:
Environment Canada, 2002, *Inventory of Landfill Gas Recovery and Utilization in Canada, 2001*, Ottawa.

3.2 Joint responses to waste management

Waste issues in Canada cannot be solved solely by government, industry or the public. Rather, they call for integrated solutions. Some of the most public and widespread initiatives are those that are run jointly by the public and private sectors. A good example is extended producer responsibility (EPR) programs.

Extended producer responsibility and product stewardship

EPR is an environmental policy under which producers accept significant responsibility, financial or physical, for the treatment or disposal of products with which consumers have finished.[1] Producers may adopt EPR voluntarily, or as a result of government regulations.

1. Environment Canada, 2002, *Extended Producer Responsibility and Stewardship,* www.ec.gc.ca/epr/en/epr.cfm (accessed March 31, 2005).

Text Box 3.3
Prince Edward Island lead acid battery take-back program

The province introduced mandatory take-back of all lead acid batteries in 1993 as a response to concerns about the impacts of lead acid batteries in the waste stream.

Retailers must charge a fee of $5 per new battery to consumers, and must follow regulations on safe storage and processing of all collected batteries. Enforcement of the regulation is carried out by the province through periodic spot checks of inventories.

Source:
Environment Canada, 2002, *PE Lead Acid Battery Take Back Programme,* www.ec.gc.ca/epr/inventory/en/DetailView.cfm?intInitiative=72 (accessed January 21 2005).

Many products can be included in EPR programs. Several countries have designed EPR programs for packaging wastes, electronics, batteries, bottles, used paint, waste oil and oil containers, tires, appliances and other items and materials. The choice of which product to target for an EPR program relies largely on the environmental impact of the product and the readiness of producers to participate. Text Box 3.2 describes Canada's e-waste EPR program.

Many companies see EPR as an opportunity to recover high-value items or show that their industry is environmentally responsible.[1]

EPR programs use one of two types of policy instruments: take-back requirements, which focus on the physical responsibility for the product; or economic instruments, which transfer the financial responsibility for disposal of the product to the producer.

Take-back programs

These programs are common in communities across Canada and around the world. They make producers responsible for providing a way to reclaim their products after they are used.

Take-back systems can be administered in various ways. Provincial governments can mandate a system and provide some funding and promotion, as is the case with the Prince Edward Island lead acid battery return program (Text Box 3.3). Alternatively, broad programs for multiple products may be established. The City of Ottawa, for example, provides promotional funding for its take-back program that includes 97 items such as used syringes (returned to participating pharmacies), fluorescent light tubes (returned to point of sale retail outlets), and clothing (with the participation of charitable organisations).[2] Over 500 retailers are now part of the voluntary program.

Text Box 3.4
The Beer Store

For more than 75 years, Ontario's Brewer's Retail organization (The Beer Store) has maintained a deposit return-to-retail program to collect beer containers and associated packaging. They boast a recovery rate of 107% —they also accept empty beer containers sold by the Liquor Control Board of Ontario stores. In 2003, more than 1.5 billion refillable bottles were washed and reused. As well, over 120 million glass bottles, 144 million aluminum cans, 26 311 tonnes of corrugated cardboard and boxboard, 150 tonnes of steel and 77 tonnes of plastic were recycled.

Source:
The Beer Store, 2004, *2003-2004 Responsible Stewardship,* www.thebeerstore.ca/about/enviro.pdf (accessed January 20 2005).

Economic instruments

Some EPR programs provide an economic incentive to encourage participation. The more common of these economic incentives are deposit-return systems, advance disposal fees and material subsidies and/or taxes.

Deposit-return

Deposit-return systems collect a deposit at the point of sale, and return it to consumers when they return the product or empty container to a retailer or other approved facility. Best known for beverage containers for soft drinks, beer and wine, deposit-return has expanded in some jurisdictions to include materials such as tires. The deposit-return system operated by Ontario's Brewer's Retail organization is described in Text Box 3.4. For a deposit-return system to succeed, the level of the deposit must be high enough to cover the cost of the container plus disposal and/or recycling costs. [3]

Advance disposal fees

Advance disposal fees are collected from the purchaser at the point of sale to cover collection and recycling costs. The levies are generally used for longer-life items such as white goods (e.g., refrigerators) and tires.

For advance disposal fees to be considered EPR, they must be directed towards the post-consumer physical management of the product.

The Tire Recycling Management Association of Alberta (TRMA) is an example of a group mandated by a provincial government to oversee the collection and post-consumer treatment of tires. TRMA levies a per-tire advance disposal surcharge, collected at the point of purchase.

1. Environment Canada, 2002, *Extended Producer Responsibility and Stewardship,* www.ec.gc.ca/epr/en/epr.cfm (accessed March 31, 2005).
2. City of Ottawa, 2005, Backgrounder: About the Take-It-Back Program, www.ottawa.ca/gc/takeitback/backgrounder_05_en.shtml (accessed May 16, 2005).
3. OECD Working Party on Pollution Prevention and Control, 2000, *Extended Producer Responsibility: A Guidance Manual for Governments*, Paris.

The surcharge is used to pay for activities such as:

- a scrap tire waste-minimization and recycling program
- activities designed to promote tire recycling
- the development of markets for products manufactured from recycled rubber.

In 2002/03, the equivalent of 3.31 million passenger tires were processed in Alberta, diverting approximately 33 000 tonnes of tires from disposal. [1]

3.3 Industry response

Waste management industry

The waste management industry provides a comprehensive range of services: the collection and transportation of waste and materials destined for recycling (including composting) or re-use; the operation of non-hazardous and hazardous waste disposal facilities; the operation of transfer stations; the operation of recycling facilities; and the treatment of hazardous waste.

Firms contract with local government to provide certain waste management services, or contract directly with other clients. The industry is made up of many small players and a few very large ones.

Large communities usually need a comprehensive set of services, such as recyclables collection and MRF and composting facility operation. Small companies with limited machinery and equipment may not be able to provide all of these services.

Large firms tend to be more diversified, performing a number of different waste management activities, while smaller businesses tend to focus on only one or two activities. Of large firms, only 13% performed just one waste management activity, while 49% reported involvement in three or more activities in 2000. In contrast, 36% of small firms reported they carried out just one activity and only 27% reported more than three activities.[2]

Of the 1 785 waste management businesses operating in 2002, the top 81 accounted for 62% of total operating revenues and 55% of its total employment (Table 3.7). The top five firms reported 34% of the industry's total operating revenues and 55% of its total employment. Waste management industry revenues totalled $4 106 million in 2002, up 19% from 2000.[3]

1. Tire Recycling Management Association of Alberta, 2003, *Investing in Our Future—Enhancing Alberta's Environment—Annual Report 2002-2003,* www.trma.com/admin/documents/PostedData/TRMAAnnualReportcomplete2003.pdf (accessed March 31, 2005).
2. Statistics Canada, 2002, *Waste Management Industry Survey: Business and Government Sectors 2000*, Catalogue no. 16F0023XIE, Ottawa.
3. Statistics Canada, Environment Accounts and Statistics Division.

Table 3.7
Waste management industry: business sector characteristics, by province and territory, 2000 and 2002

Province/territory	Businesses[1]		Total employees[2]		Operating revenues		Operating expenditures		Capital expenditures [4]	
	2000	2002	2000	2002	2000	2002	2000	2002	2000	2002
	number				$ thousand					
Newfoundland and Labrador	47	41	456	396	22 636	25 039	20 056	27 822	4 906	3 702
Prince Edward Island	8	13	104	170	7 200	8 553	6 623	13 259	x	x
Nova Scotia	84	85	850	713	80 401	60 519	74 992	51 640	18 872	8 226
New Brunswick	76	73	739	827	53 910	62 714	50 950	55 402	23 308	4 858
Quebec	579	563	5 536	6 256	715 832	938 500	663 160	729 258	91 515	77 813
Ontario	437	436	9 606	9 114	1 555 995	1 764 767	1 306 588	1 521 260	177 428	161 334
Manitoba	49	53	565	598	90 706	96 694	60 101	84 226	5 546	6 879
Saskatchewan	48	49	475	563	58 785	62 235	42 064	55 083	6 516	3 798
Alberta	174	203	2 736	2 639	377 943	428 115	315 733	359 499	38 588	33 487
British Columbia	260	292	3 028	2 936	464 941	645 672	444 382	456 402	47 113	37 746
Yukon Territory, Northwest Territories and Nunavut	20	23	102	143	10 911	13 569	9 555	13 446	x	x
Employment size group										
Under 20 employees	1 502	1 545	6 619	6 392	726 073	919 115	637 370	775 469	158 320	75 101
20 to 49 employees	164	159	4 780	4 494	636 696	658 887	588 425	573 481	86 020	39 873
50 and more employees	71	81	12 798	13 469	2 076 491	2 528 375	1 768 408	2 018 345	182 922	226 784
Canada	**1 737**	**1 785**	**24 197**	**24 355**	**3 439 260**	**4 106 377**	**2 994 203**	**3 367 296**	**427 262**	**341 758**

Notes:
Figures may not add up to totals due to rounding.
1. As businesses may operate in more than one province or territory, the national totals will not equal the sum of the provincial totals.
2. Includes full and part-time employees.
Source:
Statistics Canada, 2004, *Waste Management Industry Survey: Business and Government Sectors, 2002*, Catalogue no. 16F0023XIE, Ottawa.

Other industry responses

Firms can also work to reduce waste through company-specific programs that focus on internal environmental practices.

The most efficient waste diversion technique is to avoid generating waste in the first place. Product and packaging design can build in features that permit materials to be cleanly disposed of, re-used or recycled. According to the 2002 Survey of Environmental Protection Expenditures, 22% of establishments used product design or reformulation to reduce pollutants and waste before they are generated.[1]

Many firms include an environmental performance section in their annual reports which may describe their environmental management systems. These systems can be informal sets of practices or measurements or they can be more formalized; for example, certification by the International Standards Organisation (ISO). The existence of a waste management plan is an integral part of ISO 14000 standards.

In 2002, 19% of firms indicated that they were ISO 14000 certified. Other environmental management practices used by firms include life cycle analysis (14%), green procurement policies (14%) and eco-labelling (5%).[2]

Many businesses have also set up an environmental committee. Simple activities such as promoting recycling and double-sided printing or even donating time for park or road-side cleanup all work to address solid waste problems.

3.4 Public response

The public response to waste issues includes everything from protests over new landfill and incinerator sites to efforts to reduce, reuse and recycle. Many waste diversion programs offered by municipal governments evolved due to public pressure and lobbying by non-profit organizations.

Participation in municipal diversion programs is the most obvious public response to waste management issues. National-level data on the participation in these programs have not been collected since 1994, when participation ranged from 57.1% to 83.5%, depending on the type of material being diverted.[3]

Consumers participate in a wide range of activities that serve to divert solid waste from disposal. Old but serviceable clothing and other items are donated to charities. Households build their own backyard compositors or simply dig their organic waste into a backyard garden. While no data are available on the quantities of waste managed in these ways, these practices do occur in every part of Canada.

One interesting and very recent innovation in the field of waste diversion has been the emergence of the Internet as a forum used to facilitate diversion practices. Freecycle.org is an innovative grassroots initiative that began in Tucson, Arizona in 2003. The group claims over 724 000 members worldwide and is active in 142 Canadian communities. Participants, under no obligation, register on the site to gain access to the freestyle message board in their community. Items can be offered (they must be free and in serviceable condition) or sought after.[4]

3.5 Where do we go from here?

The responsibility for managing our waste rests with all Canadians rather than with any one single party. The public and private sectors, as well as the general public, all have a role to play.

The waste management industry faces many new challenges, such as the advent of e-waste and mitigating environmental hazards associated with waste. Industry response has included the development of new and improved ways of looking after waste materials, while governments have responded by introducing and improving waste management programs and legislation.

Answering questions such as how much waste is produced and who produces it, are vital in order to understand how best to manage the waste produced by society. Measurement systems are in place to provide some of the information needed to present a portrait of waste management in Canada.

The quality of the data on waste has improved dramatically in recent years due to better co-operation between all levels of government and the private sector; however, the available data could be improved if greater detail were available. As well, more information is needed on households' environmental and waste management activities.

1. Statistics Canada, 2004, *Environmental Protection Expenditures in the Business Sector,* Catalogue no. 16F0006XIE, Ottawa.
2. *Ibid.*
3. Statistics Canada, 1995, *Households and the Environment, 1994*, Catalogue no. 11-526-XPB, Ottawa.
4. The Freecycle Network, 2005, *Freecycle*, www.freecycle.org (accessed February 21 2005).

Annual statistics

Annual statistics

Human Activity and the Environment 2005 makes use of a pressure-state-response framework, in which the presented data are classified as measuring either the pressure placed on the environment by human activities, the state of the environment at a point in time or the socio-economic response to environmental conditions. This appendix serves as a general reference compendium for environmental statistics in Canada, pointing readers to available data on environmental-human interactions.

A) State

Physiography

Physiography, or physical geography, is the study of the physical features of the earth's surface. This section covers two of the key elements that make up Canada's physiography: land cover and hydrology.

Land Cover

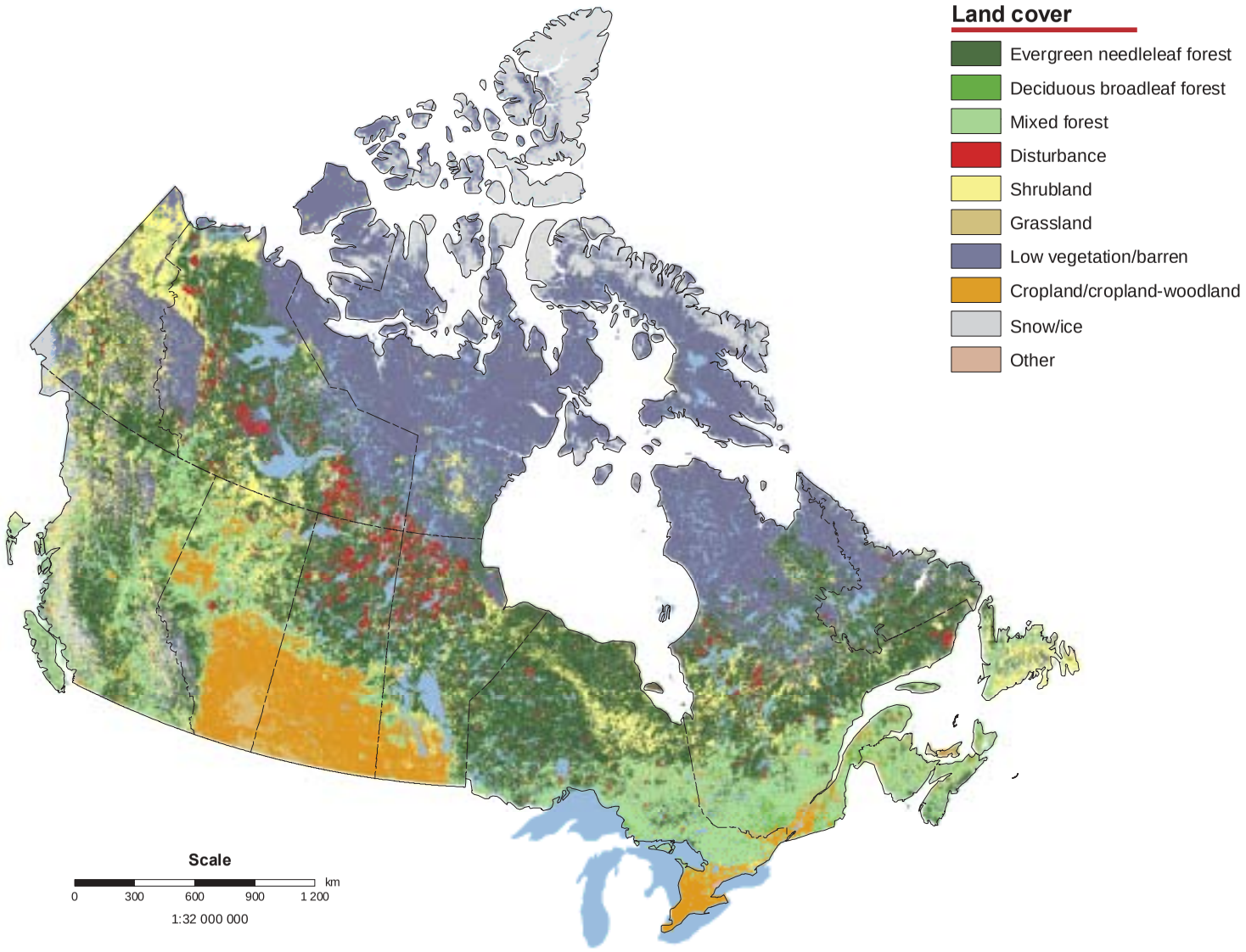
Land cover represents the surface properties of the land. Land cover information is a basic requirement for the determination of land use and, ultimately, of land value. Canada's land area totals nearly 10 million km^2. The two most extensive land cover types in Canada are evergreen needleleaf forest (26%) and low vegetation/barren (25%), representing just over half of Canada's land cover (Table A.1). Map A.1 shows the distribution of the land cover types across Canada.

Table A.1
Land cover by ecozone, 2000

Ecozone	Evergreen needleleaf forest	Deciduous broadleaf forest	Mixed forest	Disturbance	Shrubland	Grassland	Low vegetation/ barren	Cropland/ cropland-woodland	Snow/ ice	Other[1]	Total
						km^2					
Arctic Cordillera	30	0	0	10	360	0	55 350	0	182 380	7 220	245 343
Northern Arctic	1 760	0	0	50	8 460	0	960 790	0	433 110	119 240	1 523 398
Southern Arctic	55 270	0	60	840	38 200	0	625 610	0	13 120	118 190	851 281
Taiga Plains	281 970	650	64 260	36 850	114 690	0	44 670	1 740	200	110 900	655 946
Taiga Shield	494 650	0	520	91 960	103 090	0	444 020	70	30	256 260	1 390 613
Boreal Shield	896 580	13 210	478 050	65 410	179 710	70	34 870	10 090	230	243 610	1 921 837
Atlantic Maritime	21 720	11 220	138 230	600	3 300	30	70	19 980	0	7 100	202 265
Mixed Wood Plains	190	1 540	25 810	40	3 460	60	30	75 500	0	62 080	168 690
Boreal Plains	178 930	4 590	215 070	9 790	84 930	460	1 880	153 520	0	92 100	741 261
Prairies	90	10	3 850	20	4 080	46 810	80	394 560	0	17 380	466 885
Taiga Cordillera	21 110	0	4 020	930	83 210	0	137 030	0	4 310	16 510	267 119
Boreal Cordillera	171 010	180	18 020	6 970	129 090	0	88 820	0	9 780	46 690	470 567
Pacific Maritime	18 530	3 200	66 830	2 520	46 280	30	14 810	1 320	24 560	28 270	206 344
Montane Cordillera	187 880	540	117 530	2 290	74 610	1 740	55 170	7 390	15 630	27 490	490 251
Hudson Plains	236 350	0	2 070	5 390	95 170	0	14 920	10	0	20 470	374 383
Canada	**2 566 070**	**35 140**	**1 134 320**	**223 670**	**968 640**	**49 200**	**2 478 120**	**664 180**	**683 350**	**1 173 510**	**9 976 182**

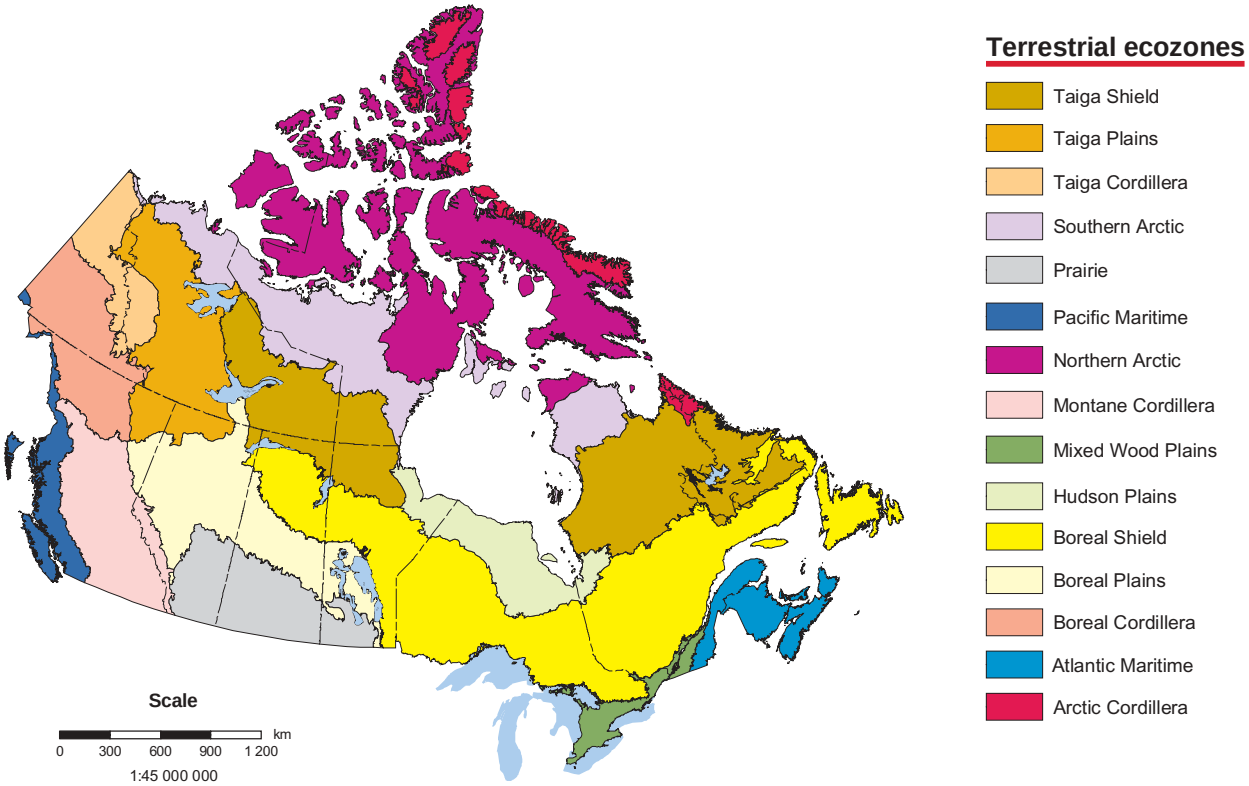
Notes:
Figures may not add up to totals due to rounding.
1. 'Other' consists of water and urban and built-up areas.
Sources:
Latifovic, Rasim and Darren Pouliot, "Multi-temporal landcover mapping for Canada: methodology and products", *Canadian Journal of Remote Sensing*, in press.
Agriculture and Agri-Food Canada and Environment Canada, 2003, Framework Data - National Resolution - Ecological Units, www.geoconnexions.org/CGDI.cfm/fuseaction/dataFramework-Data.ecoUnits/gcs.cfm (accessed March 2, 2005).
Statistics Canada, Environment Accounts and Statistics Division, Spatial Environmental Information System.

Map A.1
Land cover, 2000



Sources:
Latifovic, R., Z.-L. Zhu, J. Cihlar, C. Giri, and I. Olthof, 2004, "Land cover mapping of North and Central America - Global Land Cover 2000," in *Remote Sensing of Environment*, 89, pp 116-127.
Statistics Canada, Environment Accounts and Statistics Division.

Map A.2
Terrestrial ecozones, 2003



Source:
Wiken, E.B. *et al.*, 1996, *A Perspective on Canada's Ecosystems: An Overview of the Terrestrial and Marine Ecozones*, Canadian Council on Ecological Areas, Occasional Paper, No. 14, Ottawa.

Ecozones

The desire for a national approach to ecosystem classification and mapping in Canada led to the development of a hierarchical ecological classification framework. The objective of the approach was to delineate, classify and describe ecologically distinct areas of the earth's surface at different levels of generalization. The ecological framework was developed by identifying distinct areas of non-living (abiotic) and living (biotic) factors that are ecologically related. From the broadest to the smallest, the hierarchical classification consists of seven levels of generalization: ecozones, ecoprovinces, ecoregions, ecodistricts, ecosections, ecosites and ecoelements. Map A.2 illustrates the boundary delineations of the country's 15 terrestrial ecozones.

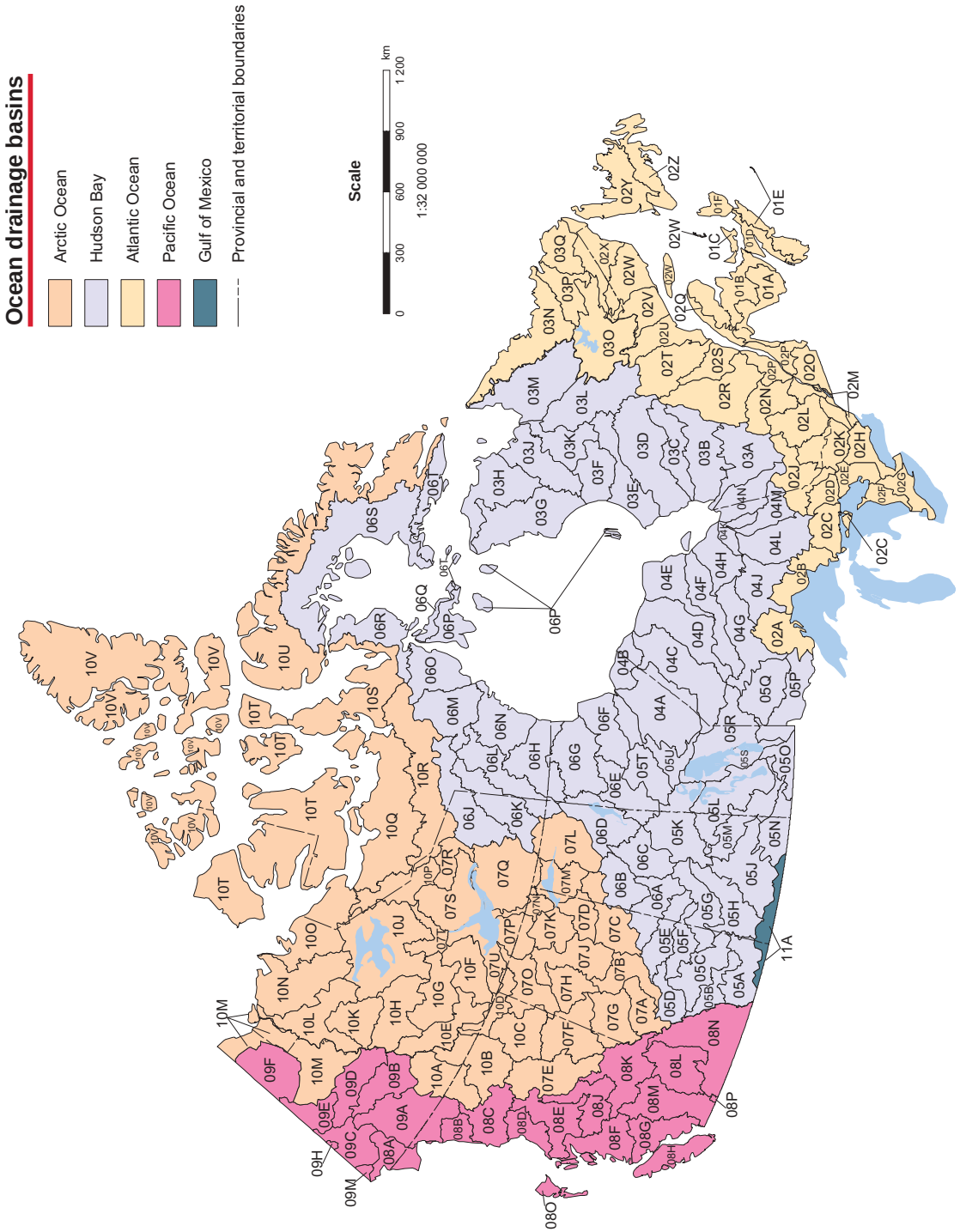
Hydrology

An estimated 12% of Canada, or 1.2 million km^2, is covered by lakes and rivers (Table A.3). While many provinces have a substantial amount of water in comparison with their population, only 3% of the area covered by water in Canada is located in inhabited regions.[1] Most of the land area of Canada drains to one of four water bodies: the Pacific, Arctic and Atlantic oceans and Hudson Bay. A small area in southern Alberta and Saskatchewan (0.3% of Canada's land area) drains into the Gulf of Mexico. Map A.3 and Table A.2 outline Canada's sub-drainage areas by ocean basin.

Canada's major river basins and their water resource characteristics are outlined in Map A.4 and Table A.3 respectively. Table A.4 shows the distribution of streamflow, water area and population for each province and territory.

1. Statistics Canada, 2003, "Fresh Water Resources," *Human Activity and the Environment, Annual Statistics 2003*, Catalogue no. 16-201-XPE, Ottawa.

Map A.3
Sub-drainage areas by ocean basin



Note:
The sub-drainage area codes on this map are used in Table A.2.
Sources:
Natural Resources Canada, 2003, *National Scale Frameworks Hydrology - Drainage Areas, Canada, Version 5.0*, www.geogratis.cgdi.gc.ca (accessed September 16, 2003).
Statistics Canada, Environment Accounts and Statistics Division, Spatial Environmental Information System.

Table A.2
Sub-drainage area names and areas by ocean basin

Sub-drainage area code	Ocean basin and sub-drainage area	Area[2] (km^2)	Sub-drainage area code	Ocean basin and sub-drainage area	Area[2] (km^2)
	Arctic Ocean		04K	Moose (Ont.)	17 949
07A	Upper Athabasca	34 856	04L	Missinaibi-Mattagami	60 593
07B	Central Athabasca - Upper	40 496	04M	Abitibi	29 291
07C	Central Athabasca - Lower	57 030	04N	Harricanaw - Coast	43 509
07D	Lower Athabasca	29 745	05A	Upper South Saskatchewan	46 466
07E	Williston Lake	72 362	05B	Bow	25 572
07F	Upper Peace	67 824	05C	Red Deer	50 316
07G	Smoky	51 508	05D	Upper North Saskatchewan	27 983
07H	Central Peace - Upper	35 412	05E	Central North Saskatchewan	42 275
07J	Central Peace - Lower	59 401	05F	Battle	30 241
07K	Lower Peace	36 510	05G	Lower North Saskatchewan	49 652
07L	Fond-du-Lac	70 650	05H	Lower South Saskatchewan	55 268
07M	Lake Athabasca - Shores	32 017	05J	Qu'Appelle	74 589
07N	Slave	17 057	05K	Saskatchewan	81 194
07O	Hay	51 405	05L	Lake Winnipegosis and Lake Manitoba	82 719
07P	Southern Great Slave Lake	33 916	05M	Assiniboine	51 259
07Q	Great Slave Lake - East Arm South Shore	96 331	05N	Souris	39 413
07R	Lockhart	27 124	05O	Red	25 444
07S	Northeastern Great Slave Lake	68 826	05P	Winnipeg	55 104
07T	Marian	24 262	05Q	English	52 550
07U	Western Great Slave Lake	30 955	05R	Eastern Lake Winnipeg	56 277
10A	Upper Liard	61 858	05S	Western Lake Winnipeg	24 650
10B	Central Liard	72 031	05T	Grass and Burntwood	42 390
10C	Fort Nelson	54 771	05U	Nelson	49 119
10D	Central Liard - Petitot	30 563	06A	Beaver (Alta.-Sask.)	49 940
10E	Lower Liard	55 571	06B	Upper Churchill (Man.)	44 288
10F	Upper Mackenzie - Mills Lake	51 042	06C	Central Churchill (Man.) - Upper	45 892
10G	Upper Mackenzie - Camsell Bend	57 858	06D	Reindeer	67 357
10H	Central Mackenzie - Blackwater Lake	67 210	06E	Central Churchill (Man.) - Lower	51 295
10J	Great Bear	158 140	06F	Lower Churchill (Man.)	54 799
10K	Central Mackenzie - The Ramparts	46 736	06G	Seal - Coast	75 970
10L	Lower Mackenzie	77 259	06H	Western Hudson Bay - Southern	73 301
10M	Peel and Southwestern Beaufort Sea	106 934	06J	Thelon	85 479
10N	Southern Beaufort Sea	99 387	06K	Dubawnt	68 911
10O	Amundsen Gulf	91 070	06L	Kazan	70 690
10P	Coppermine	50 741	06M	Chesterfield Inlet	67 783
10Q	Coronation Gulf - Queen Maud Gulf	174 677	06N	Western Hudson Bay - Central	63 743
10R	Back	135 956	06O	Western Hudson Bay - Northern	54 523
10S	Gulf of Boothia	114 748	06P	Hudson Bay - Southampton Island	48 764
10T	Southern Arctic Islands	373 194	06Q	Foxe Basin - Southampton Island	13 285
10U	Baffin Island - Arctic Drainage	299 813	06R	Foxe Basin - Melville Peninsula	59 726
10V	Northern Arctic Islands	424 817	06S	Foxe Basin - Baffin Island	211 083
	Lakes[1]	37 968	06T	Hudson Strait - Baffin and Southampton Islands	46 469
	Arctic Ocean total	**3 580 030**		Lakes[1]	24 534
				Hudson Bay total	**3 872 318**
	Hudson Bay				
03A	Nottaway - Coast	67 938		**Atlantic Ocean**	
03B	Broadback and Rupert	77 195	01A	Saint John and Southern Bay of Fundy (N.B.)	41 904
03C	Eastmain	45 930	01B	Gulf of St. Lawrence and Northern Bay of Fundy (N.B.)	60 778
03D	La Grande - Coast	112 203	01C	Prince Edward Island	5 943
03E	Grande rivière de la Baleine - Coast	62 752	01D	Bay of Fundy and Gulf of St. Lawrence (N.S.)	21 547
03F	Eastern Hudson Bay	46 383	01E	Southeastern Atlantic Ocean (N.S.)	23 132
03G	Northeastern Hudson Bay	100 054	01F	Cape Breton Island	10 685
03H	Western Ungava Bay	78 164	02A	Northwestern Lake Superior	43 729
03J	Aux Feuilles - Coast	63 722	02B	Northeastern Lake Superior	39 679
03K	Koksoak	45 542	02C	Northern Lake Huron	34 670
03L	Caniapiscau	90 094	02D	Wanipitei and French (Ont.)	19 225
03M	Eastern Ungava Bay	106 707	02E	Eastern Georgian Bay	21 958
04A	Hayes (Man.)	109 482	02F	Eastern Lake Huron	14 775
04B	Southwestern Hudson Bay	28 384	02G	Northern Lake Erie	22 621
04C	Severn	99 533	02H	Lake Ontario and Niagara Peninsula	28 734
04D	Winisk - Coast	79 224	02J	Upper Ottawa	50 786
04E	Ekwan - Coast	50 484	02K	Central Ottawa	40 678
04F	Attawapiskat - Coast	57 243	02L	Lower Ottawa	54 839
04G	Upper Albany	64 914	02M	Upper St. Lawrence	5 108
04H	Lower Albany - Coast	42 345	02N	Saint-Maurice	42 249
04J	Kenogami	52 370	02O	Central St. Lawrence	34 567

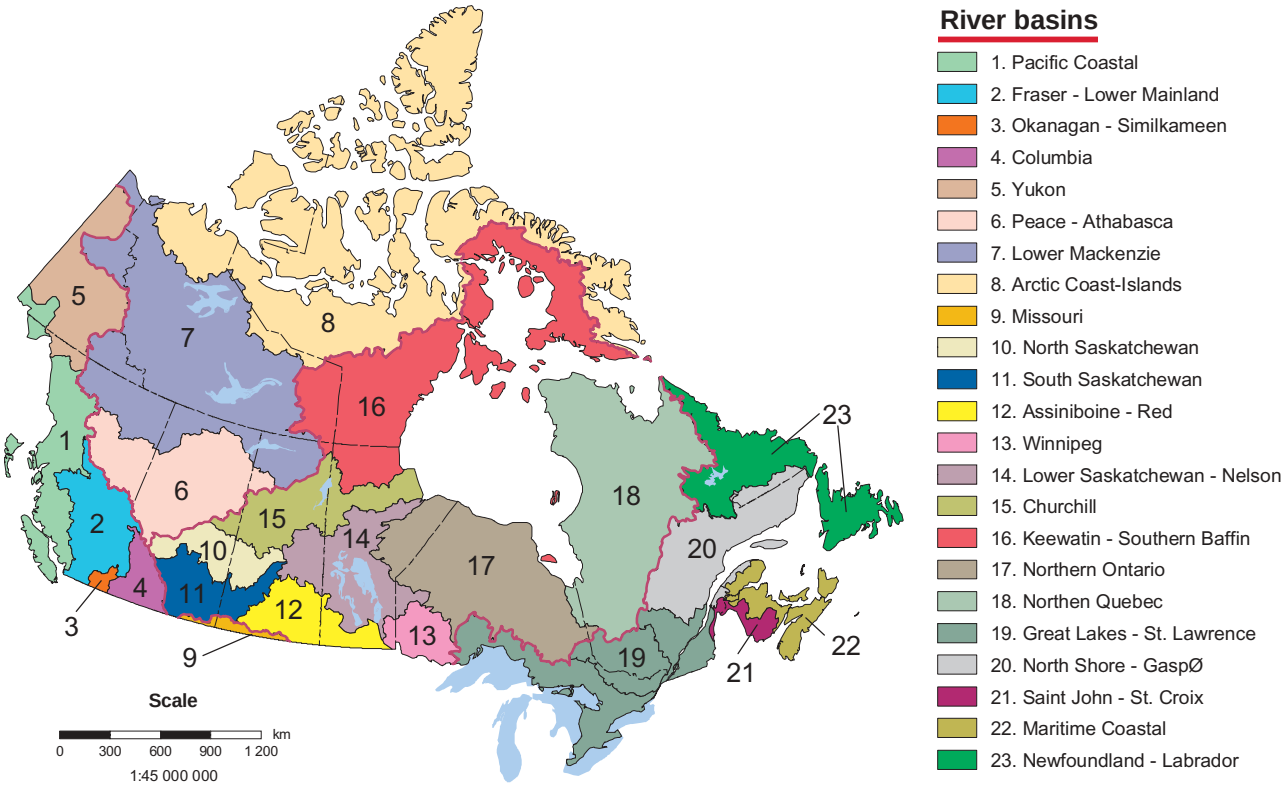
Table A.2
Sub-drainage area names and areas by ocean basin (continued)

Sub-drainage area code	Ocean basin and sub-drainage area	Area[2] (km^2)	Sub-drainage area code	Ocean basin and sub-drainage area	Area[2] (km^2)
02P	Lower St. Lawrence	37 161	08G	Southern coastal waters of B.C.	41 986
02Q	Northern Gaspé Peninsula	13 383	08H	Vancouver Island	34 882
02R	Saguenay	88 072	08J	Nechako	47 332
02S	Betsiamites - Coast	27 473	08K	Upper Fraser	67 088
02T	Manicouagan and aux Outardes	65 221	08L	Thompson	55 777
02U	Moisie and St. Lawrence Estuary	39 589	08M	Lower Fraser	61 880
02V	Gulf of St. Lawrence - Romaine	36 416	08N	Columbia - U.S.A.	102 925
02W	Gulf of St. Lawrence - Natashquan	53 841	08O	Queen Charlotte Islands	10 049
02X	Petit Mécatina and Strait of Belle Isle	50 320	08P	Skagit	1 027
02Y	Northern Newfoundland	66 102	09A	Headwaters Yukon	94 018
02Z	Southern Newfoundland	44 492	09B	Pelly	50 485
03N	Northern Labrador	92 911	09C	Upper Yukon	44 206
03O	Churchill (N.L.)	95 003	09D	Stewart	51 360
03P	Central Labrador	35 682	09E	Central Yukon	29 820
03Q	Southern Labrador	37 889	09F	Porcupine	61 566
	Lakes[1]	92 194	09H	Tanana	1 470
	Atlantic Ocean total	**1 493 352**	09M	Copper	4 112
				Pacific Ocean total	**1 003 385**
	Pacific Ocean				
08A	Alsek	31 192		**Gulf of Mexico**	
08B	Northern coastal waters of B.C.	22 767	11A	Missouri	27 097
08C	Stikine - Coast	49 997		**Gulf of Mexico total**	**27 097**
08D	Nass - Coast	29 036			
08E	Skeena - Coast	55 751		**Canada total**	**9 976 182**
08F	Central coastal waters of B.C.	54 658			

Notes:
1. 'Lakes' in this table refer to those internal lakes shown on Map A.3 as well as the Canadian portion of the Great Lakes.
2. Areas were calculated using an Albers Equal Area (NAD83) projection.

Sources:
Natural Resources Canada, 2003, National Scale Frameworks Hydrology - Drainage Areas, Canada, Version 5.0, www.geogratis.cgdi.gc.ca (accessed February 27, 2005).
Statistics Canada, Environment Accounts and Statistics Division, Spatial Environmental Information System.

Map A.4
Major river basins



Note:
The river basin codes in this map are used in Tables A.3, B.5 and B.47.
Sources:
Pearse, P.H., F. Bertrand and J.W. MacLaren, 1985, *Currents of Change: Final Report of the Inquiry on Federal Water Policy,* Environment Canada, Ottawa.
Statistics Canada, Environment Accounts and Statistics Division, Spatial Environmental Information System.

Table A.3
Water resource characteristics by major river basin[1]

			Water area[3]			Mean annual Streamflow[4]				Precipitation[5]		Dams	
Code	River basin name	Total area[2]	Total	As a share of total	Per capita 2001	Rate	Total	Per unit area	As a share of total	Rate	Volume	Number	Generating capacity[6]
		km^2		%	m^2	m^3/s	km^3	thousand m^3/km^2	%	mm	km^3	units	MW
1	Pacific Coastal	334 452	15 041	4.5	10 944	16 390	516.9	1 545	15.6	1 354	451	50	1 648
2	Fraser - Lower Mainland	233 105	9 015	3.9	4 462	3 972	125.3	537	3.8	670	156	24	848
3	Okanagan - Similkameen	15 603	650	4.2	2 279	74	2.3	150	0.1	466	7	3	594
4	Columbia	87 321	2 482	2.8	15 457	2 009	63.4	726	1.9	776	68	56	5 153
5	Yukon	332 906	9 329	2.8	343 653	2 506	79.0	237	2.4	346	115	10	76
6	Peace - Athabasca	485 146	16 725	3.4	48 306	2 903	91.5	189	2.8	497	241	17	3 427
7	Lower Mackenzie	1 330 481	176 937	13.3	3 623 373	7 337	231.4	174	7.0	365	486	18	83
8	Arctic Coast - Islands	1 764 279	177 906	10.1	10 617 432	8 744	275.8	156	8.3	189	333	0	0
9	Missouri	27 097	1 129	4.2	120 359	12	0.4	14	0.0	390	11	2	13
10	North Saskatchewan	150 151	7 245	4.8	5 539	234	7.4	49	0.2	443	67	6	504
11	South Saskatchewan	177 623	6 243	3.5	3 522	239	7.5	42	0.2	419	74	21	310
12	Assiniboine - Red	190 705	9 098	4.8	6 665	50	1.6	8	0.0	450	86	3	168
13	Winnipeg	107 654	20 599	19.1	247 350	758	23.9	222	0.7	683	74	98	905
14	Lower Saskatchewan - Nelson	360 883	67 612	18.7	309 699	1 911	60.3	167	1.8	508	183	60	4 941
15	Churchill	313 572	51 858	16.5	593 728	701	22.1	70	0.7	480	151	12	119
16	Keewatin - Southern Baffin Island	939 568	161 438	17.2	13 416 290	5 383	169.8	181	5.1	330	310	0	0
17	Northern Ontario	691 811	55 952	8.1	391 174	5 995	189.1	273	5.7	674	466	60	1 116
18	Northern Quebec	940 194	148 986	15.8	1 426 559	16 830	530.8	565	16.0	698	656	66	15 238

Table A.3
Water resource characteristics by major river basin[1] (continued)

Code	River basin name	Total area[2]	Water area[3] Total	Water area[3] As a share of total	Water area[3] Per capita 2001	Mean annual Streamflow[4] Rate	Streamflow[4] Total	Streamflow[4] Per unit area	Streamflow[4] As a share of total	Precipitation[5] Rate	Precipitation[5] Volume	Dams Number	Dams Generating capacity[6]
		km^2		%	m^2	m^3/s	km^3	thousand m^3/km^2	%	mm	km^3	units	MW
19	Great Lakes - St. Lawrence	582 945	134 928	23.1	7 624	7 197	227.0	389	6.8	957	556	623	12 515
20	North Shore - Gaspé	369 094	37 363	10.1	74 117	8 159	257.3	697	7.8	994	367	129	10 785
21	Saint John - St. Croix	41 904	1 800	4.3	4 481	779	24.6	586	0.7	1 147	48	54	1 864
22	Maritime Coastal	122 056	6 728	5.5	4 469	3 628	114.4	937	3.5	1 251	153	60	411
23	Newfoundland - Labrador	380 355	55 388	14.6	107 731	9 324	294.0	773	8.9	1 030	392	90	6 693
	Canada	**9 978 904**	**1 174 452**	**11.8**	**39 139**	**105 135**	**3 315.5**	**332**	**100.0**	**545**	**5 451**	**1 462**	**67 411**

Notes:
1. These major river basins and associated flow measures are adapted from "Laycock (1987) (see full reference below). Some of these river basin aggregates have more than one outflow.
2. Area includes the Canadian portion of the Great Lakes.
3. Water area figures are calculated from the Canada-wide 1-km water fraction derived from National Topographic Database maps.
4. Basins at the US-Canada border exclude inflow from U.S. portion of basin region.
5. Precipitation has been estimated from an Inverse Distance Weighted (IDW) interpolation of the 1971 to 2000 normals.
6. The generating capacity refers to the maximum power capability from hydro plants. The survey coverage for those plants is limited to those utilities and companies which have at least one plant with a total generating capacity of over 500 kW.

Sources:
Environment Canada, 2003, *Canadian Climate Normals, 1971 to 2000*, Meteorological Service of Canada, climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html (accessed February 23, 2005).
Pearse, P.H., F. Bertrand and J.W. MacLaren, 1985, *Currents of Change: Final Report of the Inquiry on Federal Water Policy*, Environment Canada, Ottawa.
Fernandes, R., G. Pavlic, W. Chen and R. Fraser, 2001, Canada-wide 1-km water fraction, National Topographic Database, Natural Resources Canada, www.nrcan.gc.ca/ess/_portal_esst.cache/gc_ccrs_e (accessed February 23, 2005).
Laycock, A.H., 1987, "The Amount of Canadian Water and its Distribution," in *Canadian Aquatic Resources*, no. 215 of *Canadian Bulletin of Fisheries and Aquatic Sciences*, M.C. Healey and R.R. Wallace (eds.), 13-42, Fisheries and Oceans Canada, Ottawa.
Natural Resources Canada, GeoAccess Division, 2003, 1:1 Million Digital Drainage Area Framework, version 4.8b.
Statistics Canada, 2001 Census of Population.
Statistics Canada, 2000, *Electric Power Generating Stations*, Catalogue no. 57-206-XIB.

Table A.4
Distribution of streamflow, water area and 2001 population, by province and territory

Province/territory	Streamflow	Water area	Population
	%		
Newfoundland and Labrador	8.6	5.0	1.7
Prince Edward Island	0.1	0.1	0.5
Nova Scotia	1.2	0.5	3.0
New Brunswick	1.3	0.2	2.4
Quebec	21.6	18.6	24.1
Ontario	8.9	8.8	38.0
Manitoba	2.6	10.0	3.7
Saskatchewan	1.5	7.0	3.3
Alberta	1.9	2.6	9.9
British Columbia	24.0	3.0	13.0
Yukon Territory	4.2	1.0	0.1
Northwest Territories and Nunavut	24.0	43.3	0.2
Canada	**100.0**	**100.0**	**100.0**

Sources:
Laycock, A.H.,1987, "The Amount of Canadian Water and its Distribution," in *Canadian Aquatic Resources*, no. 215 of *Canadian Bulletin of Fisheries and Aquatic Sciences*, M.C. Healey and R.R. Wallace (eds.), 13-42, Fisheries and Oceans Canada, Ottawa.
Fernandes, R., G. Pavlic, W. Chen and R. Fraser, 2001, Canada-wide 1-km water fraction, National Topographic Database, Natural Resources Canada, www.nrcan.gc.ca/ess/_portal_esst.cache/gc_ccrs_e (accessed April 29 2002).
Statistics Canada, 2001 Census of Population.

Climate

Climate can be defined as the average weather that occurs in a specific area over a period of time. Humans rely heavily on the regularity of climate patterns for almost all of their activities. Climate is measured using various weather elements as indicators. The two essential indicators, temperature and precipitation, are measured systematically at a site over time, accumulating an archive of observations from which climatic summaries can be derived for that location. Daily stations provide readings once or twice daily for temperature and precipitation while principal stations provide hourly readings of more detailed weather information for forecasting purposes.

Table A.5 lists some of the more extreme weather events that affected areas of Canada in 2004.

Table A.5
Top 10 Canadian weather stories of 2004

Rank[1]	Event	Location	Event length
1	Storm Drowns and Pounds Edmonton	Alberta	July
2	White Juan Buries Halifax	Nova Scotia	February
3	Summer's Cold Shoulder	Canada	summer
4	Peterborough's Flood of Two Centuries	Ontario	July
5	British Columbia and Yukon - Warm, Dry and on Fire	British Columbia and Yukon	April to July
6	January's Nation-wide Deep Freeze	Canada	January
7	A Billion Dollar Frost	Western Canada	August
8	Weather Picks on Nova Scotia Again	Nova Scotia	November
9	Snow Dump Smothers Prairie Spring	Prairies	May
10	Weather Cures the West Nile Virus	Canada	summer

Note:
1. Canada's Top Weather Stories for 2004 are rated from one to ten based on the degree to which Canada and Canadians were impacted, the extent of the area affected, economic effects and longevity as a top news story.
Source:
Environment Canada, Meteorological Service of Canada, 2005, *Environment Canada's Top Weather Stories for 2004*, www.msc.ec.gc.ca/media/top10/2004_e.html (accessed January 5, 2005).

Temperature

Drastic changes in temperature signal the change from one season to the next in Canada. Although winters can be bitterly cold, summers can be hot and dry, or hot and humid, depending on the region. Table A.6 summarizes the mean daily temperatures by month as recorded at selected weather stations across Canada and averaged over the period 1971 to 2000.

Figure A.1 shows the trend in average air temperature in Canada over the last half-century. Like the rest of the world, Canada appears to be experiencing warmer weather. Table A.7 presents temperature trends and departures for the climate regions shown in Map A.5.

Table A.6
Average daily temperatures by month for selected weather stations, 1971 to 2000[1]

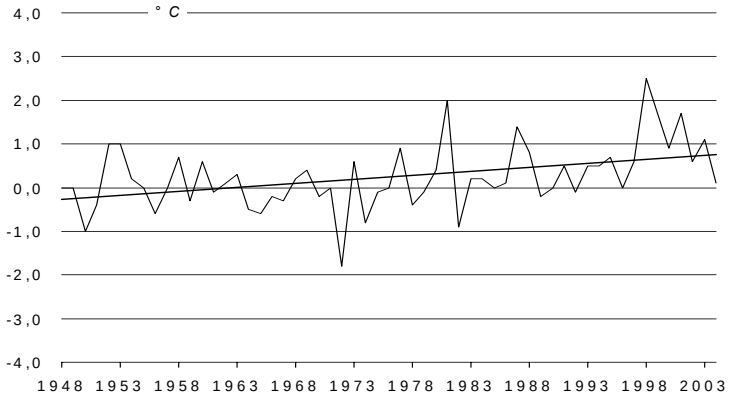
	Average daily temperature												
Station	January	February	March	April	May	June	July	August	September	October	November	December	Annual
	°C												
Goose Bay, N.L.	-18.1	-16.3	-9.6	-1.7	5.1	11.0	15.4	14.5	9.2	2.4	-4.5	-13.9	-0.5
Gander, N.L.	-7.4	-7.9	-4.0	1.3	6.7	11.6	16.0	15.7	11.4	5.8	1.0	-4.3	3.8
St. John's, N.L.	-4.8	-5.4	-2.5	1.6	6.2	10.9	15.4	15.5	11.8	6.9	2.6	-2.2	4.7
Charlottetown, P.E.I.	-8.0	-7.8	-3.1	2.7	9.1	14.6	18.5	18.1	13.6	7.8	2.3	-4.1	5.3
Sydney, N.S.	-5.7	-6.5	-2.7	2.1	7.8	13.3	17.7	17.7	13.4	8.0	3.3	-2.1	5.5
Halifax, N.S.	-6.0	-5.6	-1.4	4.0	9.8	15.0	18.6	18.4	14.1	8.3	3.1	-2.8	6.3
Yarmouth, N.S.	-3.0	-3.0	0.3	4.9	9.7	13.7	16.5	16.9	13.8	9.1	4.8	-0.2	7.0
Moncton, N.B.	-8.9	-8.0	-2.9	3.2	9.9	15.1	18.6	17.9	13.0	7.1	1.4	-5.5	5.1
Saint John, N.B.	-8.1	-7.3	-2.5	3.6	9.4	14.0	17.1	16.9	12.8	7.3	2.0	-4.7	5.0
Chapais 2, Que.	-18.8	-16.6	-9.5	-0.5	7.9	14.0	16.3	14.9	9.3	2.9	-5.4	-14.8	0.0
Kuujjuaq, Que.	-24.3	-23.6	-18.3	-9.1	0.3	7.2	11.5	10.6	5.6	-0.7	-8.4	-19.3	-5.7
Kuujjuarapik, Que.	-23.4	-23.2	-17.3	-7.6	1.3	7.0	10.6	11.4	7.4	2.1	-5.0	-16.2	-4.4
Québec, Que.	-12.8	-11.1	-4.6	3.3	11.2	16.5	19.2	17.9	12.5	6.2	-0.7	-9.1	4.0
Sept-Îles, Que.	-15.3	-13.4	-7.1	0.0	5.9	11.7	15.3	14.2	9.3	3.4	-3.1	-11.3	0.8
Montréal, Que.	-10.4	-9.0	-2.5	5.5	12.9	17.7	20.5	19.2	13.9	7.5	1.0	-6.8	5.8
Ottawa, Ont.	-10.8	-8.7	-2.5	5.7	13.4	18.3	20.9	19.5	14.3	7.8	1.0	-7.1	6.0
Kapuskasing, Ont.	-18.7	-15.5	-8.6	0.5	9.0	14.4	17.2	15.7	10.1	3.8	-4.8	-14.3	0.7
Thunder Bay, Ont.	-14.8	-12.0	-5.5	2.9	9.5	14.0	17.6	16.6	11.0	5.0	-3.0	-11.6	2.5
Toronto, Ont.	-6.3	-5.4	-0.4	6.3	12.9	17.8	20.8	19.9	15.3	8.9	3.2	-2.9	7.5
Windsor, Ont.	-4.5	-3.2	2.0	8.2	14.9	20.1	22.7	21.6	17.4	11.0	4.6	-1.5	9.4
The Pas, Man.	-20.6	-16.1	-8.9	1.0	9.0	14.8	17.7	16.5	10.0	3.1	-7.8	-17.4	0.1
Winnipeg, Man.	-17.8	-13.6	-6.1	4.0	12.0	17.0	19.5	18.5	12.3	5.3	-5.3	-14.4	2.6
Churchill, Man.	-26.7	-24.6	-19.5	-9.7	-0.7	6.6	12.0	11.7	5.6	-1.7	-12.6	-22.8	-6.9
Regina, Sask.	-16.2	-11.9	-5.0	4.5	11.7	16.4	18.8	18.0	11.7	4.8	-5.5	-13.2	2.8
Saskatoon, Sask.	-17.0	-13.0	-5.8	4.4	11.5	16.0	18.2	17.3	11.2	4.5	-6.2	-14.3	2.2
Calgary, Alta.	-8.9	-6.1	-1.9	4.6	9.8	13.8	16.2	15.6	10.8	5.4	-3.1	-7.4	4.1
Edmonton, Alta.	-13.5	-10.5	-4.5	4.3	10.4	14.1	15.9	15.1	10.1	4.3	-5.7	-11.3	2.4
Victoria, B.C.	3.8	4.9	6.4	8.8	11.8	14.4	16.4	16.4	14.0	9.8	6.1	4.0	9.7
Penticton, B.C.	-1.7	0.7	4.7	9.0	13.6	17.4	20.4	20.1	14.9	8.7	3.1	-1.1	9.2
Vancouver, B.C.	3.3	4.8	6.6	9.2	12.5	15.2	17.5	17.6	14.6	10.1	6.0	3.5	10.1
Prince Rupert, B.C.	1.3	2.5	3.9	6.0	8.7	11.1	13.1	13.5	11.3	7.9	4.1	2.2	7.1
Prince George, B.C.	-9.6	-5.4	-0.3	5.2	9.9	13.3	15.5	14.8	10.1	4.6	-2.9	-7.8	4.0
Mayo, Y.T.	-25.7	-19.0	-9.6	0.9	8.4	14.0	16.0	13.1	6.4	-2.9	-15.9	-22.3	-3.1
Whitehorse, Y.T.	-17.7	-13.7	-6.6	0.9	6.9	11.8	14.1	12.5	7.1	0.6	-9.4	-14.9	-0.7

Table A.6
Average daily temperatures by month for selected weather stations, 1971 to 2000[1] (continued)

Station	Average daily temperature												
	January	February	March	April	May	June	July	August	September	October	November	December	Annual
	°C												
Inuvik, N.W.T.	-27.6	-26.9	-23.2	-12.8	0.2	11.3	14.2	11.0	3.7	-8.2	-21.0	-25.7	-8.8
Yellowknife, N.W.T.	-26.8	-23.4	-17.3	-5.3	5.6	13.5	16.8	14.2	7.1	-1.7	-13.8	-23.7	-4.6
Resolute, Nvt.	-32.4	-33.1	-30.7	-22.8	-10.9	-0.1	4.3	1.5	-4.7	-14.9	-23.6	-29.2	-16.4
Alert, Nvt.	-32.3	-33.4	-32.4	-24.3	-11.8	-0.8	3.3	0.8	-9.2	-19.3	-26.4	-30.0	-18.0
Clyde, Nvt.	-28.1	-29.6	-27.2	-19.0	-8.5	0.7	4.4	3.9	0.0	-7.6	-17.5	-24.8	-12.8
Iqaluit, Nvt.	-26.6	-28.0	-23.7	-14.8	-4.4	3.6	7.7	6.8	2.2	-4.9	-12.8	-22.7	-9.8
Baker Lake, Nvt.	-32.3	-31.5	-27.2	-17.4	-5.8	4.9	11.4	9.5	2.6	-7.5	-20.1	-28.4	-11.8

Note:
1. Averaged over the period 1971 to 2000.
Source:
Environment Canada, National Climate Data and Information Archive, 2004, *Canadian Climate Normals or Averages, 1971-2000*, www.climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html (accessed November 15, 2004).

Figure A.1
Annual national temperature departures and long-term trend, 1948 to 2004



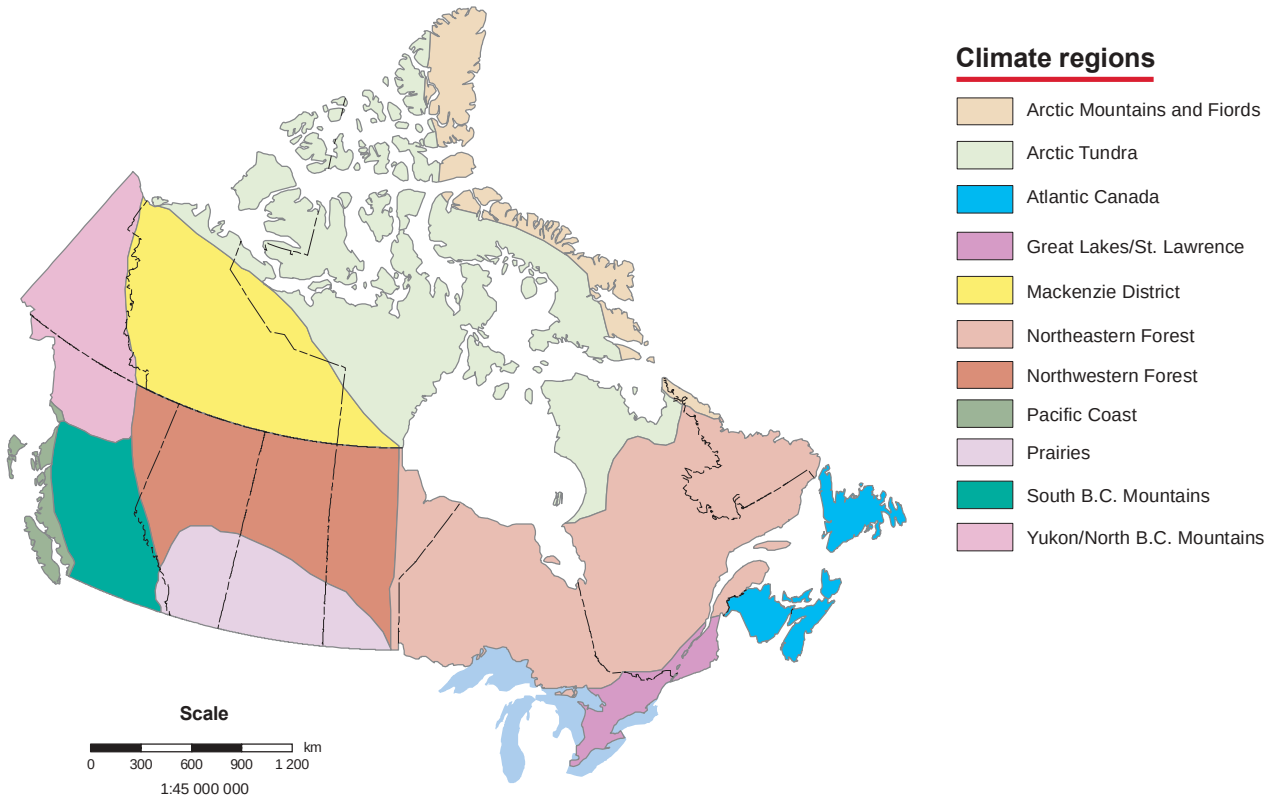
Note:
Departures from 1951 to 1980 average.
Source:
Environment Canada, Meteorological Service of Canada, Climate Research Branch, 2005, *Climate Trends and Variations Bulletin for Canada, Annual 2004*, www.msc.ec.gc.ca/ccrm/bulletin/national_e.cfm (accessed January 20, 2005).

Table A.7
Annual regional temperature departures, trends and extremes, 1948 to 2004

Climate region[1]	Trend[2]	Extreme years				Annual 2004[p]	
		Coldest		Warmest			
		Year on record	Departure[3]	Year on record	Departure[3]	Rank[4]	Departure[3]
	°C		°C		°C		°C
Atlantic Canada	0.0	1972	-1.4	1999	2.0	23	0.1
Great Lakes/St. Lawrence Lowlands	0.4	1978	-1.0	1998	2.3	29	0.1
Northeastern Forest	0.5	1972	-1.9	1998	2.1	33	0.0
Northwestern Forest	1.6	1950	-2.1	1987	3.0	30	0.1
Prairies	1.3	1950	-2.1	1987	3.1	24	0.6
South British Columbia Mountains	1.4	1955	-1.8	1998	2.0	4	1.6
Pacific Coast	1.2	1955	-1.2	1958	1.6	2	1.5
North British Columbia Mountains/Yukon	2.0	1972	-2.1	1981	2.8	4	2.2
Mackenzie District	1.8	1982	-1.5	1998	3.9	46	-0.7
Arctic Tundra	1.2	1972	-2.4	1998	3.3	46	-0.5
Arctic Mountains and Fiords	0.7	1972	-1.9	1981	2.2	25	0.2
Canada	**1.1**	**1972**	**-1.8**	**1998**	**2.5**	**28**	**0.1**

Notes:
1. The climate regions of Canada are illustrated in Map A.5.
2. A linear (least square) trend over the period of record.
3. Difference from the normal temperature.
4. This column ranks 2004 temperature departures over a 57 year period between 1948 and 2004. For example, on the first line of the table, the Atlantic Canada Climate Region had a departure that was .1 degrees C warmer than the long term temperature average, which ranked the 2004 season as the 23rd warmest over the 57 year period.
Source:
Environment Canada, Meteorological Service of Canada, Climate Research Branch, 2005, *Climate Trends and Variations Bulletin for Canada, Annual 2004*, www.msc.ec.gc.ca/ccrm/bulletin/regional_e.cfm (accessed January 20, 2005).

Map A.5
Canadian climate regions



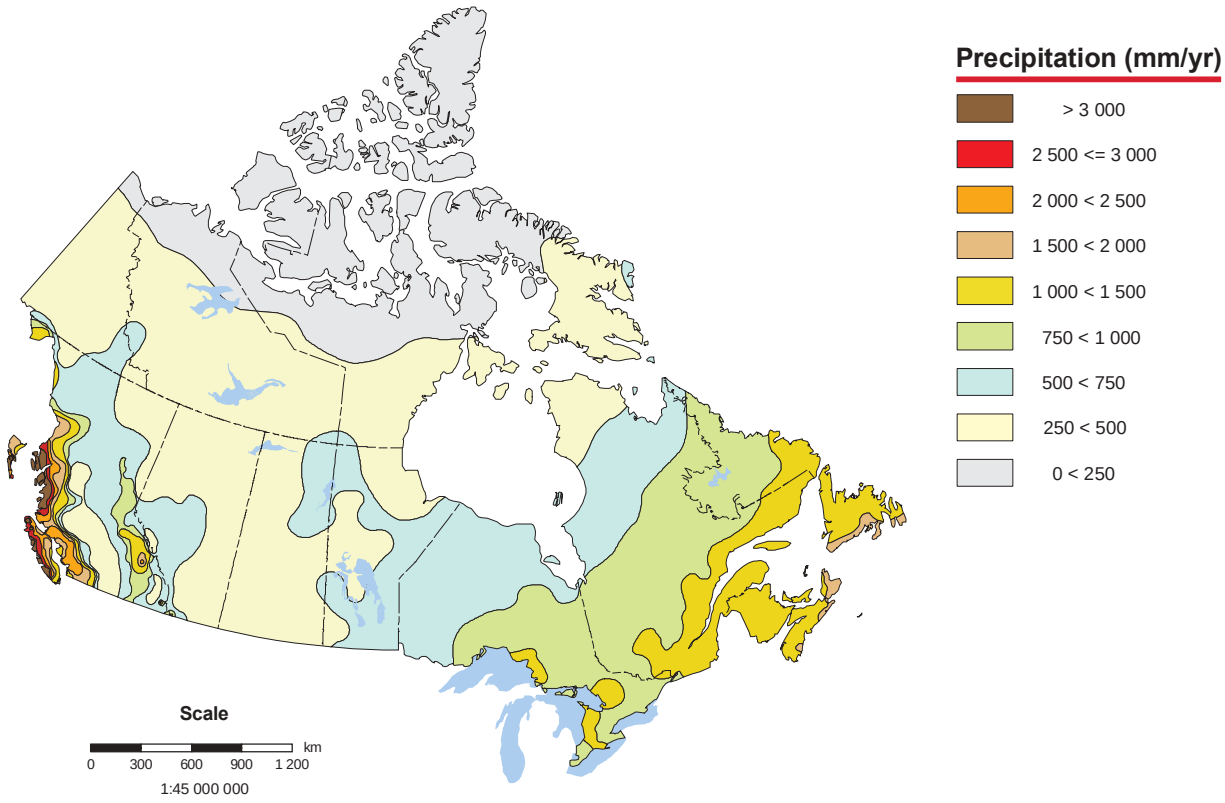
Source:
Environment Canada, Atmospheric Environment Service, Climate Research Branch, 1998, *Climate Trends and Variations Bulletin for Canada*, Ottawa.

Precipitation

Some 5 500 km^3 of precipitation falls on Canada every year, mainly in the form of rain and snow.[1] Air masses that carry this precipitation generally circulate from west to east (Map A.6). Figure A.2 shows the average annual precipitation as recorded at selected weather stations.

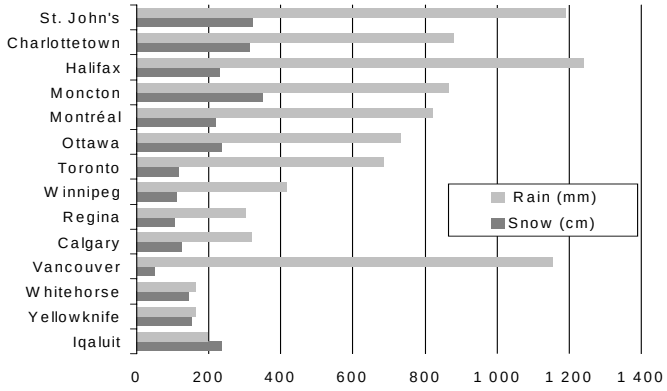
1. Statistics Canada, 2003, "Fresh Water Resources," *Human Activity and the Environment, Annual Statistics 2003*, Catalogue no. 16-201-XPE, Ottawa.

Map A.6
Normal precipitation, 1971 to 2000



Note:
The data for this map were estimated using a two-pass inverse distance-weighted interpolation of the 1971 to 2000 normal precipitation data from the Meteorological Service of Canada, using the Albers Equal Area Conic projection (Statistics Canada, Environment Accounts and Statistics Division).
Sources:
Environment Canada, Meteorological Service of Canada.
Statistics Canada, Environment Accounts and Statistics Division.

Figure A.2
Average annual precipitation, 1971 to 2000



Source:
Environment Canada, 2004, *Canadian Climate Normals, 1971-2000*, www.climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html (accessed November 25, 2004).

B) Pressure

Driving forces

Driving forces are the conditions and activities that shape the relationship between human activities and the environment. Topics covered in this section include population, economic conditions and transportation.

Population

Population growth, distribution and density are major factors in determining the impacts that human activities have on the environment. Canada's population has expanded considerably since 1901, when there were 5.4 million Canadians (Table B.1). By 2001, the population had grown almost six-fold, reaching over 31 million people. However, growth rates have not been consistent over time. Two historical periods were characterized by high annual population growth rates. The first was from 1901 to 1911, when massive immigration resulted in annual growth rates of up to 3%. The second period of high growth followed the end of the Second World War and is generally referred to as the 'baby boom'. In contrast to these two periods of population growth, two periods of slow economic activity (1891 to 1901 and 1931 to 1941) coincided with a slump in population growth rates. Since 1957, when the annual growth rate was 3.3%, growth rates have been decreasing, fluctuating between 1% and 1.8% from 1970 to 2001.

The growth of Canada's population is the result of two factors: natural increase and net migration. Since the 1960s, the population growth rate has slowed (Table B.2). In the early 1960s, natural increase accounted for over 90% of population growth. From 1960 to 2004, the number of births per year decreased and the number of deaths per year increased. By 2001, net migration had become a more important component of population growth, accounting for nearly two-thirds the annual increase.

Tables B.3 and B.4 present population by ecozone, illustrating the unevenness of Canada's population distribution. Although the average population density for Canada was only three persons per km^2 in 2001, over 30 persons per km^2 inhabited the Great Lakes - St. Lawrence river basin (Table B.5).

In 2001, 80% of the Canadian population lived in urban areas compared to 76% two decades earlier. Table B.6 breaks down urban and rural population by sub-drainage area.

Table B.1
Total population by province and territory, 1901 to 2001, selected years

	Total population										Change	
Province/territory	1901	1911	1921	1931	1941	1951	1961	1971	1981	1991	2001	1901 to 1951	1951 to 2001
	thousands											%	
Newfoundland and Labrador	…	…	…	…	…	361.4	457.9	530.9	574.8	579.5	522.0	…	44
Prince Edward Island	103.3	93.7	88.6	88.0	95.0	98.4	104.6	112.6	123.7	130.3	136.7	-5	39
Nova Scotia	459.6	492.3	523.8	512.8	578.0	642.6	737.0	797.3	854.6	915.1	932.4	40	45
New Brunswick	331.1	351.9	387.9	408.2	457.4	515.7	597.9	642.5	706.3	745.5	749.9	56	45
Quebec	1 648.9	2 005.8	2 360.5	2 874.7	3 331.9	4 055.7	5 259.2	6 137.3	6 547.7	7 064.6	7 397.0	146	82
Ontario	2 182.9	2 527.3	2 933.7	3 431.7	3 787.7	4 597.5	6 236.1	7 849.0	8 811.3	10 428.1	11 897.6	111	159
Manitoba	255.2	461.4	610.1	700.1	729.7	776.5	921.7	998.9	1 036.4	1 109.6	1 151.3	204	48
Saskatchewan	91.3	492.4	757.5	921.8	896.0	831.7	925.2	932.0	975.9	1 002.7	1 000.1	811	20
Alberta	73.0	374.3	588.5	731.6	796.2	939.5	1 332.0	1 665.7	2 294.2	2 592.6	3 056.7	1 187	225
British Columbia	178.7	392.5	524.6	694.3	817.8	1 165.2	1 629.1	2 240.5	2 823.9	3 373.5	4 078.4	552	250
Yukon Territory	27.2	8.5	4.1	4.2	5.0	9.1	14.6	19.0	23.9	28.9	30.1	-67	231
Northwest Territories	20.1[1]	6.5[1]	8.1[1]	9.3[1]	12.0[1]	16.0[1]	23.0[1]	36.4[1]	47.6[1]	38.7	40.8	-20	…
Nunavut	…	…	…	…	…	…	…	…	…	22.2	28.1	…	…
Canada	**5 371.3**	**7 206.6**	**8 787.8**	**10 376.7**	**11 506.7**	**14 009.4**	**18 238.3**	**21 962.0**	**24 820.4**	**28 031.4**	**31 021.3**	**161**	**121**

Notes:
Figures may not add up to totals due to rounding.
1. Includes Nunavut.
Sources:
Statistics Canada, 1983, *Historical Statistics of Canada, Second Edition*, F.H. Leacy (ed.), Catalogue no. 11-516-XPE, Ottawa.
Statistics Canada, CANSIM, tables 051-0001 and 051-0024.

Table B.2
Components of population growth, 1960 to 2004

Year	Population			Natural increase			Net migration		
	Total	Growth	Growth rate	Births	Deaths	Natural increase	Immigration	Emigration	Net migration
	thousands		%	thousands			thousands		
1960	17 909	…	…	478.6	139.7	338.9	104.1	..	..
1961	18 271	362	2.0	475.7	141.0	334.7	71.7	..	..
1962	18 614	343	1.8	469.7	143.7	326.0	74.6	..	..
1963	18 964	350	1.8	465.8	147.4	318.4	93.2	..	..
1964	19 325	361	1.9	452.9	145.9	307.0	112.6	..	..
1965	19 678	353	1.8	418.6	148.9	269.7	146.8	..	..
1966	20 048	370	1.8	387.7	149.9	237.8	194.7	..	..
1967	20 412	364	1.8	370.9	150.3	220.6	222.9	..	..
1968	20 729	317	1.5	364.3	153.2	211.1	184.0	..	..
1969	21 028	299	1.4	369.7	154.5	215.2	161.5	..	..
1970	21 324	296	1.4	372.0	156.0	216.0	147.7	..	..
1971	21 962	638	2.9	362.2	157.3	204.9	121.9	..	..
1972	22 218	256	1.2	351.3	159.5	191.7	117.0	26.6	90.5
1973	22 492	273	1.2	345.8	162.6	183.2	138.5	27.7	110.8
1974	22 808	316	1.4	342.4	166.3	176.2	217.5	46.8	170.7
1975	23 143	335	1.4	356.0	168.8	187.2	209.3	40.5	168.8
1976	23 450	307	1.3	364.3	166.4	197.9	170.0	30.3	139.7
1977	23 726	276	1.2	357.9	165.7	192.1	130.9	25.1	105.9
1978	23 963	237	1.0	359.8	169.0	190.8	101.0	31.4	69.5
1979	24 202	238	1.0	362.4	165.8	196.6	84.5	30.9	53.7
1980	24 516	314	1.3	367.3	171.5	195.8	143.8	20.5	123.3
1981	24 820	304	1.2	372.1	170.5	201.6	127.2	17.8	109.4
1982	25 117	297	1.2	372.5	172.4	200.1	135.3	29.1	106.2
1983	25 367	250	1.0	373.6	176.5	197.1	101.4	31.1	70.3
1984	25 608	241	0.9	374.5	174.2	200.4	88.6	31.8	56.8
1985	25 843	235	0.9	376.3	179.1	197.2	83.9	28.1	55.8
1986	26 101	258	1.0	375.4	183.4	192.0	88.7	24.8	63.9
1987	26 449	348	1.3	373.0	182.6	190.4	130.9	31.0	99.9
1988	26 795	347	1.3	370.0	189.9	180.1	152.2	26.7	125.5
1989	27 282	486	1.8	384.0	188.4	195.6	177.6	26.3	151.3
1990	27 698	416	1.5	403.3	192.6	210.7	203.4	25.8	177.5
1991	28 031	334	1.2	402.9	192.4	210.5	221.4	28.5	192.9
1992	28 367	335	1.2	403.1	197.0	206.1	244.3	49.5	194.8
1993	28 682	315	1.1	392.2	201.8	190.4	266.9	48.5	218.4
1994	28 999	317	1.1	386.2	206.5	179.7	235.4	52.8	182.5
1995	29 302	303	1.0	382.0	209.4	172.6	220.7	53.4	167.3
1996	29 611	309	1.0	372.5	209.8	162.7	217.5	49.1	168.4
1997	29 907	296	1.0	357.3	217.2	140.1	224.9	59.4	165.4
1998	30 157	250	0.8	345.1	217.7	127.4	194.5	58.7	135.8
1999	30 404	247	0.8	338.3	217.6	120.7	173.2	56.1	117.1
2000	30 689	285	0.9	336.9	217.2	119.7	205.7	56.0	149.7
2001	31 021	332	1.1	327.1	219.1	108.0	252.5	55.4	197.1
2002	31 373	351	1.1	328.2	220.5	107.7	256.3	46.4	209.9
2003	31 660	288	0.9	329.3	224.7	104.6	199.2	46.5	152.7
2004	31 946	286	0.9	330.8	233.1	97.7	239.1	46.7	192.4

Note:
Population growth figures do not equal the sum of the natural increase and net migration. The balance of non-permanent residents and the number of returning Canadians, as well as a residual need to be added.
Sources:
Statistics Canada, 1992, *Report on the Demographic Situation in Canada 1992,* Catalogue no. 91-209, Ottawa.
Statistics Canada, *Quarterly Demographic Statistics,* Catalogue no. 91-002, Ottawa, various issues.
Statistics Canada, Census of Population and Demography Division.
Statistics Canada, CANSIM, tables 051-0001 and 051-0004.

Table B.3
Population by ecozone, 1981 and 2001

Ecozone	Area	Population			Density	
		1981	2001	Change 1981 to 2001	1981	2001
	km^2	persons			persons/100 km^2	
Arctic Cordillera	234 708	821	1 304	483	0.35	0.56
Northern Arctic	1 371 340	11 872	20 451	8 579	0.87	1.49
Southern Arctic	702 542	8 137	14 470	6 333	1.16	2.06
Taiga Plains	569 363	18 358	20 726	2 368	3.22	3.64
Taiga Shield	1 122 504	30 859	38 116	7 257	2.75	3.40
Boreal Shield	1 640 949	2 731 344	2 821 808	90 464	166.45	103.31
Atlantic Maritime	192 017	2 428 735	2 537 685	108 950	1 264.86	1 321.60
Mixed Wood Plains	107 017	12 187 952	15 631 830	3 443 878	11 388.75	14 606.81
Boreal Plains	668 664	673 775	771 205	97 430	100.76	115.34
Prairies	443 159	3 499 494	4 222 569	723 075	789.67	952.83
Taiga Cordillera	264 213	563	370	-193	0.21	0.14
Boreal Cordillera	459 864	26 507	30 690	4 183	5.76	6.67
Pacific Maritime	196 200	2 014 790	3 027 206	1 012 416	1 026.91	1 542.92
Montane Cordillera	474 753	701 014	859 134	158 120	147.66	180.96
Hudson Plains	359 546	8 960	9 530	570	2.49	2.65
Canada	**8 806 839**	**24 343 181**	**30 007 094**	**5 663 913**	**276.41**	**340.72**

Notes:
The area figures are for land area only and are calculated by taking the total ecozone area and subtracting the surface water area in the ecozone derived from the 1-km water fraction digital coverage.
The total area of Canada excluding the Great Lakes is 9 886 215 km^2. Including the Canadian portion of the Great Lakes the total area of Canada is 9 976 182 km^2.
The population figures presented here are the census counts and are not adjusted for net undercoverage and non-permanent residents.
Sources:
Statistics Canada, Environment Accounts and Statistics Division, Spatial Environmental Information System and Censuses of Population, 1981 and 2001.
Agriculture and Agri-Food Canada, and Environment Canada, 2003, Framework Data - National Resolution - Ecological Units, www.geoconnexions.org/CGDI.cfm/fuseaction/dataFramework-Data.ecoUnits/gcs.cfm (accessed March 2, 2005).
Fernandes, R., G. Pavlic, W. Chen and R. Fraser, 2001, Canada-wide 1-km water fraction, National Topographic Database, Natural Resources Canada, www.nrcan.gc.ca/ess/_portal_esst.cache/gc_ccrs_e (accessed March 2, 2005).

Table B.4
Population by provincial and territorial ecozone, 1981, 1991 and 2001

Provincial/territorial ecozone	Area	Area	Population					Density				
						Change	Change				Change	Change
	1981 to 1999	1999 to 2001	1981	1991	2001	1981 to 2001	1991 to 2001	1981	1991	2001	1981 to 2001	1991 to 2001
	km^2		persons					persons/km^2			%	
Newfoundland and Labrador												
Arctic Cordillera	17 318	17 318	0	0	0	0	0	0.000	0.000	0.000	0.0	0.0
Boreal Shield	139 813	139 813	563 063	563 897	508 197	-54 866	-55 700	4.027	4.033	3.635	-10.8	-11.0
Taiga Shield	194 228	194 228	4 618	4 577	4 733	115	156	0.024	0.024	0.024	2.4	3.3
Total	**351 359**	**351 359**	**567 681**	**568 474**	**512 930**	**-54 751**	**-55 544**	**1.616**	**1.618**	**1.460**	**-10.7**	**-10.8**
Prince Edward Island												
Atlantic Maritime	5 402	5 402	122 506	129 765	135 294	12 788	5 529	22.679	24.023	25.047	9.5	4.1
Total	**5 402**	**5 402**	**122 506**	**129 765**	**135 294**	**12 788**	**5 529**	**22.679**	**24.023**	**25.047**	**9.5**	**4.1**
Nova Scotia												
Atlantic Maritime	50 633	50 633	847 442	899 942	908 007	60 565	8 065	16.737	17.774	17.933	6.7	0.9
Total	**50 633**	**50 633**	**847 442**	**899 942**	**908 007**	**60 565**	**8 065**	**16.737**	**17.774**	**17.933**	**6.7**	**0.9**
New Brunswick												
Atlantic Maritime	70 602	70 602	696 403	723 900	729 498	33 095	5 598	9.864	10.253	10.333	4.5	0.8
Total	**70 602**	**70 602**	**696 403**	**723 900**	**729 498**	**33 095**	**5 598**	**9.864**	**10.253**	**10.333**	**4.5**	**0.8**
Quebec												
Arctic Cordillera	12 360	12 360	0	0	0	0	0	0.000	0.000	0.000	0.0	0.0
Atlantic Maritime	65 380	65 380	762 384	758 879	764 886	2 502	6 007	11.661	11.607	11.699	0.3	0.8
Boreal Shield	573 556	573 556	1 159 520	1 227 015	1 292 746	133 226	65 731	2.022	2.139	2.254	10.3	5.1
Hudson Plains	34 724	34 724	1 342	1 788	2 312	970	524	0.039	0.051	0.067	42.0	22.7
Mixed Wood Plains	27 220	27 220	4 501 391	4 894 723	5 160 906	659 515	266 183	165.373	179.823	189.602	12.8	5.2
Northern Arctic	33 599	33 599	932	1 461	1 842	910	381	0.028	0.043	0.055	49.4	20.7
Southern Arctic	123 968	123 968	2 156	3 257	4 017	1 861	760	0.017	0.026	0.032	46.3	18.9
Taiga Shield	437 194	437 194	10 678	8 840	10 770	92	1 930	0.024	0.020	0.025	0.9	17.9
Total	**1 308 002**	**1 308 002**	**6 438 403**	**6 895 963**	**7 237 479**	**799 076**	**341 516**	**4.922**	**5.272**	**5.533**	**11.0**	**4.7**
Ontario												
Boreal Shield	559 603	559 603	933 099	952 438	933 908	809	-18 530	1.667	1.702	1.669	0.1	-2.0
Hudson Plains	254 963	254 963	5 447	5 789	5 214	-233	-575	0.021	0.023	0.020	-4.5	-11.0
Mixed Wood Plains	79 798	79 798	7 686 561	9 126 658	10 470 924	2 784 363	1 344 266	96.326	114.372	131.218	26.6	12.8
Total	**894 364**	**894 364**	**8 625 107**	**10 084 885**	**11 410 046**	**2 784 939**	**1 325 161**	**9.644**	**11.276**	**12.758**	**24.4**	**11.6**

Table B.4
Population by provincial and territorial ecozone, 1981, 1991 and 2001 (continued)

			Population					Density				
	Area	Area				Change	Change				Change	Change
Provincial/territorial ecozone	1981 to 1999	1999 to 2001	1981	1991	2001	1981 to 2001	1991 to 2001	1981	1991	2001	1981 to 2001	1991 to 2001
	km^2				persons			persons/km^2			%	
Manitoba												
Boreal Plains	83 667	83 667	104 579	110 298	116 672	12 093	6 374	1.250	1.318	1.394	10.4	5.5
Boreal Shield	216 334	216 334	65 707	68 052	72 277	6 570	4 225	0.304	0.315	0.334	9.1	5.8
Hudson Plains	66 685	66 685	2 171	2 361	2 004	-167	-357	0.033	0.035	0.030	-8.3	-17.8
Prairies	64 234	64 234	852 832	910 069	927 172	74 340	17 103	13.277	14.168	14.434	8.0	1.8
Southern Arctic	1 142	1 142	0	0	0	0	0	0.000	0.000	0.000	0.0	0.0
Taiga Shield	109 048	109 048	952	1 162	1 458	506	296	0.009	0.011	0.013	34.7	20.3
Total	**541 110**	**541 110**	**1 026 241**	**1 091 942**	**1 119 583**	**93 342**	**27 641**	**1.897**	**2.018**	**2.069**	**8.3**	**2.5**
Saskatchewan												
Boreal Plains	163 274	163 274	161 945	158 821	160 484	-1 461	1 663	0.992	0.973	0.983	-0.9	1.0
Boreal Shield	147 484	147 484	9 955	12 086	14 680	4 725	2 594	0.067	0.082	0.100	32.2	17.7
Prairies	229 248	229 248	792 946	816 283	801 806	8 860	-14 477	3.459	3.561	3.498	1.1	-1.8
Taiga Shield	37 460	37 460	3 467	1 738	1 963	-1 504	225	0.093	0.046	0.052	-76.6	11.5
Total	**577 467**	**577 467**	**968 313**	**988 928**	**978 933**	**10 620**	**-9 995**	**1.677**	**1.713**	**1.695**	**1.1**	**-1.0**
Alberta												
Boreal Plains	367 431	367 431	354 030	387 592	438 155	84 125	50 563	0.964	1.055	1.192	19.2	11.5
Boreal Shield	4 159	4 159	0	4	0	0	-4	0.000	0.001	0.000	0.0	0.0
Montane Cordillera	46 336	46 336	27 961	31 481	39 813	11 852	8 332	0.603	0.679	0.859	29.8	20.9
Prairies	149 676	149 676	1 853 716	2 123 916	2 493 591	639 875	369 675	12.385	14.190	16.660	25.7	14.8
Taiga Plains	60 663	60 663	2 017	2 560	2 938	921	378	0.033	0.042	0.048	31.3	12.9
Taiga Shield	7 932	7 932	0	0	310	310	310	0.000	0.000	0.039	100.0	100.0
Total	**636 199**	**636 199**	**2 237 724**	**2 545 553**	**2 974 807**	**737 083**	**429 254**	**3.517**	**4.001**	**4.676**	**24.8**	**14.4**
British Columbia												
Boreal Cordillera	188 728	188 728	3 598	3 351	2 396	-1 202	-955	0.019	0.018	0.013	-50.2	-39.9
Boreal Plains	39 073	39 073	48 582	49 126	53 174	4 592	4 048	1.243	1.257	1.361	8.6	7.6
Montane Cordillera	428 417	428 417	673 053	720 713	819 321	146 268	98 608	1.571	1.682	1.912	17.9	12.0
Pacific Maritime	192 107	192 107	2 014 790	2 503 960	3 027 206	1 012 416	523 246	10.488	13.034	15.758	33.4	17.3
Taiga Plains	66 853	66 853	4 444	4 911	5 641	1 197	730	0.066	0.073	0.084	21.2	12.9
Total	**915 178**	**915 178**	**2 744 467**	**3 282 061**	**3 907 738**	**1 163 271**	**625 677**	**2.999**	**3.586**	**4.270**	**29.8**	**16.0**
Yukon Territory												
Boreal Cordillera	266 546	266 546	22 909	27 488	28 294	5 385	806	0.086	0.103	0.106	19.0	2.8
Pacific Maritime	4 093	4 093	0	0	0	0	0	0.000	0.000	0.000	0.0	0.0
Southern Arctic	4 496	4 496	1	0	0	-1	0	0.000	0.000	0.000	0.0	0.0
Taiga Cordillera	180 170	180 170	243	309	370	127	61	0.001	0.002	0.002	34.3	16.5
Taiga Plains	18 110	18 110	0	0	10	10	10	0.000	0.000	0.001	100.0	100.0
Total	**473 415**	**473 415**	**23 153**	**27 797**	**28 674**	**5 521**	**877**	**0.049**	**0.059**	**0.061**	**19.3**	**3.1**
Northwest Territories[1]												
Arctic Cordillera	205 053	…	821	1 047	…	…	…	0.004	0.005	…	…	…
Boreal Cordillera	4 589	4 589	0	0	0	0	0	0.000	0.000	0.000	0.0	0.0
Boreal Plains	15 218	15 218	4 639	3 008	2 720	-1 919	-288	0.305	0.198	0.179	-70.6	-10.6
Hudson Plains	3 174	…	0	0	…	…	…	0.000	0.000	…	…	…
Northern Arctic	1 337 719	198 761	10 940	14 867	512	-10 428	-14 355	0.008	0.075	0.003	-217.5	-2 803.7
Southern Arctic	572 936	158 124	5 980	7 057	3 109	-2 871	-3 948	0.010	0.045	0.020	46.9	-127.0
Taiga Cordillera	84 043	84 043	320	0	0	-320	0	0.004	0.000	0.000	0.0	0.0
Taiga Plains	423 737	423 737	11 897	13 958	12 137	240	-1 821	0.028	0.033	0.029	2.0	-15.0
Taiga Shield	336 641	257 638	11 144	17 712	18 882	7 738	1 170	0.033	0.069	0.073	54.8	6.2
Total	**2 983 143**	**1 142 110**	**45 741**	**57 649**	**37 360**	**-8 381**	**-20 289**	**0.015**	**0.050**	**0.033**	**53.1**	**-54.3**
Nunavut[1]												
Arctic Cordillera	…	205 053	…	…	1 304	…	…	…	…	0.006	…	…
Hudson Plains	…	3 174	…	…	0	…	…	…	…	0.000	…	…
Northern Arctic	…	1 138 957	…	…	18 097	…	…	…	…	0.016	…	…
Southern Arctic	…	414 811	…	…	7 344	…	…	…	…	0.018	…	…
Taiga Shield	…	79 003	…	…	0	…	…	…	…	0.000	…	…
Total	**…**	**1 841 032**	**…**	**…**	**26 745**	**…**	**…**	**…**	**…**	**0.015**	**…**	**…**
Canada	**8 806 839**	**8 806 839**	**24 343 181**	**27 296 859**	**30 007 094**	**5 663 913**	**2 710 235**	**2.764**	**3.099**	**3.407**	**18.9**	**9.0**

Notes:
The area figures are for land area only and are calculated by taking the total ecozone area and subtracting the surface water area in the ecozone derived from the 1-km water fraction digital coverage.
The total area of Canada excluding the Great Lakes is 9 886 215 km^2. Including the Great Lakes the total area of Canada is 9 976 182 km^2.
The population figures presented here are the census counts and are not adjusted for net undercoverage and non-permanent residents.
1. As Nunavut was created on April 1, 1999, population data is not available for 1981 and 1991. Population for 1981 and 1991 for Nunavut is included in the Northwest Territories data.
Sources:
Statistics Canada, Environment Accounts and Statistics Division, Spatial Environmental Information System and Censuses of Population, 1981, 1991 and 2001.
Agriculture and Agri-Food Canada, and Environment Canada, 2003, Framework Data - National Resolution - Ecological Units, www.geoconnexions.org/CGDI.cfm/fuseaction/dataFramework-Data.ecoUnits/gcs.cfm (accessed March 2, 2005).
Fernandes, R., G. Pavlic, W. Chen and R. Fraser, 2001, Canada-wide 1-km water fraction, National Topographic Database, Natural Resources Canada, www.nrcan.gc.ca/ess/_portal_esst.cache/gc_ccrs_e (accessed March 2, 2005).

Table B.5
Population characteristics by major river basin,[1] 1971 and 2001

Code	River basin name	Total population 1971	Total population 2001	Population as a share of total 2001	Population change 1971 to 2001	Population density in 2001 By total area[2]	Population density in 2001 By water area[3]	Mean annual streamflow per capita
		persons		%		persons/km^2		thousand m^3/person
1	Pacific Coastal	916 210	1 374 422	4.58	50.0	4.1	91.4	376
2	Fraser - Lower Mainland	967 851	2 020 656	6.73	108.8	8.7	224.1	62
3	Okanagan - Similkameen	120 553	285 145	0.95	136.5	18.3	438.7	8
4	Columbia	131 462	160 605	0.54	22.2	1.8	64.7	394
5	Yukon	17 204	27 148	0.09	57.8	0.1	2.9	2 911
6	Peace - Athabasca	206 564	346 234	1.15	67.6	0.7	20.7	264
7	Lower Mackenzie	34 182	48 832	0.16	42.9	0.0	0.3	4 738
8	Arctic Coast - Islands	7 690	16 756	0.06	117.9	0.0	0.1	16 457
9	Missouri	14 349	9 378	0.03	-34.6	0.3	8.3	40
10	North Saskatchewan	844 730	1 307 959	4.36	54.8	8.7	180.5	6
11	South Saskatchewan	948 446	1 772 288	5.91	86.9	10.0	283.9	4
12	Assiniboine - Red	1 250 804	1 365 079	4.55	9.1	7.2	150.0	1
13	Winnipeg	84 685	83 277	0.28	-1.7	0.8	4.0	287
14	Lower Saskatchewan - Nelson	237 276	218 315	0.73	-8.0	0.6	3.2	276
15	Churchill	61 711	87 343	0.29	41.5	0.3	1.7	253
16	Keewatin - Southern Baffin Island	6 271	12 033	0.04	91.9	0.0	0.1	14 107
17	Northern Ontario	149 112	143 036	0.48	-4.1	0.2	2.6	1 322
18	Northern Quebec	87 805	104 437	0.35	18.9	0.1	0.7	5 082
19	Great Lakes - St. Lawrence	12 759 943	17 698 641	58.98	38.7	30.4	131.2	13
20	North Shore - Gaspé	503 796	504 113	1.68	0.1	1.4	13.5	510
21	Saint John - St. Croix	365 294	401 681	1.34	10.0	9.6	223.2	61
22	Maritime Coastal	1 329 135	1 505 585	5.02	13.3	12.3	223.8	76
23	Newfoundland - Labrador	523 238	514 131	1.71	-1.7	1.4	9.3	572
	Canada	**21 568 311**	**30 007 094**	**100.00**	**39.1**	**3.0**	**25.5**	**110**

Notes:
1. These major river basins and associated flow measures are adapted from "Laycock (1987) (see full reference below). Some of these river basin aggregates have more than one outflow.
2. Area includes the Canadian portion of the Great Lakes.
3. Water area figures are calculated from the Canada-wide 1-km water fraction derived from National Topographic Database maps.

Sources:
Environment Canada, 2003, *Canadian Climate Normals, 1971 to 2000*, Meteorological Service of Canada, climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html (accessed February 23, 2005).
Pearse, P.H., F. Bertrand and J.W. MacLaren, 1985, *Currents of Change: Final Report of the Inquiry on Federal Water Policy*, Environment Canada, Ottawa.
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Laycock, A.H., 1987, "The Amount of Canadian Water and its Distribution," in *Canadian Aquatic Resources*, no. 215 of *Canadian Bulletin of Fisheries and Aquatic Sciences*, M.C. Healey and R.R. Wallace (eds.), 13-42, Fisheries and Oceans Canada, Ottawa.
Natural Resources Canada, GeoAccess Division, 2003, 1:1 Million Digital Drainage Area Framework, version 4.8b.
Statistics Canada, Censuses of Population 1971 and 2001.

Table B.6
Rural and urban population by provincial and territorial sub-drainage area, 1981, 1991 and 2001

Province/territory and sub-drainage area	Total population 1981	Total population 1991	Total population 2001	Rural population 1981	Rural population 1991	Rural population 2001	Urban population 1981	Urban population 1991	Urban population 2001	Urban population as a share of total 1981	Urban population as a share of total 1991	Urban population as a share of total 2001
	persons									%		
Canada	**24 343 181**	**27 296 859**	**30 007 094**	**5 907 254**	**6 389 985**	**6 098 883**	**18 435 927**	**20 906 874**	**23 908 211**	**75.7**	**76.6**	**79.7**
Newfoundland and Labrador												
Petit Mécatina and Strait of Belle Isle	2 459	2 181	1 996	2 459	2 181	1 996	0	0	0	0.0	0.0	0.0
Northern Newfoundland	217 670	208 475	178 576	108 398	114 128	95 175	109 272	94 347	83 401	50.2	45.3	46.7
Southern Newfoundland	318 693	329 620	306 490	115 106	136 495	110 091	203 587	193 125	196 399	63.9	58.6	64.1
Northern Labrador	2 173	2 650	2 897	2 173	2 650	2 897	0	0	0	0.0	0.0	0.0
Churchill (Nfld.)	19 707	17 075	13 966	941	1 763	744	18 766	15 312	13 222	95.2	89.7	94.7
Central Labrador	4 314	5 511	6 288	3 041	3 844	3 114	1 273	1 667	3 174	29.5	30.2	50.5
Southern Labrador	2 665	2 962	2 717	2 665	2 962	2 717	0	0	0	0.0	0.0	0.0
Total	**567 681**	**568 474**	**512 930**	**234 783**	**264 023**	**216 734**	**332 898**	**304 451**	**296 196**	**58.6**	**53.6**	**57.7**
Prince Edward Island												
Prince Edward Island	122 506	129 765	135 294	77 991	77 952	74 619	44 515	51 813	60 675	36.3	39.9	44.8
Total	**122 506**	**129 765**	**135 294**	**77 991**	**77 952**	**74 619**	**44 515**	**51 813**	**60 675**	**36.3**	**39.9**	**44.8**
Nova Scotia												
Bay of Fundy and Gulf of St. Lawrence (N.S.)	290 513	315 814	316 125	181 909	198 959	193 198	108 604	116 855	122 927	37.4	37.0	38.9
Southeastern Atlantic Ocean (N.S.)	386 841	422 442	444 428	131 472	150 451	148 173	255 369	271 991	296 255	66.0	64.4	66.7
Cape Breton Island	170 088	161 686	147 454	67 219	69 024	59 627	102 869	92 662	87 827	60.5	57.3	59.6
Total	**847 442**	**899 942**	**908 007**	**380 600**	**418 434**	**400 998**	**466 842**	**481 508**	**507 009**	**55.1**	**53.5**	**55.8**

Table B.6
Rural and urban population by provincial and territorial sub-drainage area, 1981, 1991 and 2001 (continued)

Province/territory and sub-drainage area	Total population			Rural population			Urban population			Urban population as a share of total		
	1981	1991	2001	1981	1991	2001	1981	1991	2001	1981	1991	2001
	persons									%		
New Brunswick												
Saint John and Southern Bay of Fundy (N.B.)	345 581	363 107	368 440	149 479	174 257	167 403	196 102	188 850	201 037	56.7	52.0	54.6
Gulf of St. Lawrence and Northern Bay of Fundy (N.B.)	350 822	360 793	361 058	193 704	204 429	194 193	157 118	156 364	166 865	44.8	43.3	46.2
Total	**696 403**	**723 900**	**729 498**	**343 183**	**378 686**	**361 596**	**353 220**	**345 214**	**367 902**	**50.7**	**47.7**	**50.4**
Quebec												
Saint John and Southern Bay of Fundy (N.B.)	38 940	36 463	35 468	31 329	29 647	27 868	7 611	6 816	7 600	19.5	18.7	21.4
Gulf of St. Lawrence and Northern Bay of Fundy (N.B.)	100 914	93 776	86 339	65 463	68 616	58 108	35 451	25 160	28 231	35.1	26.8	32.7
Upper Ottawa	57 888	61 617	58 469	28 135	30 517	30 225	29 753	31 100	28 244	51.4	50.5	48.3
Central Ottawa	43 263	49 196	52 498	15 950	17 126	16 823	27 313	32 070	35 675	63.1	65.2	68.0
Lower Ottawa	364 220	419 520	483 061	133 440	156 820	177 074	230 780	262 700	305 987	63.4	62.6	63.3
Upper St. Lawrence	70 180	73 043	79 071	22 676	24 127	20 999	47 504	48 916	58 072	67.7	67.0	73.4
Saint-Maurice	131 619	126 960	126 415	21 778	25 202	20 271	109 841	101 758	106 144	83.5	80.1	84.0
Central St. Lawrence	3 895 362	4 253 609	4 516 239	533 625	587 749	525 820	3 361 737	3 665 860	3 990 419	86.3	86.2	88.4
Lower St. Lawrence	1 052 259	1 118 660	1 155 135	325 544	343 054	309 200	726 715	775 606	845 935	69.1	69.3	73.2
Northern Gaspé Peninsula	140 055	132 853	129 521	69 063	64 602	59 021	70 992	68 251	70 500	50.7	51.4	54.4
Saguenay	287 272	287 217	279 079	89 640	90 657	79 165	197 632	196 560	199 914	68.8	68.4	71.6
Betsiamites - Coast	16 203	15 158	14 583	10 638	10 050	7 437	5 565	5 108	7 146	34.3	33.7	49.0
Manicouagan and aux Outardes	23 659	20 236	19 667	4 349	4 078	5 090	19 310	16 158	14 577	81.6	79.8	74.1
Moisie and St. Lawrence Estuary	61 199	53 056	49 334	11 994	7 939	6 758	49 205	45 117	42 576	80.4	85.0	86.3
Gulf of St. Lawrence - Romaine	2 065	2 148	1 802	2 065	2 148	1 802	0	0	0	0.0	0.0	0.0
Gulf of St. Lawrence - Natashquan	20 757	19 965	19 631	16 050	15 234	15 054	4 707	4 731	4 577	22.7	23.7	23.3
Petit Mécatina and Strait of Belle Isle	4 110	4 723	3 712	4 110	4 723	3 712	0	0	0	0.0	0.0	0.0
Nottaway - Coast	32 308	27 009	25 339	6 774	5 870	6 549	25 534	21 139	18 790	79.0	78.3	74.2
Broadback and Rupert	2 959	3 381	4 867	2 959	3 381	3 053	0	0	1 814	0.0	0.0	37.3
Eastmain	328	444	613	328	444	613	0	0	0	0.0	0.0	0.0
La Grande - Coast	5 410	4 213	4 967	5 410	4 213	1 500	0	0	3 467	0.0	0.0	69.8
Grande rivière de la Baleine - Coast	1 067	1 113	1 333	1 067	1 113	1 333	0	0	0	0.0	0.0	0.0
Eastern Hudson Bay	0	284	348	0	284	348	0	0	0	0.0	0.0	0.0
Northeastern Hudson Bay	1 662	2 510	3 053	1 662	2 510	3 053	0	0	0	0.0	0.0	0.0
Western Ungava Bay	1 324	2 077	2 647	1 324	2 077	2 647	0	0	0	0.0	0.0	0.0
Aux Feuilles - Coast	179	283	387	179	283	387	0	0	0	0.0	0.0	0.0
Koksoak	805	1 405	1 932	805	1 405	1 932	0	0	0	0.0	0.0	0.0
Caniapiscau	3 170	1 144	1 252	1 173	1 144	1 252	1 997	0	0	63.0	0.0	0.0
Eastern Ungava Bay	149	529	710	149	529	710	0	0	0	0.0	0.0	0.0
Abitibi	24 628	23 758	22 324	15 680	14 801	13 701	8 948	8 957	8 623	36.3	37.7	38.6
Harricanaw - Coast	54 449	59 613	57 683	21 205	24 666	18 825	33 244	34 947	38 858	61.1	58.6	67.4
Total	**6 438 403**	**6 895 963**	**7 237 479**	**1 444 564**	**1 545 009**	**1 420 330**	**4 993 839**	**5 350 954**	**5 817 149**	**77.6**	**77.6**	**80.4**
Ontario												
Northwestern Lake Superior	133 444	136 791	132 416	20 596	26 383	29 201	112 848	110 408	103 215	84.6	80.7	77.9
Northeastern Lake Superior	55 593	51 072	46 240	13 642	13 656	14 114	41 951	37 416	32 126	75.5	73.3	69.5
Northern Lake Huron	263 667	266 295	253 414	50 210	49 309	48 148	213 457	216 986	205 266	81.0	81.5	81.0
Wanipitei and French (Ont.)	91 667	91 311	90 066	30 059	32 326	33 109	61 608	58 985	56 957	67.2	64.6	63.2
Eastern Georgian Bay	410 132	540 304	682 624	178 345	222 239	228 519	231 787	318 065	454 105	56.5	58.9	66.5
Eastern Lake Huron	263 421	302 160	307 409	143 474	155 685	152 782	119 947	146 475	154 627	45.5	48.5	50.3
Northern Lake Erie	1 649 123	1 838 281	2 032 283	381 437	389 840	381 715	1 267 686	1 448 441	1 650 568	76.9	78.8	81.2
Lake Ontario and Niagara Peninsula	4 560 423	5 477 416	6 368 255	404 134	535 516	439 404	4 156 289	4 941 900	5 928 851	91.1	90.2	93.1
Upper Ottawa	54 624	58 455	53 097	21 538	24 525	23 391	33 086	33 930	29 706	60.6	58.0	55.9
Central Ottawa	300 424	334 531	376 026	74 479	94 586	98 251	225 945	239 945	277 775	75.2	71.7	73.9
Lower Ottawa	493 691	624 619	709 610	123 890	135 268	151 036	369 801	489 351	558 574	74.9	78.3	78.7
Upper St. Lawrence	152 764	173 594	176 848	58 399	69 670	72 128	94 365	103 924	104 720	61.8	59.9	59.2
Severn	4 291	3 590	5 763	4 291	3 590	5 763	0	0	0	0.0	0.0	0.0
Winisk - Coast	1 572	1 946	2 615	1 572	1 946	2 615	0	0	0	0.0	0.0	0.0
Attawapiskat - Coast	1 403	1 949	1 962	1 403	1 949	669	0	0	1 293	0.0	0.0	65.9
Upper Albany	2 774	1 554	2 106	2 774	1 554	2 106	0	0	0	0.0	0.0	0.0
Lower Albany - Coast	1 202	1 199	441	1 202	1 199	441	0	0	0	0.0	0.0	0.0
Kenogami	11 043	9 062	8 144	3 808	2 753	2 860	7 235	6 309	5 284	65.5	69.6	64.9
Moose (Ont.)	2 977	2 851	2 886	1 745	1 848	936	1 232	1 003	1 950	41.4	35.2	67.6
Missinaibi-Mattagami	71 356	68 267	62 046	19 419	21 411	14 825	51 937	46 856	47 221	72.8	68.6	76.1
Abitibi	26 502	26 248	23 685	9 574	9 256	8 310	16 928	16 992	15 375	63.9	64.7	64.9
Harricanaw - Coast	1	0	0	1	0	0	0	0	0	0.0	0.0	0.0
Winnipeg	43 134	43 515	43 245	17 148	18 874	19 604	25 986	24 641	23 641	60.2	56.6	54.7

Table B.6
Rural and urban population by provincial and territorial sub-drainage area, 1981, 1991 and 2001 (continued)

Province/territory and sub-drainage area	Total population			Rural population			Urban population			Urban population as a share of total		
	1981	1991	2001	1981	1991	2001	1981	1991	2001	1981	1991	2001
	persons									%		
English	28 900	28 301	28 487	13 956	16 090	17 194	14 944	12 211	11 293	51.7	43.1	39.6
Eastern Lake Winnipeg	979	1 574	378	979	1 574	378	0	0	0	0.0	0.0	0.0
Total	**8 625 107**	**10 084 885**	**11 410 046**	**1 578 075**	**1 831 047**	**1 747 499**	**7 047 032**	**8 253 838**	**9 662 547**	**81.7**	**81.8**	**84.7**
Manitoba												
Hayes (Man.)	5 142	7 366	10 442	5 142	7 366	10 442	0	0	0	0.0	0.0	0.0
Southwestern Hudson Bay	0	5	0	0	5	0	0	0	0	0.0	0.0	0.0
Qu'Appelle	0	338	43	0	338	43	0	0	0	0.0	0.0	0.0
Saskatchewan	22 252	19 853	19 823	7 728	6 320	7 793	14 524	13 533	12 030	65.3	68.2	60.7
Lake Winnipegosis and Lake Manitoba	79 806	74 797	71 832	58 125	54 656	52 686	21 681	20 141	19 146	27.2	26.9	26.7
Assiniboine	297 306	282 505	279 358	49 371	49 614	48 652	247 935	232 891	230 706	83.4	82.4	82.6
Souris	20 059	16 345	15 033	16 036	12 504	11 203	4 023	3 841	3 830	20.1	23.5	25.5
Red	528 217	612 804	640 410	109 953	122 642	123 790	418 264	490 162	516 620	79.2	80.0	80.7
Winnipeg	10 696	12 649	13 024	8 690	9 770	10 435	2 006	2 879	2 589	18.8	22.8	19.9
Eastern Lake Winnipeg	4 430	3 779	4 803	4 430	3 779	4 803	0	0	0	0.0	0.0	0.0
Western Lake Winnipeg	24 662	25 456	29 318	20 650	20 205	24 616	4 012	5 251	4 702	16.3	20.6	16.0
Grass and Burntwood	18 234	19 833	17 841	2 107	3 330	3 447	16 127	16 503	14 394	88.4	83.2	80.7
Nelson	7 457	9 856	10 773	7 457	8 716	10 773	0	1 140	0	0.0	11.6	0.0
Reindeer	573	929	1 142	573	929	1 142	0	0	0	0.0	0.0	0.0
Central Churchill (Man.) - Lower	5 724	4 015	4 462	3 637	3 181	3 158	2 087	834	1 304	36.5	20.8	29.2
Lower Churchill (Man.)	1 441	1 179	963	1 441	1 179	963	0	0	0	0.0	0.0	0.0
Seal - Coast	242	233	316	242	233	316	0	0	0	0.0	0.0	0.0
Total	**1 026 241**	**1 091 942**	**1 119 583**	**295 582**	**304 767**	**314 262**	**730 659**	**787 175**	**805 321**	**71.2**	**72.1**	**71.9**
Saskatchewan												
Upper South Saskatchewan	652	451	582	652	451	582	0	0	0	0.0	0.0	0.0
Red Deer	71	4	50	71	4	50	0	0	0	0.0	0.0	0.0
Central North Saskatchewan	42 945	43 519	44 183	20 526	18 394	20 208	22 419	25 125	23 975	52.2	57.7	54.3
Battle	7 054	7 106	6 899	5 844	6 245	5 917	1 210	861	982	17.2	12.1	14.2
Lower North Saskatchewan	95 063	94 457	92 619	48 340	42 591	40 233	46 723	51 866	52 386	49.1	54.9	56.6
Lower South Saskatchewan	247 581	277 064	289 707	63 735	56 679	58 872	183 846	220 385	230 835	74.3	79.5	79.7
Qu'Appelle	323 503	330 068	317 601	101 871	91 042	78 785	221 632	239 026	238 816	68.5	72.4	75.2
Saskatchewan	48 814	45 364	44 031	31 234	30 915	29 835	17 580	14 449	14 196	36.0	31.9	32.2
Lake Winnipegosis and Lake Manitoba	18 349	15 797	14 388	14 964	12 838	11 603	3 385	2 959	2 785	18.4	18.7	19.4
Assiniboine	77 599	70 605	62 979	42 241	34 985	30 152	35 358	35 620	32 827	45.6	50.4	52.1
Souris	59 354	57 080	53 072	36 337	32 787	28 707	23 017	24 293	24 365	38.8	42.6	45.9
Beaver (Alta.-Sask.)	18 694	19 909	22 071	14 837	14 618	17 489	3 857	5 291	4 582	20.6	26.6	20.8
Upper Churchill (Man.)	6 794	7 072	8 203	5 162	7 072	8 203	1 632	0	0	24.0	0.0	0.0
Central Churchill (Man.) - Upper	6 568	8 010	10 427	6 568	5 432	7 140	0	2 578	3 287	0.0	32.2	31.5
Reindeer	881	1 567	2 017	881	1 567	2 017	0	0	0	0.0	0.0	0.0
Central Churchill (Man.) - Lower	758	770	1 092	758	770	1 092	0	0	0	0.0	0.0	0.0
Central Athabasca - Lower	17	41	24	17	41	24	0	0	0	0.0	0.0	0.0
Fond-du-Lac	856	1 701	1 946	856	1 701	1 946	0	0	0	0.0	0.0	0.0
Lake Athabasca - Shores	3 290	242	187	783	242	187	2 507	0	0	76.2	0.0	0.0
Missouri	9 470	8 101	6 855	9 470	7 157	6 855	0	944	0	0.0	11.7	0.0
Total	**968 313**	**988 928**	**978 933**	**405 147**	**365 531**	**349 897**	**563 166**	**623 397**	**629 036**	**58.2**	**63.0**	**64.3**
Alberta												
Upper South Saskatchewan	193 205	209 242	232 499	55 464	56 453	60 872	137 741	152 789	171 627	71.3	73.0	73.8
Bow	670 162	805 825	1 024 550	38 617	43 626	57 920	631 545	762 199	966 630	94.2	94.6	94.3
Red Deer	167 549	188 285	223 791	82 460	85 302	95 953	85 089	102 983	127 838	50.8	54.7	57.1
Upper North Saskatchewan	295 406	303 688	345 670	39 806	38 425	43 439	255 600	265 263	302 231	86.5	87.3	87.4
Central North Saskatchewan	533 508	639 621	702 226	106 973	105 091	107 360	426 535	534 530	594 866	79.9	83.6	84.7
Battle	100 597	99 182	111 186	54 552	47 646	54 468	46 045	51 536	56 718	45.8	52.0	51.0
Lower North Saskatchewan	7 438	8 167	7 229	5 793	6 391	5 249	1 645	1 776	1 980	22.1	21.7	27.4
Lower South Saskatchewan	434	391	343	434	391	343	0	0	0	0.0	0.0	0.0
Beaver (Alta.-Sask.)	27 656	32 587	35 816	13 773	15 697	18 327	13 883	16 890	17 489	50.2	51.8	48.8
Upper Athabasca	34 185	37 479	40 805	8 660	8 463	9 958	25 525	29 016	30 847	74.7	77.4	75.6
Central Athabasca - Upper	50 446	53 530	57 292	32 068	34 420	34 277	18 378	19 110	23 015	36.4	35.7	40.2
Central Athabasca - Lower	32 610	26 977	35 484	8 587	7 324	10 727	24 023	19 653	24 757	73.7	72.9	69.8
Lower Athabasca	9 088	18 115	17 310	104	513	599	8 984	17 602	16 711	98.9	97.2	96.5
Upper Peace	21 716	22 607	21 006	12 733	13 955	12 969	8 983	8 652	8 037	41.4	38.3	38.3
Smoky	61 186	65 285	78 080	25 322	23 419	25 540	35 864	41 866	52 540	58.6	64.1	67.3
Central Peace - Upper	15 180	12 550	14 607	9 669	8 371	9 587	5 511	4 179	5 020	36.3	33.3	34.4
Central Peace - Lower	10 289	14 850	19 294	8 095	12 001	14 440	2 194	2 849	4 854	21.3	19.2	25.2

Table B.6
Rural and urban population by provincial and territorial sub-drainage area, 1981, 1991 and 2001 (continued)

Province/territory and sub-drainage area	Total population			Rural population			Urban population			Urban population as a share of total		
	1981	1991	2001	1981	1991	2001	1981	1991	2001	1981	1991	2001
	persons									%		
Lower Peace	822	1 233	1 623	822	1 233	1 623	0	0	0	0.0	0.0	0.0
Lake Athabasca - Shores	944	1 008	1 106	944	1 008	1 106	0	0	0	0.0	0.0	0.0
Slave	27	30	21	27	30	21	0	0	0	0.0	0.0	0.0
Hay	1 874	2 536	2 383	1 874	2 536	2 383	0	0	0	0.0	0.0	0.0
Central Liard - Petitot		23	0	0	23	0	0	0	0	0.0	0.0	0.0
Missouri	3 402	2 342	2 486	3 402	2 342	2 486	0	0	0	0.0	0.0	0.0
Total	**2 237 724**	**2 545 553**	**2 974 807**	**510 179**	**514 660**	**569 647**	**1 727 545**	**2 030 893**	**2 405 160**	**77.2**	**79.8**	**80.9**
British Columbia												
Williston Lake	7 441	7 464	6 223	1 644	1 900	1 267	5 797	5 564	4 956	77.9	74.5	79.6
Upper Peace	49 542	52 099	54 428	21 725	19 506	23 228	27 817	32 593	31 200	56.1	62.6	57.3
Smoky		290	153	0	290	153	0	0	0	0.0	0.0	0.0
Hay	473	251		473	251		0	0	0	0.0	0.0	0.0
Northern Coastal Waters of B.C.		38		0	38		0	0	0	0.0	0.0	0.0
Stikine - Coast	610	875	912	610	875	912	0	0	0	0.0	0.0	0.0
Nass - Coast	3 628	2 950	2 587	3 628	2 950	2 587	0	0	0	0.0	0.0	0.0
Skeena - Coast	59 264	60 695	60 688	24 003	20 628	20 965	35 261	40 067	39 723	59.5	66.0	65.5
Central Coastal Waters of B.C.	18 242	17 226	16 280	5 780	6 433	6 047	12 462	10 793	10 233	68.3	62.7	62.9
Southern Coastal Waters of B.C.	473 827	531 144	620 090	28 796	29 050	25 311	445 031	502 094	594 779	93.9	94.5	95.9
Vancouver Island	496 692	590 844	665 695	128 239	146 691	136 674	368 453	444 153	529 021	74.2	75.2	79.5
Nechako	59 565	59 877	63 123	21 654	22 234	22 023	37 911	37 643	41 100	63.6	62.9	65.1
Upper Fraser	68 559	70 244	76 008	27 789	27 203	29 414	40 770	43 041	46 594	59.5	61.3	61.3
Thompson	143 162	149 300	172 640	64 667	60 967	65 358	78 495	88 333	107 282	54.8	59.2	62.1
Lower Fraser	1 008 559	1 347 658	1 712 430	131 958	149 007	119 605	876 601	1 198 651	1 592 825	86.9	88.9	93.0
Columbia - U.S.A.	341 572	378 996	444 638	134 482	145 593	136 686	207 090	233 403	307 952	60.6	61.6	69.3
Queen Charlotte Islands	5 621	5 316	4 935	5 621	5 316	4 935	0	0	0	0.0	0.0	0.0
Skagit	992	83	169	992	83	169	0	0	0	0.0	0.0	0.0
Headwaters Yukon	402	479	578	402	479	578	0	0	0	0.0	0.0	0.0
Upper Liard	1 691	1 435	379	1 691	1 435	379	0	0	0	0.0	0.0	0.0
Central Liard	40	137	141	40	137	141	0	0	0	0.0	0.0	0.0
Fort Nelson	4 585	4 660	5 641	861	856	1 453	3 724	3 804	4 188	81.2	81.6	74.2
Total	**2 744 467**	**3 282 061**	**3 907 738**	**605 055**	**641 922**	**597 885**	**2 139 412**	**2 640 139**	**3 309 853**	**78.0**	**80.4**	**84.7**
Yukon Territory												
Alsek	367	651	634	367	651	634	0	0	0	0.0	0.0	0.0
Headwaters Yukon	16 898	21 462	22 900	2 084	5 127	6 057	14 814	16 335	16 843	87.7	76.1	73.6
Pelly	2 152	1 772	988	2 152	1 772	988	0	0	0	0.0	0.0	0.0
Upper Yukon	396	292	247	396	292	247	0	0	0	0.0	0.0	0.0
Stewart	934	535	450	934	535	450	0	0	0	0.0	0.0	0.0
Central Yukon	916	1 487	1 679	916	1 487	1 679	0	0	0	0.0	0.0	0.0
Porcupine	243	256	299	243	256	299	0	0	0	0.0	0.0	0.0
Upper Liard	1 247	1 334	1 406	1 247	1 334	1 406	0	0	0	0.0	0.0	0.0
Peel and Southwestern Beaufort Sea	0	8	71	0	8	71	0	0	0	0.0	0.0	0.0
Total	**23 153**	**27 797**	**28 674**	**8 339**	**11 462**	**11 831**	**14 814**	**16 335**	**16 843**	**64.0**	**58.8**	**58.7**
Northwest Territories												
Thelon	0	0	0	0	0	0	0	0	0	0.0	0.0	0.0
Chesterfield Inlet	954	1 186	...	954	1 186	...	0	0	...	0.0	0.0	...
Western Hudson Bay - Central	2 568	3 580	...	2 568	3 580	...	0	0	...	0.0	0.0	...
Western Hudson Bay - Northern	24	0	0	24	0	0	0	0	0	0.0	0.0	0.0
Hudson Bay - Southampton Island	812	1 104	...	812	1 104	...	0	0	...	0.0	0.0	...
Foxe Basin - Melville Peninsula	1 447	1 950	...	1 447	1 950	...	0	0	...	0.0	0.0	...
Foxe Basin - Baffin Island	78	47	...	78	47	...	0	0	...	0.0	0.0	...
Hudson Strait - Baffin and Southampton Islands	1 089	1 402	...	1 089	1 402	...	0	0	...	0.0	0.0	...
Slave	2 298	2 484	2 185	0	2 484	2 185	2 298	0	0	100.0	0.0	0.0
Hay	2 957	3 518	3 561	94	849	669	2 863	2 669	2 892	96.8	75.9	81.2
Southern Great Slave Lake	2 341	717	809	480	717	809	1 861	0	0	79.5	0.0	0.0
Great Slave Lake - East Arm South Shore	253	296	248	253	296	248	0	0	0	0.0	0.0	0.0
Northeastern Great Slave Lake	10 856	17 164	18 195	1 373	5 304	2 140	9 483	11 860	16 055	87.4	69.1	88.2
Marian	268	392	453	268	392	453	0	0	0	0.0	0.0	0.0
Western Great Slave Lake	406	39	261	406	39	261	0	0	0	0.0	0.0	0.0
Lower Liard	844	570	988	844	570	988	0	0	0	0.0	0.0	0.0
Upper Mackenzie - Mills Lake	733	760	873	733	760	873	0	0	0	0.0	0.0	0.0
Upper Mackenzie - Camsell Bend	980	1 189	812	980	1 189	812	0	0	0	0.0	0.0	0.0
Central Mackenzie - Blackwater Lake	438	549	638	438	549	638	0	0	0	0.0	0.0	0.0

Table B.6
Rural and urban population by provincial and territorial sub-drainage area, 1981, 1991 and 2001 (continued)

Province/territory and sub-drainage area	Total population			Rural population			Urban population			Urban population as a share of total		
	1981	1991	2001	1981	1991	2001	1981	1991	2001	1981	1991	2001
	persons									%		
Great Bear	818	803	810	818	803	810	0	0	0	0.0	0.0	0.0
Central Mackenzie - The Ramparts	420	644	666	420	644	666	0	0	0	0.0	0.0	0.0
Lower Mackenzie	3 730	3 952	3 638	583	774	754	3 147	3 178	2 884	84.4	80.4	79.3
Peel and Southwestern Beaufort Sea	1 353	1 560	1 393	1 353	1 560	1 393	0	0	0	0.0	0.0	0.0
Southern Beaufort Sea	829	1 029	1 032	829	1 029	1 032	0	0	0	0.0	0.0	0.0
Amundsen Gulf	624	255	286	624	255	286	0	0	0	0.0	0.0	0.0
Coppermine	371	0	0	371	0	0	0	0	0	0.0	0.0	0.0
Coronation Gulf - Queen Maud Gulf	86	1 130	...	86	1 130	...	0	0	...	0.0	0.0	...
Back	0	0	...	0	0	...	0	0	...	0.0	0.0	...
Gulf of Boothia	688	989	...	688	989	...	0	0	...	0.0	0.0	...
Southern Arctic Islands	1 832	2 494	512	1 832	2 494	512	0	0	0	0.0	0.0	0.0
Baffin Island - Arctic Drainage	5 334	7 545	...	3 001	4 095	...	2 333	3 450	...	43.7	45.7	...
Northern Arctic Islands	310	301	...	310	301	...	0	0	...	0.0	0.0	...
Total	**45 741**	**57 649**	**37 360**	**23 756**	**36 492**	**15 529**	**21 985**	**21 157**	**21 831**	**48.1**	**36.7**	**58.4**
Nunavut												
Chesterfield Inlet	...	...	1 507	...	...	1 507	...	...	0	...	...	0.0
Western Hudson Bay - Central	...	...	4 726	...	...	2 549	...	...	2 177	...	...	46.1
Hudson Bay - Southampton Island	...	...	1 396	...	...	1 396	...	...	0	...	...	0.0
Foxe Basin - Melville Peninsula	...	...	2 507	...	...	2 507	...	...	0	...	...	0.0
Foxe Basin - Baffin Island	...	...	0	...	...	0	...	...	0	...	...	0.0
Hudson Strait - Baffin and Southampton Islands	...	...	1 581	...	...	1 581	...	...	0	...	...	0.0
Great Bear	...	...	0	...	...	0	...	...	0	...	...	0.0
Amundsen Gulf	...	...	1 212	...	...	1 212	...	...	0	...	...	0.0
Coronation Gulf - Queen Maud Gulf	...	...	10	...	...	10	...	...	0	...	...	0.0
Back	...	...	0	...	...	0	...	...	0	...	...	0.0
Gulf of Boothia	...	...	1 325	...	...	1 325	...	...	0	...	...	0.0
Southern Arctic Islands	...	...	2 269	...	...	2 269	...	...	0	...	...	0.0
Baffin Island - Arctic Drainage	...	...	9 759	...	...	3 247	...	...	6 512	...	...	66.7
Northern Arctic Islands	...	...	453	...	...	453	...	...	0	...	...	0.0
Total	**...**	**...**	**26 745**	**...**	**...**	**18 056**	**...**	**...**	**8 689**	**...**	**...**	**32.5**
Canada	**24 343 181**	**27 296 859**	**30 007 094**	**5 907 254**	**6 389 985**	**6 098 883**	**18 435 927**	**20 906 874**	**23 908 211**	**75.7**	**76.6**	**79.7**

Notes:
See Map A.3 and Table A.2 for classification codes and area figures for these sub-drainage areas.
The population figures presented here are not adjusted for net undercoverage and non-permanent residents.
Sources:
Statistics Canada, Environment Accounts and Statistics Division, Spatial Environmental Information System and Censuses of Population, 1981, 1991 and 2001.

Economy

Since 1961, there has been a shift away from resource-based industries to service-based industries. Between 1961 and 2000, the share of GDP held by the business and personal services industries almost doubled, from 8% in 1961 to 15% in 2000 (Table B.7).

Employment shows a similar picture, with employment in the agricultural, forest and metal and mineral products industries dropping from 23% in 1961 to 9% in 2002, while employment in the business and personal services industries increased from 11% in 1961 to 29% in 2002 (Table B.8)

Table B.9 outlines the changes in the composition of exports and imports over time. In 1961, the agricultural, forest, and metal and mineral products industries accounted for 63% of total exports. By 2000, these industries accounted for only a quarter of total exports. In contrast, the fuel and energy industry increased from 4% to 11%, while the transportation equipment industry increased its share from 2% to 23%.

Table B.7
Gross domestic product by industry, 1961 to 2000, selected years

Industry[1]	1961	1966	1971	1976	1981	1986	1991	1996	2000
					%				
Agricultural products[2]	8.6	9.1	6.6	6.5	5.9	5.5	4.8	4.6	3.8
Forest products[2]	4.8	4.3	3.5	3.6	3.7	3.5	2.7	3.9	3.8
Metal and mineral products[2]	7.2	7.3	6.2	5.4	5.1	4.1	3.4	3.6	3.9
Fuel and energy[2]	5.1	4.7	5.0	6.7	8.7	7.8	6.6	7.4	8.5
Chemicals and chemical products	2.2	2.2	1.8	1.5	1.7	1.8	1.7	2.0	1.6
Textiles, fabrics and clothing	1.9	1.8	1.5	1.3	1.2	1.0	0.8	0.7	0.8
Electrical and electronic products	1.7	2.0	1.7	1.5	1.4	1.3	1.2	1.2	1.6
Machinery and equipment	1.2	1.6	1.2	1.2	1.4	1.1	0.9	1.2	1.4
Transportation equipment	1.8	2.4	2.6	2.1	1.7	2.2	2.0	2.8	3.4
Miscellaneous goods	1.0	1.0	1.0	1.0	1.1	1.2	1.1	1.3	1.6
Construction	7.5	7.6	7.4	8.3	7.7	6.1	6.3	5.0	5.0
Transportation and communications	9.2	8.7	8.4	7.7	7.4	7.5	6.9	6.7	6.9
Distributive trades	12.0	11.4	11.6	11.4	10.4	11.2	11.0	10.4	10.2
Finance and insurance	8.3	7.9	8.6	8.1	5.0	5.8	6.1	6.7	6.9
Real estate	6.0	5.4	5.9	5.4	9.5	10.4	12.1	12.0	10.7
Business and personal services	7.8	8.2	9.1	9.7	10.4	11.3	12.8	13.1	14.5
Government services	12.9	13.8	17.1	17.9	17.0	17.1	18.5	16.4	14.4
Other services	0.7	0.6	0.7	0.7	0.8	0.9	1.1	1.2	1.2
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Notes:
1. The industry groupings in this table are a special aggregation based on the 1997 North American Industry Classification System (NAICS).
2. Includes both extraction and downstream manufacturing industries.

Sources:
Statistics Canada, Input-Output Division and Environment Accounts and Statistics Division.

Table B.8
Employment by industry, 1961 to 2002, selected years

Industry[1]	1961	1971	1981	1991	2001	2002
			%			
Agricultural products[2]	14.0	9.0	6.8	5.7	4.0	4.0
Forest products[2]	4.2	3.6	3.4	2.7	2.4	2.2
Metal and mineral products[2]	4.8	4.7	3.7	2.6	2.5	2.4
Fuel and energy[2]	1.2	1.2	1.7	1.5	1.5	1.5
Chemicals and chemical products	1.6	1.5	1.2	1.0	0.8	0.8
Textiles, fabrics and clothing	3.3	2.6	1.9	1.3	1.0	1.0
Electrical and electronic products	1.7	1.8	1.3	1.0	0.8	0.8
Machinery and equipment	1.1	1.2	1.3	0.9	1.0	1.0
Transportation equipment	1.6	2.0	1.7	1.6	1.5	1.5
Miscellaneous goods	1.3	1.4	1.4	1.4	1.7	1.7
Construction	9.1	8.3	7.1	6.6	6.0	6.1
Transportation and communications	8.1	7.1	6.7	6.2	6.5	6.4
Distributive trades	15.3	16.2	17.0	17.5	16.3	16.4
Finance and insurance	3.4	4.1	4.8	4.9	6.2	6.3
Real estate	0.0	0.0	0.6	0.8	0.7	0.7
Business and personal services	11.0	13.6	17.2	21.2	28.2	28.5
Government services	16.7	20.5	20.4	20.9	16.4	16.3
Other services	1.4	1.2	1.8	2.2	2.6	2.5
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Notes:
1. The industry groupings in this table are a special aggregation based on the 1997 North American Industry Classification System (NAICS).
2. Includes both extraction and downstream manufacturing industries.

Sources:
Statistics Canada, Input-Output Division and Environment Accounts and Statistics Division.

Table B.9
Exports and imports by commodity group, 1961 to 2000, selected years

Commodity group[1]	Exports					Imports				
	1961	1971	1981	1991	2000	1961	1971	1981	1991	2000
	% of total exports					% of total imports				
Agricultural products[2]	17.1	10.3	10.9	7.3	5.7	12.5	8.0	7.2	6.5	5.1
Forest products[2]	21.7	13.9	12.7	11.3	10.4	4.0	3.3	2.9	3.7	3.5
Metal and mineral products[2]	24.3	17.1	16.8	12.8	8.4	12.0	10.2	11.8	8.0	8.9
Fuel and energy[2]	3.8	6.3	11.0	8.1	11.0	7.9	5.9	10.9	4.5	4.8
Chemicals and chemical products	3.1	2.6	4.2	4.9	5.9	6.1	6.0	6.0	7.2	8.8
Textiles, fabrics and clothing	1.1	1.1	1.8	1.7	2.6	6.7	5.6	4.4	5.0	4.1
Electrical and electronic products	1.0	2.2	2.4	4.1	6.8	5.6	5.6	6.3	9.3	12.3
Machinery and equipment	2.7	4.0	5.5	5.6	5.9	14.3	15.6	15.4	14.0	14.6
Transportation equipment	2.3	21.4	16.7	21.7	23.4	11.7	21.9	20.0	21.3	22.0
Miscellaneous goods	0.2	0.5	0.6	0.8	2.1	2.2	1.9	2.5	3.5	3.3
Construction	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Transportation and communications	9.5	7.8	8.2	8.2	6.0	1.7	1.4	2.4	3.2	2.5
Distributive trades	1.9	2.7	2.4	3.6	3.4	0.1	0.4	0.2	0.2	0.2
Finance and insurance	0.9	0.8	1.2	2.4	1.6	1.3	1.9	1.9	3.4	3.0
Real estate	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Business and personal services	1.0	1.4	4.3	6.1	6.7	2.0	2.7	6.4	8.1	6.9
Government services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Other services	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unallocated imports and exports	9.5	7.9	1.3	1.3	0.0	11.9	9.8	1.6	1.9	0.0
Total	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**	**100.0**

Notes:
For statistical reasons, it was impossible to allocate up to 10% of total exports and imports to the appropriate categories prior to 1981. The table therefore underestimates the trade in certain commodities before 1981.
1. The commodity groupings in this table are a special aggregation.
2. Includes both extraction and downstream manufacturing industries.
Sources:
Statistics Canada, Input-Output Division and Environment Accounts and Statistics Division.

Transportation

Ground, water and air transportation are essential to the economy. Bringing goods to market and getting people from place to place, transportation refers to the transport of goods and commercial passengers, as well as private transport.

Tables B.10 through B.13 and Figure B.1 outline the tonnage of goods transported by water, rail, truck and air transport. In 2002, 346 million tonnes of goods were transported by water compared to 322 million tonnes by rail, 294 million tonnes by truck and 0.79 million tonnes by air. Truck transport has seen the largest increase since 1997, with freight carried rising by 37% to 305 million tonnes of goods in 2003. Since peaking in 2000, air freight tonnage decreased by 24% to 642 751 tonnes in 2003. While the amount of railroad freight shipped grew steadily between 1907 and 2001 (with the exception of the depression years), rail freight per person remained relatively stable (Figure B.1).

In 2003, 39.8 million passengers were transported by Canadian air transport carriers, down 15% from a high reached in 2000 (Table B.13). Trains carried 4.3 million passengers in 2002 (Table B.11).

The number of road motor vehicle registrations increased by 8% between 1999 and 2003, reaching nearly 18.9 million vehicles. Since 1999, the number of vehicles weighing less than 4 500 kg has increased by 1.2 million to 17.8 million. These vehicles accounted for 94% of all registered road motor vehicles. Motorcycles and mopeds showed the largest percentage increase in registrations, with 373 thousand vehicles registered in 2003, a 36% increase over 1999 (Table B.14). As the number of vehicles on the road increased over the course of the twentieth century, the number of persons per vehicle fell to 1.7 in 2003, compared with 8.6 in 1931(Figure B.2).

Close to 58 thousand passenger buses were in use in 2002, 61% of which were used to transport students to school and employees to work. Urban transit vehicles made up a further 27% of passenger buses. All together, urban transit vehicles used 50% of the diesel fuel consumed by buses in 2003, compared to 32% for school and employee buses (Table B.15).

The majority (69%) of petroleum products used for transportation in 2003 were sold through retail pump sales. The road transport and urban transit industries used another 13% of petroleum products, compared to 9% for airlines (Table B.16).

Table B.10
Water transport, 1988 to 2003

Year	Freight loaded		Freight unloaded		Net tonnage	Containerized freight		Movement of freight	Passengers transported by ferry
	Domestic	International	Domestic	International		Domestic	International		
	t							t-km[1]	passengers
					millions				
1988	70.0	171.1	70.0	78.9	320.0	1.6	12.6	1 535 267	..
1989	62.0	159.1	62.0	80.3	301.4	1.4	12.1	1 440 267	38.7
1990	60.4	159.0	60.4	73.3	292.7	1.3	12.3	1 614 653	40.8
1991	57.9	168.0	57.9	66.1	292.0	0.8	12.2	1 708 444	40.4
1992	52.3	153.8	52.3	69.3	275.4	1.0	12.6	1 578 406	40.0
1993	50.4	152.6	50.4	71.6	274.6	0.9	13.3	1 561 381	41.2
1994	52.2	170.0	52.2	76.9	299.1	0.8	14.7	1 697 540	43.2
1995	50.4	176.5	50.4	83.2	310.1	0.8	15.6	1 775 600	42.0
1996	48.8	174.3	48.8	85.6	308.7	0.8	17.1	1 780 975	39.8
1997	46.7	187.9	46.7	94.7	329.3	1.0	18.8	1 967 331	38.2
1998	48.3	179.0	48.3	100.4	327.7	0.9	19.7	1 876 721	37.3
1999	52.2	179.6	52.2	101.6	333.4	0.9	22.5	1 881 478	39.2
2000	54.5	187.8	54.5	105.9	348.2	0.9	24.0	1 969 188	38.5
2001	53.9	174.7	53.9	112.1	340.7	0.9	23.5	1 872 734	39.0
2002	62.8	174.3	62.6	108.5	345.6	1.0	25.6	1 765 574	39.4
2003	68.1	191.4	68.3	115.2	374.7	1.0	28.2	1 919 479	38.9

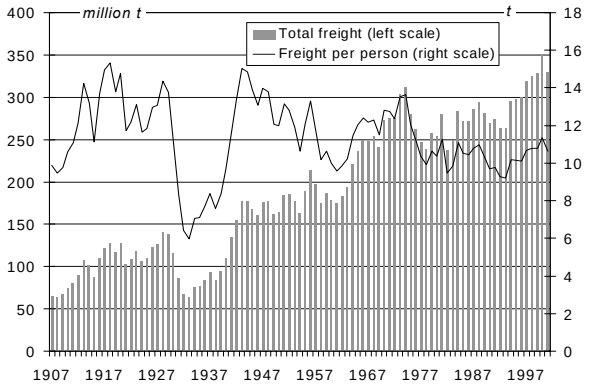
Note:
1. The movement of one tonne over a distance of one kilometre.
Sources:
Statistics Canada, *Shipping in Canada*, Catalogue no. 54-205-XIE, Ottawa, various issues.
Transport Canada, Surface and Marine Statistics and Forecasts.

Table B.11
Rail transport[1], 1997 to 2002

Year	Freight movement		Passenger movement		Locomotives	Passenger cars	Freight cars	Fuel consumed[4]	Track operated
	t	t-km[2]	passengers	passenger-km[3]					
	millions				number			million L	km
1997	319.1	306 198	4.1	1 515	3 143	426	107 976	2 258	74 949
1998	325.2	298 797	4.0	1 458	3 142	430	105 676	2 129	73 360
1999	328.4	297 504	4.1	1 510	3 115	435	102 917	1 979	70 346
2000	348.8	319 769	4.2	1 533	2 956	464	102 200	1 989	72 201
2001	329.8	318 264	4.2	1 553	2 889	449	100 110	1 997	69 410
2002	322.4	320 556	4.3	1 597	2 894	497	96 673	2 019	72 744

Notes:
1. Private railways, that transport goods solely for parent companies and do not operate on a for-hire basis, are excluded.
2. The movement of one tonne over a distance of one kilometre.
3. The movement of a passenger over a distance of one kilometre. Passenger-kilometres are derived by multiplying the number of passengers by the distance travelled.
4. Diesel and heavy fuel oil in 1997. Diesel only from 1998 to 2002.
Source:
Statistics Canada, *Rail in Canada*, Catalogue no. 52-216-XIE, Ottawa, various issues.

Figure B.1
Railroad freight shipped, 1907 to 2001



Sources:
Canadian Political Science Association and Social Science Research Council of Canada, 1965,
Historical Statistics of Canada, M.C. Urquhart, Catalogue no. HA746 U7, Toronto.
Statistics Canada, 1983, Historical Statistics of Canada, Second Edition, F.H. Leacy (ed.), Catalogue no. 11-516-XPE, Ottawa.
Statistics Canada, Rail in Canada, Catalogue no. 52-216-XIE, Ottawa, various issues.

Table B.12
Truck transport, 1989 to 2003

Year	Freight carried		Shipments		
	t	t-km[1]	Number of shipments	Weight per shipment	Distance per shipment
	millions			kg	km
1989	189.6	77 383	34.9	5 431	621
1990	174.2	77 069	30.0	5 816	647
1991	150.6	70 048	29.1	5 178	648
1992	149.5	72 276	27.6	5 410	656
1993	173.4	83 968	27.9	6 208	659
1994	195.6	101 873	30.5	6 418	641
1995	210.9	109 434	32.3	6 523	685
1996	229.0	120 459	35.2	6 509	709
1997	223.3	130 141	32.0	6 962	792
1998	233.9	137 552	33.8	6 914	776
1999	269.3	158 104	36.4	7 396	771
2000	278.4	164 720	35.6	7 830	798
2001	288.0	170 569	36.9	7 800	795
2002	293.6	177 012	38.5	7 629	778
2003	305.2	184 744	40.3	7 580	794

Notes:
These figures pertain only to Canada-based for-hire trucking carriers.
1. The movement of one tonne over a distance of one kilometre.
Source:
Statistics Canada, *Trucking in Canada*, Catalogue no. 53-222-XIB, Ottawa, various issues.

Table B.13
Air transport, 1988 to 2003

Year	Freight carried		Passengers	
	weight	t-km[1]	passengers	passenger-km[2]
	t	millions		
1988	591 250	1 516	34.8	62 141
1989	603 828	1 552	35.7	65 628
1990	628 180	1 727	36.3	66 608
1991	603 267	1 565	31.3	57 953
1992	596 812	1 493	31.9	62 117
1993	624 561	1 636	31.1	60 985
1994	653 444	1 791	32.5	65 636
1995	692 579	2 034	36.0	73 506
1996	721 260	2 168	39.6	82 270
1997	789 146	2 353	43.6	92 104
1998	822 185	2 280	45.2	96 643
1999	832 987	2 364	46.4	99 623
2000	845 809	2 327	46.8	104 917
2001	789 625	2 149	45.4	102 473
2002	786 607	2 151	40.5	95 094
2003	642 751	1 810	39.8	89 951

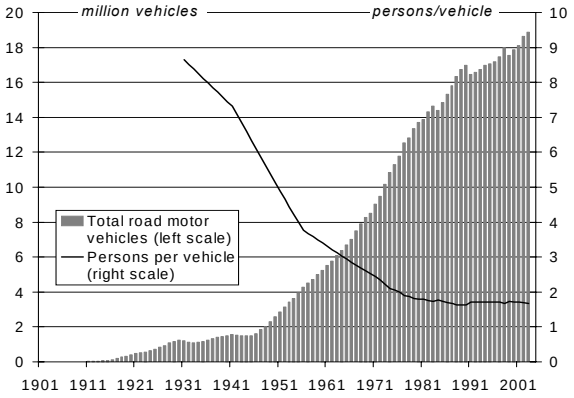
Notes:
Figures include all Canadian carriers that earned more than 1 million dollars in revenue during each of the previous two years.
1. The movement of one tonne over a distance of one kilometre.
2. The movement of a passenger over a distance of one kilometre. Passenger-kilometres are derived by multiplying the number of passengers by distance travelled.
Source:
Statistics Canada, Transportation Division.

Table B.14
Motor vehicle registrations, 1999 to 2003

Year	Road motor vehicles							
	Vehicles weighing less than 4 500 kg	Vehicles weighing 4 500 to 14 999 kg	Vehicles weighing 15 000 kg or more	Buses	Motorcycles and mopeds	Total	Trailers	Off-road, construction and farm vehicles
	thousands							
1999	16 538	387	262	73	274	17 534	4 145	1 957
2000[r]	16 832	391	270	77	311	17 882	3 989	1 756
2001	17 055	387	267	74	318	18 102	4 023	1 302
2002	17 544	367	277	79	350	18 617	4 161	1 419
2003	17 755	378	282	80	373	18 869	4 309	1 488

Note:
In 1999, Statistics Canada implemented a revised methodology for motor vehicle registration data in Canada. These data are not comparable with motor vehicle registrations prior to 1999.
Source:
Statistics Canada, CANSIM, table 405-0004.

Figure B.2
Road motor vehicles, 1903 to 2003



Note:
In 1999, Statistics Canada changed the data collection methodology for road motor vehicles. Some of the difference in the vehicle trend after 1999 may be attributable to this methodological change.
Sources:
Canadian Political Science Association and Social Science Research Council of Canada, 1965, *Historical Statistics of Canada,* M.C. Urquhart, Catalogue no. HA746 U7, Toronto.
Statistics Canada, 1983, *Historical Statistics of Canada, Second Edition*, F.H. Leacy (ed.), Catalogue no. 11-516-XPE, Ottawa.
Statistics Canada, CANSIM, tables 405-0001 and 405-0004.

Table B.15
Fuel consumption and number of vehicles by passenger bus and urban transit industries, 2003

Industry	Fuel consumed				Electricity	Number of vehicles
	Diesel	Gasoline	Propane	Natural gas		
	thousand L				thousand kW	number
Urban transit systems	390 919	1 879	772	16 579	781 755	15 798
Interurban and rural bus transportation	61 356	41	0	0	0	1 570
School and employee bus transportation	247 884	5 016	1 809	0	0	35 573
Charter bus	48 208	110	0	0	0	2 200
Other transit - shuttle	14 159	1 742	3 932	0	0	1 797
Sight-seeing	2 501	2	0	0	0	172
Other[1]	19 576	0	0	0	22 505	879
Total	**784 603**	**8 790**	**6 514**	**16 579**	**804 260**	**57 989**

Note:
1. Comprised mostly of municipal transit operations that are part of municipal budgets rather than separate operating entities.
Source:
Statistics Canada, 2005, *Service Bulletin, Surface and Marine Transport*, Catalogue no. 50-002-XIB, Vol. 21, no. 1, Ottawa.

Table B.16
Consumption of refined petroleum products[1] by transportation industry, 1990 to 2003

Year	Industry						
	Railways	Airlines[2]	Marine[2]	Road transport and urban transit	Retail pump sales	Pipelines[3]	**Total**
	thousand m^3						
1990	2 313	4 078	2 640	4 419	32 541	16	**46 007**
1991	2 143	3 687	2 733	4 474	31 447	15	**44 499**
1992	2 241	3 921	2 711	4 657	32 067	12	**45 608**
1993	2 233	3 756	2 397	5 104	33 048	8	**46 545**
1994	2 310	4 015	2 574	5 979	34 208	30	**49 116**
1995	2 092	4 244	2 523	6 450	34 251	36	**49 596**
1996	2 046	4 941	2 480	6 690	34 849	57	**51 062**
1997	2 074	5 082	2 481	7 147	35 778	13	**52 574**
1998	1 999	5 227	2 919	7 197	36 817	24	**54 182**
1999	2 116	5 583	2 741	7 345	37 902	24	**55 711**
2000	2 169	5 634	2 801	7 175	38 101	21	**55 901**
2001	2 132	5 015	3 016	6 721	38 448	12	**55 344**
2002	1 934	5 299	2 718	6 871	38 665	9	**55 496**
2003	1 928	5 336	2 519	7 368	39 046	21	**56 217**

Notes:
Figures may not add up to totals due to rounding.
1. Refined petroleum products refers to motor gasoline, diesel fuel oil, light fuel oil, heavy fuel oil, aviation gasoline and aviation turbo fuel.
2. Includes fuels purchased in Canada by domestic and foreign companies.
3. The volume used to operate and run the pumps at the pumping stations.
Source:
Statistics Canada, CANSIM, table 128-0003.

Natural resources

This section examines one of the main sources of impacts on the environment – natural resource consumption. The statistics presented here on agriculture, fisheries, forestry, minerals and energy, provide an indication of the role that Canada's environment plays as a source of natural resources.

Agriculture

From 1951 to 2001, the number of farms in Canada decreased by 60%, from 623 087 to 246 923 (Table B.17). Figure B.3 illustrates that while the total area of agricultural land remained stable at 68 million hectares, the area of cropland increased to 36 million hectares. The average farm size increased from 113 hectares in 1951 to 273 hectares in 2001.

Figures B.4 and B.5 present the production of selected field crops and small grains, while Figure B.6 presents livestock inventories.

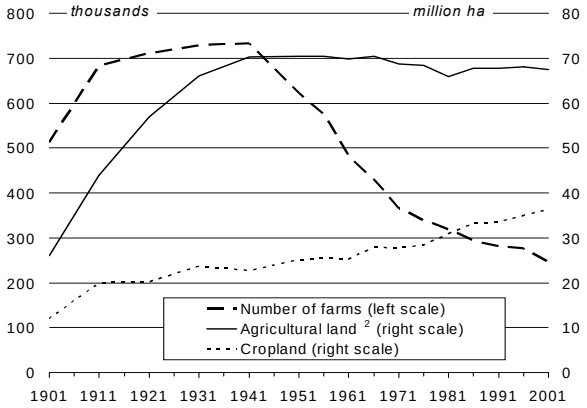
Table B.17
Number of farms by province, 1871 to 2001, selected years

Year	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	**Total**
						number					
1871	…	…	46 316	31 202	118 086	172 258	…	…	…	…	**367 862**
1881	…	13 629	55 873	36 837	137 863	206 989	9 077	1 014[2]	…	2 743	**464 025**
1891[1]	…	14 549	60 122	38 577	174 996	216 195	22 008	9 244[3]	…	6 490	**542 181**
1901[1]	…	13 748	54 478	37 006	140 110	204 054	32 252	13 445	9 479	6 501	**511 073**
1911[1]	…	14 113	52 491	37 755	149 701	212 108	43 631[4]	95 013[4]	60 559[4]	16 958	**682 329**
1921	…	13 701	47 432	36 655	137 619	198 053	53 252[4]	119 451[4]	82 954[4]	21 973	**711 090**
1931	…	12 865	39 444	34 025	135 957	192 174	54 199	136 472	97 408	26 079	**728 623**
1941	…	12 230	32 977	31 889	154 669	178 204	58 024	138 713	99 732	26 394	**732 832**
1951	3 626	10 137	23 515	26 431	134 336	149 920	52 383	112 018	84 315	26 406	**623 087**
1961	1 752	7 335	12 518	11 786	95 777	121 333	43 306	93 924	73 212	19 934	**480 877**
1971	1 042	4 543	6 008	5 485	61 257	94 722	34 981	76 970	62 702	18 400	**366 110**
1981	679	3 154	5 045	4 063	48 144	82 448	29 442	67 318	58 056	20 012	**318 361**
1991	725	2 361	3 980	3 252	38 076	68 633	25 706	60 840	57 245	19 225	**280 043**
1996	742	2 217	4 453	3 405	35 991	67 520	24 383	56 995	59 007	21 835	**276 548**
2001	643	1 845	3 923	3 034	32 139	59 728	21 071	50 598	53 652	20 290	**246 923**

Notes:
1. Excludes plots under one acre, to attain comparability with data for later years.
2. Data comprise the portion of the Northwest Territories located west of Manitoba.
3. Data comprise the districts of Assiniboia, Saskatchewan and Alberta.
4. Data exclude farms located on Indian reserves.

Sources:
Statistics Canada, 1983, *Historical Statistics of Canada, Second Edition*, F.H. Leacy (ed.), Catalogue no. 11-516-XPE, Ottawa.
Statistics Canada, 1997, *Historical Overview of Canadian Agriculture*, Catalogue no. 93-358-XPB, Ottawa.
Statistics Canada, 2002, Census of Agriculture, www.statcan.ca/english/freepub/95F0301XIE/tables/html/Table3Can.htm (accessed February 16, 2005).

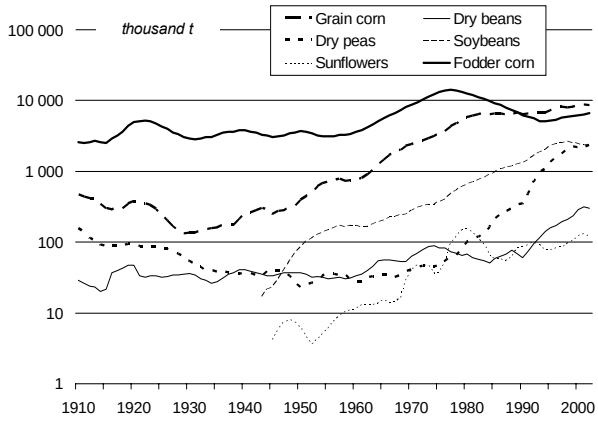
Figure B.3
Number of farms, agricultural land and cropland, 1901 to 2001[1]



Notes:
1. The definition of a census farm changed over the years, affecting the comparability of data among censuses.
2. Data for 1901 and 1911 includes all improved land.

Sources:
Statistics Canada, 1983, *Historical Statistics of Canada, Second Edition*, F.H. Leacy (ed.),Catalogue no. 11-516E, Ottawa.
Statistics Canada, 1997, *Historical Overview of Canadian Agriculture*, Catalogue no. 93-358_XPB, Ottawa.
Statistics Canada, 2004, Census of Agriculture, www.statcan.ca/english/Pgdb/agrc25a.htm (accessed February 16, 2005).

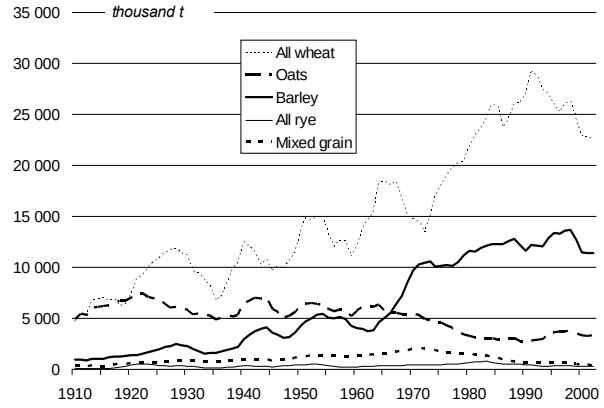
Figure B.4
Selected field crop production, 1910 to 2002[1] (five-year averages)



Note:
1. Data from 1908 to 2004 are used to create the five-year averages.

Source:
Statistics Canada, CANSIM, table 001-0010.

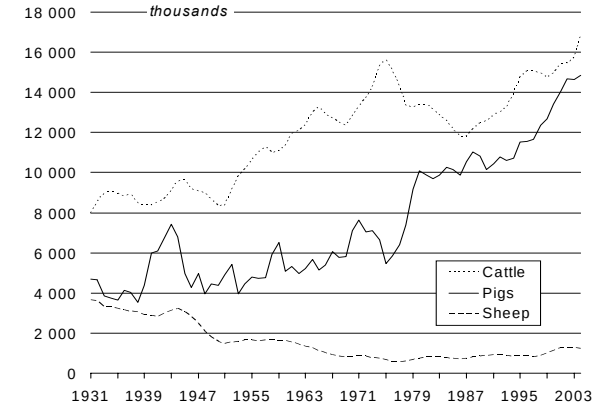
Figure B.5
Production of major small grains, 1910 to 2002[1] (five-year averages)



Note:
1. Data from 1908 to 2004 are used to create the five-year averages.

Source:
Statistics Canada, CANSIM, table 001-0010.

Figure B.6
Selected livestock populations, 1931 to 2004



Source:
Statistics Canada, CANSIM, tables 003-0032, 003-0031 and 003-0004.

Fisheries

Despite declines in fish stocks during the last part of the twentieth century, Canadian fisheries continue to play an important role in communities in Atlantic Canada and British Columbia. Fishing industries contributed 0.2% or $1.9 billion to total GDP in 2004 (Table B.18). The fishing industries employed 56 thousand people in 2004, 0.35% of total employment in Canada (Table B.19).

Exports and imports of fish and fish products are presented in Table B.20. Canada continues to be a net exporter of these products, with exports of $4.9 billion and imports of $1.8 billion in 2004.

After a steady decline throughout the early 1990s, the total catch of fish and shellfish has remained relatively stable, with slightly over 1 million tonnes, worth $2.2 billion, caught in 2003 (Table B.21). Aquaculture production decreased for the first time since 1992, falling to 156 thousand tonnes in 2003 (Table B.22).

Table B.18
Gross domestic product of fishing industries, 1997 to 2004

Year	Total GDP	Fishing industries			
		Fishing, hunting and trapping	Seafood product preparation and packaging	Total	Share of total GDP
	$ million chained 1997				%
1997	816 756	847	721	1 568	0.19
1998	848 414	821	715	1 536	0.18
1999	896 069	807	843	1 650	0.18
2000	943 737	832	876	1 708	0.18
2001	959 620	914	874	1 788	0.19
2002	991 870	915	972	1 887	0.19
2003	1 013 899	849	974	1 823	0.18
2004	1 044 583	860	996	1 856	0.18

Source:
Statistics Canada, CANSIM, table 379-0017.

Table B.19
Employment in the fishing industries, 1987 to 2004

Year	Total employment	Fishing industries				
		Fishing	Animal aquaculture	Seafood product preparation and packaging	Total	Share of total employment
	thousand persons					%
1987	12 334	33.4	2.3	31.7	67.4	0.55
1988	12 708	37.4	1.6	35.5	74.5	0.59
1989	12 986	36.7	2.0	34.0	72.7	0.56
1990	13 079	37.2	2.4	31.1	70.7	0.54
1991	12 851	41.1	3.0	29.8	73.9	0.58
1992	12 720	35.3	3.1	29.6	68.0	0.53
1993	12 782	36.2	2.9	25.7	64.8	0.51
1994	13 044	34.9	2.5	25.2	62.6	0.48
1995	13 271	28.4	2.2	22.6	53.2	0.40
1996	13 392	29.9	3.1	20.4	53.4	0.40
1997	13 677	29.7	3.8	22.7	56.2	0.41
1998	14 019	29.7	2.4	22.5	54.6	0.39
1999	14 390	29.4	3.4	24.7	57.5	0.40
2000	14 759	28.6	4.7	23.0	56.3	0.38
2001	14 947	25.7	4.0	23.7	53.4	0.36
2002	15 308	25.7	3.2	27.8	56.7	0.37
2003	15 665	26.2	3.1	24.3	53.6	0.34
2004	15 950	26.5	3.5	25.7	55.7	0.35

Sources:
Statistics Canada, Labour Force Survey.
Statistics Canada, CANSIM, table 282-0088.

Table B.20
Exports and imports of fish and fish products, 1971 to 2004

Year	Exports			Imports		
	Total exports	Fish, fresh, frozen, preserved and canned	Share of total exports	Total imports	Fish and marine animals	Share of total imports
	$ million		%	$ million		%
1971	17 782	276	1.55	15 314	60	0.39
1972	20 222	340	1.68	18 272	81	0.44
1973	25 649	484	1.89	22 726	110	0.48
1974	32 738	418	1.28	30 903	119	0.38
1975	33 616	451	1.34	33 962	134	0.39
1976	38 166	590	1.54	36 608	182	0.50
1977	44 495	795	1.79	41 523	219	0.53
1978	53 361	1 111	2.08	49 048	248	0.51
1979	65 582	1 271	1.94	61 157	310	0.51
1980	76 681	1 265	1.65	67 903	355	0.52
1981	84 432	1 494	1.77	77 140	360	0.47
1982	84 393	1 591	1.89	66 739	352	0.53
1983	90 556	1 563	1.73	73 098	418	0.57
1984	111 330	1 595	1.43	91 493	488	0.53

Table B.20
Exports and imports of fish and fish products, 1971 to 2004 (continued)

	Exports			Imports		
Year	Total exports	Fish, fresh, frozen, preserved and canned	Share of total exports	Total imports	Fish and marine animals	Share of total imports
	$ million		%	$ million		%
1985	119 061	1 849	1.55	102 669	494	0.48
1986	125 172	2 580	2.06	115 195	613	0.53
1987	131 484	2 957	2.25	119 324	691	0.58
1988	143 534	2 818	1.96	132 715	679	0.51
1989	146 963	2 530	1.72	139 217	738	0.53
1990	152 056	2 817	1.85	141 000	679	0.48
1991	147 669	2 636	1.79	140 658	736	0.52
1992	163 464	2 736	1.67	154 430	777	0.50
1993	190 213	2 868	1.51	177 123	996	0.56
1994	228 167	3 259	1.43	207 873	1 126	0.54
1995	265 334	3 496	1.32	229 937	1 287	0.56
1996	280 079	3 444	1.23	237 689	1 470	0.62
1997	303 378	3 498	1.15	277 727	1 434	0.52
1998	327 162	3 665	1.12	303 399	1 636	0.54
1999	369 035	4 261	1.15	327 026	1 870	0.57
2000	429 372	4 561	1.06	362 337	1 929	0.53
2001	420 657	4 722	1.12	350 683	1 945	0.55
2002	413 795	5 236	1.27	356 581	1 935	0.54
2003	400 010	4 981	1.25	341 833	1 811	0.53
2004	430 358	4 874	1.13	363 123	1 805	0.50

Source:
Statistics Canada, CANSIM, table 228-0003.

Table B.21
Landed catch and value, 1990 to 2003

	Groundfish[1]		Pelagic fish[2]		Shellfish[3]		Total[4]	
Year	Catch	Value	Catch	Value	Catch	Value	Catch	Value
	t (live weight)	$ thousand	t (live weight)	$ thousand	t (live weight)	$ thousand	t (live weight)	$ thousand
1990	791 276	474 251	559 741	422 607	251 498	519 831	1 645 909	1 433 625
1991	791 620	499 530	429 975	292 995	251 368	583 448	1 509 032	1 394 200
1992	630 122	415 092	389 712	314 912	269 751	649 930	1 322 206	1 400 322
1993	431 413	297 818	419 620	364 165	288 999	732 220	1 164 880	1 424 056
1994	332 767	252 388	350 690	402 280	318 258	1 012 237	1 034 177	1 699 372
1995	218 652	229 018	301 952	242 071	310 369	1 275 569	860 650	1 782 957
1996	274 308	231 294	312 146	270 231	307 808	1 036 503	924 856	1 579 380
1997	276 316	255 307	323 499	222 454	346 266	1 092 141	986 911	1 610 999
1998	287 207	292 497	327 252	159 610	372 511	1 135 795	1 019 447	1 610 678
1999	300 995	332 471	302 357	143 018	399 829	1 423 569	1 039 219	1 924 589
2000	227 309	311 058	294 178	167 429	434 129	1 562 164	973 890	2 061 194
2001[p]	274 925	302 344	307 671	171 914	448 347	1 638 186	1 068 584	2 138 434
2002[p]	257 217	287 692	312 655	184 827	469 840	1 646 412	1 059 126	2 153 854
2003[p]	255 495	279 282	345 648	178 408	438 593	1 692 638	1 062 428	2 182 729

Notes:
1. Species that are usually caught near the ocean bottom, including cod, haddock, pollock, redfish, halibut, flounder, and many others.
2. The pelagic species live in midwater or close to the surface. They include herring, capelin, swordfish, tuna, and many others.
3. Aquatic shelled molluscs (e.g. oysters) and crustaceans (e.g. crabs, shrimp).
4. Data do not add up because total also includes marine plants, lumpfish roe and miscellaneous other marine products.

Source:
Department of Fisheries and Oceans, Statistical Services, 2004, www.dfo-mpo.gc.ca/communic/statistics/commercial/landings/seafisheries/index_e.htm (accessed November 15, 2004).

Table B.22
Aquaculture production, 1986 to 2003

	Trout[1]		Oysters		Salmon		Mussels		Total[2, 3]	
Year	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value
	t	$ thousand	t	$ thousand	t	$ thousand	t	$ thousand	t	$ thousand
1986	2 176	14 626	5 164	5 752	1 073	11 271	2 062	3 427	10 488	35 106
1987	3 031	18 611	5 794	6 874	3 125	31 043	1 740	2 839	13 936	61 669
1988	3 444	20 809	5 913	6 987	9 719	71 202	2 045	3 368	21 466	105 355
1989	3 888	22 655	6 489	9 015	16 276	102 018	3 391	4 148	30 273	139 137
1990	4 677	26 714	6 774	8 462	21 167	155 059	3 598	3 964	36 462	195 955
1991	3 324	15 575	5 900	5 952	34 109	195 538	3 956	4 875	49 594	233 559
1992	3 927	20 234	5 843	6 049	30 325	202 735	4 877	5 696	46 931	244 014
1993	4 121	21 737	6 036	6 573	36 670	234 036	5 141	5 727	53 927	277 604

Table B.22
Aquaculture production, 1986 to 2003 (continued)

Year	Trout[1]		Oysters		Salmon		Mussels		Total[2, 3]	
	Weight	Value	Weight	Value	Weight	Value	Weight	Value	Weight	Value
	t	$ thousand	t	$ thousand	t	$ thousand	t	$ thousand	t	$ thousand
1994	4 434	24 169	7 534	9 081	36 083	249 152	6 867	7 575	57 147	301 992
1995	5 316	26 216	7 719	9 702	42 515	286 852	8 626	9 891	66 269	341 957
1996	7 712	38 993	7 989	10 710	45 624	287 154	9 898	12 022	73 187	362 527
1997	6 876	33 629	5 631	8 695	56 775	324 030	11 570	13 834	82 487	392 123
1998	8 376	42 123	8 137	11 321	58 618	349 043	15 018	18 965	92 105	436 867
1999	12 576	60 830	8 785	13 278	72 890	450 084	17 397	23 185	114 204	567 841
2000	12 037	57 289	9 624	16 515	82 195	483 755	21 262	27 078	128 030	608 881
2001	11 218	51 193	11 319	16 772	105 606	470 471	21 515	30 283	154 069	605 491
2002	8 864	42 788	11 520	15 176	126 321	502 036	20 572	31 281	171 796	628 290
2003	6 811	32 803	12 784	18 370	105 050	434 170	20 510	30 681	155 634	585 544

Notes:
1. Includes steelhead.
2. Data do not add up because total also includes char, other finfish, clams and scallops.
3. Starting in 1996, total includes restocking to outfitters in Quebec.

Sources:
Department of Fisheries and Oceans, Statistical Services, 2004, www.dfo-mpo.gc.ca/communic/statistics/aqua/index_e.htm (accessed November 8, 2004).
Statistics Canada, 2004, *Aquaculture Statistics, 2003*, Catalogue no. 23-222-XIE, Ottawa.

Forestry

The production of logs and bolts has followed an upward trend for several decades, with production at 160 million m^3 in 2002. Pulpwood production has decreased since the mid-eighties, falling from 40 million m^3 in 1985 to 26 million m^3 in 2002 (Table B.23). Gross domestic product of forest products industries topped $26 billion in 2004, accounting for 2.5% of total GDP (Table B.24).

Starting in 2002, employment in the forest products industries was significantly lower compared to previous years (Table B.25). A major contributor to this decrease was the softwood lumber dispute with the United States, which particularly affected employment in British Columbia.

The value of forest products exports followed an upward trend from 1986 to 2000, then declined from $44 billion in 2000 to $35 billion in 2003. In 2004 exports recovered to $40 billion. Forest products' share of total exports declined over this period, from 14.7% in 1986 to 9.7% in 2004 (Table B.26).

Table B.23
Production of selected forest products, 1922 to 2003, selected years

Year	Logs and bolts[1]	Pulpwood	Sawn lumber
	thousand m^3		
1922	19 082	11 779	..
1925	24 092	15 286	..
1930	29 142	17 942	..
1935	17 721	18 296	..
1940	32 639	26 165	..
1945	30 610	32 938	..
1950	40 112	40 296	14 512
1955	44 282	48 292	18 598
1960	51 141	42 307	18 829
1965	62 643	42 607	23 745
1970	75 645	40 553	26 401
1975	73 542[r]	37 270[r]	26 645
1980	109 952	38 909	44 597
1985	119 317[r]	40 620[r]	54 587
1990	118 950[r]	35 876[2]	54 544
1995	150 150[r]	30 926[3]	62 577
2000	166 654[r]	28 699[r]	76 786
2001	156 161[r]	23 079[r]	73 634
2002	160 097[2]	25 804[2]	79 804
2003	..	..	77 688

Notes:
1. Logs are defined as the stem of a tree after it has been felled; the raw material from which lumber, plywood, and other wood products are processed. Bolts are defined as raw material used in the manufacture of shingles and shakes; short logs to be sawn for lumber or peeled for veneer.
2. Estimated by provincial or territorial forestry agency.
3. Estimated by the Canadian Forest Service or by Statistics Canada.

Sources:
Statistics Canada, 1983, *Historical Statistics of Canada, Second Edition*, F.H. Leacy (ed.), Catalogue no. 11-516-XPE, Ottawa.
Canadian Council of Forest Ministers, National Forestry Database Program, 2004, nfdp.ccfm.org (accessed November 10, 2004).
Statistics Canada, CANSIM, table 303-0009.

Table B.24
Gross domestic product of forest products industries, 1997 to 2004

	Industries					Industries as share of total GDP				
Year	Forestry and logging	Sawmills and wood preservation	Other wood product manufacturing	Pulp, paper and paperboard mills	Total	Forestry and logging	Sawmills and wood preservation	Other wood product manufacturing	Pulp, paper and paperboard mills	Total
	$ million chained 1997					%				
1997	5 564	6 240	1 554	8 294	21 652	0.68	0.76	0.19	1.02	2.65
1998	5 644	6 609	1 585	7 910	21 748	0.67	0.78	0.19	0.93	2.56
1999	5 845	6 753	1 836	8 989	23 423	0.65	0.75	0.20	1.00	2.61
2000	6 209	7 419	2 193	9 538	25 359	0.66	0.79	0.23	1.01	2.69
2001	6 272	6 785	2 209	8 586	23 852	0.65	0.71	0.23	0.89	2.49
2002	6 365	7 231	2 550	8 752	24 898	0.64	0.73	0.26	0.88	2.51
2003	6 547	7 407	2 658	8 772	25 384	0.65	0.73	0.26	0.87	2.50
2004	6 962	7 901	2 756	8 779	26 398	0.67	0.76	0.26	0.84	2.53

Source:
Statistics Canada, CANSIM, table 379-0017.

Table B.25
Employment in forest products industries[1] by province and territory, 1991 to 2004

Year	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T., N.W.T. and Nvt.	**Canada**
	persons											
1991	1 456	.	3 766	14 831	65 168	42 018	1 704	860	9 003	74 402	.	**218 480**
1992	1 471	.	3 634	13 226	58 029	40 130	1 491	976	8 586	69 401	.	**202 215**
1993	1 448	.	3 625	13 423	57 788	39 462	1 656	1 167	10 478	69 590	.	**204 053**
1994	1 908	.	4 650	12 805	59 942	40 031	2 235	1 359	10 144	74 324	.	**213 819**
1995	2 116	.	3 957	13 722	62 321	39 881	2 304	1 502	10 918	71 274	.	**214 688**
1996	2 004	.	4 024	13 691	63 044	39 608	2 247	1 338	12 391	73 087	.	**218 358**
1997	2 305	.	4 451	14 237	66 734	43 000	2 409	1 620	12 759	70 836	.	**225 356**
1998	1 863	.	4 511	14 725	66 508	43 348	2 744	2 017	13 518	65 662	.	**221 511**
1999	1 639	.	4 447	14 636	67 666	44 379	2 958	1 787	14 395	69 431	.	**228 248**
2000	1 730	.	4 867	16 553	72 222	45 495	3 385	1 559	13 452	72 531	.	**238 707**
2001	1 729	.	4 099	15 727	67 715	44 971	3 861	1 556	13 454	62 584	.	**222 244**
2002	1 667	.	3 586	15 238	62 761	42 638	x	1 407	12 766	51 247	.	**201 461**
2003	x	.	3 385	x	63 264	39 512	x	1 180	11 790	49 790	.	**196 828**
2004	x	.	3 265	x	64 434	37 781	x	1 229	12 597	48 412	.	**194 306**

Notes:
Data do not add up to Canada total because of unavailable data for some provinces or territories.
1. Includes the following industries: forestry and logging; pulp, paper and paperboard mills; sawmills and wood preservation; and other wood product manufacturing.
Source:
Statistics Canada, CANSIM, table 281-0024.

Table B.26
Export of forest products, 1986 to 2004

Year	Other crude wood products	Lumber	Other wood fabricated materials	Wood pulp and similar pulp	Newsprint paper	Other paper and paperboard	Total	Total as share of Canadian exports
	$ million							%
1986	320.3	5 032.8	1 031.1	4 072.5	5 661.2	1 560.7	17 678.6	14.7
1987	467.4	5 937.6	1 095.1	5 473.9	6 028.7	1 944.1	20 946.8	16.7
1988	473.4	5 461.7	1 086.6	6 496.2	7 299.7	1 400.7	22 218.3	16.0
1989	438.3	5 590.6	1 060.4	6 940.8	6 507.1	1 753.2	22 290.4	16.1
1990	328.2	5 463.0	1 085.3	6 122.5	6 462.5	2 217.4	21 678.9	14.6
1991	283.0	5 225.5	965.8	4 937.5	6 499.1	2 215.0	20 125.9	13.8
1992	371.5	6 606.9	1 367.8	5 068.6	6 317.3	2 525.8	22 257.9	13.7
1993	389.3	9 514.8	1 787.3	4 640.9	6 656.8	2 812.5	25 801.6	13.8
1994	317.3	11 460.3	2 324.4	6 755.4	6 968.5	3 443.5	31 269.4	13.9
1995	339.2	10 966.3	2 735.0	10 938.3	9 480.1	4 785.1	39 244.0	15.0
1996	339.0	12 591.3	2 973.0	6 922.5	8 849.6	4 441.1	36 116.5	13.1
1997	324.7	13 080.7	3 486.9	6 917.4	7 958.3	4 711.1	36 479.1	12.2
1998	417.2	11 755.1	4 548.9	6 717.8	8 094.0	5 432.4	36 965.4	11.6
1999	528.9	13 413.9	5 965.1	7 468.0	8 254.7	5 780.9	41 411.5	11.7
2000	668.3	12 285.6	5 603.4	9 906.2	8 984.2	6 387.6	43 835.3	10.6
2001	667.8	11 703.3	5 384.5	7 356.0	9 294.5	6 356.1	40 762.2	10.1
2002	812.6	11 006.2	5 657.4	7 003.3	8 318.9	5 705.4	38 503.8	9.7
2003	702.3	9 070.7	6 363.2	6 809.0	7 360.4	4 958.4	35 264.0	9.3
2004	648.1	11 670.3	7 941.1	7 154.0	7 364.1	5 294.1	40 071.7	9.7

Note:
Figures may not add up to totals due to rounding.
Source:
Statistics Canada, CANSIM, table 228-0003.

Minerals

The mineral industries include the extraction and production of metallic minerals such as copper, gold, iron, nickel, silver and zinc; mineral fuels including coal, crude petroleum and natural gas; and other minerals including potash, sand, and gravel. In 2004, mining and oil and gas extraction industries contributed 3.7% to GDP while petroleum and coal products and selected primary mineral manufacturing contributed another 1.1% (Tables B.27 and B.29).

In 2004, total employment in the mining and oil and gas extraction industries reached 155 088 (Table B.28). Since 1991, Alberta's share of total employment in the mining and oil and gas extraction industries has risen from 45% to 58%.

In 2003, crude petroleum production in Canada reached nearly $34 billion. In the same year, close to $43 billion worth of natural gas was extracted, with the majority coming from the western provinces and Nova Scotia. Metal production totalled just under $10 billion (Table B.30). Tables B.31 and B.32 detail reserves and production of selected minerals.

Table B.27
Gross domestic product of mining and oil and gas extraction industries, 1997 to 2004

Year	Oil and gas extraction	Coal mining	Metal ore mining	Non-metallic mineral mining and quarrying	Support activities for mining and oil and gas extraction	Total	Total as share of total GDP
			$ million chained 1997				%
1997	21 203	1 209	5 027	2 464	4 032	33 935	4.2
1998	21 947	1 185	5 252	2 402	3 761	34 547	4.1
1999	22 058	1 166	5 057	2 839	3 345	34 465	3.8
2000	22 014	1 235	5 390	2 780	4 404	35 823	3.8
2001	21 505	1 370	5 194	3 008	4 752	35 829	3.7
2002	22 086	1 217	4 923	3 249	4 018	35 493	3.6
2003	22 284	1 123	4 609	3 990	5 346	37 352	3.7
2004	22 750	1 216	4 553	4 418	5 536	38 473	3.7

Source:
Statistics Canada, CANSIM, table 379-0017.

Table B.28
Employment in mining and oil and gas extraction industries by province and territory, 1991 to 2004

Year	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T., N.W.T. and Nvt.	**Canada**
						persons						
1991	.	.	.	3 390	16 654	25 261	4 226	8 328	68 206	16 053	.	**152 742**
1992	.	.	.	3 395	15 067	23 039	4 230	8 312	58 766	12 664	.	**135 330**
1993	.	.	.	3 113	13 344	23 767	3 992	8 106	54 546	10 542	.	**126 664**
1994	.	.	.	2 966	13 052	21 413	3 766	8 527	63 907	12 297	.	**135 304**
1995	.	.	.	3 544	12 311	22 785	3 442	9 992	58 743	13 061	.	**132 204**
1996	.	.	.	3 606	11 872	22 723	2 927	10 124	57 110	11 862	.	**128 240**
1997	.	.	.	3 520	14 090	22 690	3 762	10 910	63 173	12 781	.	**138 972**
1998	.	.	.	3 373	14 066	20 066	3 657	10 539	65 936	13 010	.	**138 040**
1999	.	.	.	3 637	13 908	19 618	2 854	10 254	63 813	10 665	.	**132 392**
2000	.	.	.	3 840	14 064	18 872	3 190	11 153	66 960	10 618	.	**136 269**
2001	.	.	.	3 490	11 143	18 426	2 720	11 334	73 614	10 546	.	**138 685**
2002	.	.	.	3 004	11 649	17 312	2 324	9 982	77 782	10 311	.	**139 827**
2003	.	.	.	x	11 882	17 345	x	10 191	86 032	10 517	.	**149 750**
2004	.	.	.	x	11 839	18 976	x	11 068	89 385	11 516	.	**155 088**

Note:
Data do not add up to Canada total because of unavailable data for some provinces or territories.
Source:
Statistics Canada, CANSIM, table 281-0024.

Table B.29
Gross domestic product of petroleum and coal products and selected primary metal manufacturing, 1997 to 2004

Year	Petroleum and coal products manufacturing	Iron and steel mills and ferro-alloy manufacturing	Alumina and aluminum production and processing	Non-ferrous metal (except aluminum) production and processing	Total	Total as share of total GDP
			$ million chained 1997			%
1997	1 657	3 142	2 088	1 865	8 752	1.07
1998	1 805	3 416	2 452	2 063	9 736	1.15
1999	1 737	3 419	2 607	2 149	9 912	1.11
2000	1 741	3 605	3 200	2 276	10 822	1.15
2001	1 859	2 962	3 300	2 747	10 868	1.13
2002	1 909	3 180	3 480	2 705	11 274	1.14
2003	1 992	3 144	3 535	2 495	11 166	1.10
2004	2 017	3 150	3 408	2 814	11 389	1.09

Source:
Statistics Canada, CANSIM, table 379-0017.

Table B.30
Production of leading minerals by province and territory, 2003[p]

Province/ territory	Selected metallic minerals						Fuels			Selected non-metallic minerals		Total production		
	Copper	Gold	Iron ore	Nickel	Silver	Zinc	Coal	Crude petroleum	Natural gas[1]	Potash	Sand and gravel	Metallic minerals	Fuels	Non-metallic minerals
							$ million							
N.L	0.00	17.62	874.77	0.00	0.03	0.00	0.00	5 030.22	0.00	0.00	9.22	892.42	5 030.22	44.16
P.E.I.	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	x	0.00	0.00	3.35
N.S.	0.00	0.00	0.00	0.00	0.00	0.00	x	149.23	1 249.00	0.00	x	0.00	x	x
N.B.	23.24	4.07	0.00	0.00	44.11	318.87	17.08	0.00	0.00	x	11.94	441.29	17.08	230.59
Que.	195.40	457.19	x	321.69	50.49	290.84	0.00	0.00	0.00	0.00	88.30	2 337.20	0.00	1 314.07
Ont.	392.51	1 253.02	0.00	1 192.39	31.74	84.78	0.00	45.68	66.93	0.00	410.44	3 274.10	112.61	2 269.12
Man.	70.33	64.45	0.00	492.96	5.64	96.71	0.00	159.88	0.00	0.00	35.20	768.70	159.88	102.48
Sask.	29.63	33.73	0.00	0.00	0.36	6.17	x	4 958.01	1 516.00	x	38.89	574.45	x	x
Alta.	0.00	0.81	0.00	0.00	0.00	0.00	330.48	22 187.60	33 973.44	0.00	234.95	0.81	56 491.52	837.56
B.C.	588.80	354.47	x	0.00	142.45	57.54	999.99	718.88	5 780.27	0.00	177.51	1 282.38	7 499.14	578.06
Y.T.	0.00	25.82	0.00	0.00	0.09	0.00	0.00	0.00	48.09	0.00	10.63	25.91	48.09	10.63
N.W.T.	0.00	44.66	0.00	0.00	0.17	0.00	0.00	360.98	154.06	0.00	3.42	72.96	515.04	1 728.03
Nvt.	0.00	29.86	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.00	29.94	0.00	0.00
Canada	**1 299.92**	**2 285.70**	**1 444.94**	**2 007.04**	**275.16**	**854.90**	**1 494.49**	**33 610.47**	**42 787.78**	**1 647.84**	**1 046.91**	**9 700.17**	**77 892.74**	**9 030.94**

Notes:
Figures may not add up to totals due to rounding.
1. Includes natural gas by-products.
Sources:
Statistics Canada, 2004, *Canada's Mineral Production, Preliminary Estimates, 2003*, Catalogue no. 26-202-XIB, Ottawa.
Statistics Canada, Manufacturing, Construction and Energy Division.

Table B.31
Reserves of selected major metals, 1977 to 2002

Year	Copper	Nickel	Lead	Zinc	Gold	Silver
			thousand t			
1977	16 914	7 749	8 954	26 953	0.5	31
1978	16 184	7 843	8 930	26 721	0.5	31
1979	16 721	7 947	8 992	26 581	0.6	32
1980	16 714	8 348	9 637	27 742	0.8	34
1981	15 511	7 781	9 380	26 833	0.9	32
1982	16 889	7 546	9 139	26 216	0.8	31
1983	16 214	7 393	9 081	26 313	1.2	31
1984	15 530	7 191	9 180	26 000	1.2	31
1985	14 201	7 041	8 503	24 553	1.4	29
1986	12 918	6 780	7 599	22 936	1.5	26
1987	12 927	6 562	7 129	21 471	1.7	25
1988	12 485	6 286	6 811	20 710	1.8	26
1989	12 082	6 092	6 717	20 479	1.6	24
1990	11 261	5 776	5 643	17 847	1.5	20
1991	11 040	5 691	4 957	16 038	1.4	18
1992	10 755	5 605	4 328	14 584	1.3	16

Table B.31
Reserves of selected major metals, 1977 to 2002 (continued)

Year	Copper	Nickel	Lead	Zinc	Gold	Silver
			thousand t			
1993	9 740	5 409	4 149	14 206	1.3	16
1994	9 533	5 334	3 861	14 514	1.5	19
1995	9 250	5 832	3 660	14 712	1.5	19
1996	9 667	5 623	3 450	13 660	1.7	19
1997	9 032	5 122	2 344	10 588	1.5	17
1998	8 402	5 683	1 845	10 159	1.4	16
1999	7 763	4 983	1 586	10 210	1.3	15
2000	7 419	4 782	1 315	8 876	1.1	14
2001	6 666	4 335	970	7 808	1.1	13
2002	6 774	4 920	872	6 871	1.0	11

Source:
Natural Resources Canada, 2005, *Canadian Minerals Yearbook*, www.nrcan.gc.ca/mms/cmy/pref_e.htm (accessed February 17, 2005).

Table B.32
Annual production[1] of metals and non-fuel minerals, 1948 to 2004

Year	Copper	Nickel	Lead	Zinc	Iron ore	Gold	Potash	Salt	Gypsum
					thousand t				
1948	218	119	152	212	1 213	0.11	..	672	2 916
1949	239	117	145	262	3 334	0.13	..	679	2 735
1950	240	112	150	284	3 271	0.14	..	779	3 325
1951	245	125	144	309	4 246	0.14	..	875	3 450
1952	234	127	153	337	4 783	0.14	..	882	3 255
1953	230	130	176	364	5 906	0.13	..	866	3 483
1954	275	146	198	342	6 679	0.14	..	880	3 584
1955	296	159	184	393	14 772	0.14	..	1 129	4 234
1956	322	162	171	384	20 274	0.14	..	1 443	4 440
1957	326	170	165	375	20 205	0.14	..	1 607	4 151
1958	313	127	169	386	14 267	0.14	..	2 155	3 596
1959	359	169	169	359	22 215	0.14	..	2 985	5 335
1960	398	195	186	369	19 550	0.14	..	3 007	4 722
1961	398	211	209	377	18 469	0.14	..	2 945	4 478
1962	415	211	195	420	24 820	0.13	..	3 301	4 836
1963	416	200	184	424	27 300	0.12	..	3 377	5 409
1964	444	207	185	611	34 857	0.12	..	3 618	5 770
1965	463	242	268	747	36 181	0.11	1 335	4 159	5 718
1966	461	203	276	872	36 914	0.10	1 979	3 746	5 421
1967	547	224	285	994	37 788	0.09	2 389	4 532	4 549
1968	575	240	309	1 052	43 040	0.09	2 576	4 413	5 378
1969	520	194	289	1 096	36 337	0.08	3 161	4 199	5 782
1970	610	278	353	1 136	47 458	0.07	3 108	4 919	5 733
1971	654	267	368	1 134	42 957	0.07	3 558	5 061	6 081
1972	720	235	335	1 129	38 736	0.06	3 495	4 902	7 349
1973	824	249	342	1 227	47 499	0.06	4 454	5 047	7 610
1974	821	269	294	1 127	46 784	0.05	5 776	5 447	7 226
1975	721	240	315	1 004	44 742	0.05	4 726	5 123	5 746
1976	731	241	256	982	55 416	0.05	5 215	5 994	6 003
1977	759	233	281	1 071	53 621	0.05	5 764	6 039	7 231
1978	659	128	320	1 067	42 931	0.05	6 344	6 452	8 074
1979	636	126	311	1 100	59 617	0.05	7 074	6 881	8 099
1980	710	188	280	920	50 224	0.05	7 225	7 226	7 285
1981	691	160	269	911	49 551	0.05	6 549	7 239	7 025
1982	613	89	272	966	33 198	0.06	5 309	7 930	5 986
1983	653	125	272	988	32 959	0.07	6 294	8 602	7 507
1984	722	174	264	1 063	39 930	0.08	7 527	10 235	7 775
1985	739	170	268	1 049	39 502	0.09	6 661	10 085	7 761
1986	699	164	334	988	36 167	0.10	6 753	10 740	8 802
1987	794	189	373	1 158	37 804	0.12	7 668	10 129	9 095
1988	758	199	351	1 370	39 934	0.13	8 154	10 687	9 513
1989	704	196	269	1 273	39 445	0.16	7 014	11 158	8 195
1990	771	195	233	1 179	35 670	0.17	7 345	11 191	7 977
1991	780	188	248	1 083	35 917	0.18	7 087	11 871	6 729
1992	762	178	340	1 196	32 137	0.16	7 040	11 088	7 293
1993	711	178	183	991	33 774	0.15	6 880	10 993	7 564
1994	591	142	168	976	36 728	0.15	8 517	12 244	8 586
1995	701	172	204	1 095	37 024	0.15	8 855	10 957	8 055

Table B.32
Annual production[1] of metals and non-fuel minerals, 1948 to 2004 (continued)

Year	Copper	Nickel	Lead	Zinc	Iron ore	Gold	Potash	Salt	Gypsum
					thousand t				
1996	653	182	242	1 163	34 709	0.16	8 120	12 248	8 201
1997	648	181	171	1 027	39 293	0.17	9 235	13 497	8 628
1998	691	198	150	992	36 847	0.16	8 884	13 034	8 307
1999	582	177	155	963	33 990	0.16	8 475	12 686	9 347
2000	622	181	143	936	35 247	0.15	9 033	12 164	8 572
2001	614	184	150	1 012	27 119	0.16	8 237	13 725	7 820
2002	584	180	101	924	30 902	0.15	8 361	12 736	8 810
2003	541	155	93	757	33 322	0.14	9 229	13 718	8 380
2004	536	176	71	735	28 256	0.13	10 189	14 030	9 235

Note:
1. Refers to the recoverable metal in concentrates shipped, with the exception of iron ore where the quantity of ore mined is the determining factor.
Source:
Statistics Canada, CANSIM, tables 152-0001 and 152-0004.

Energy

Energy resources such as coal, crude oil, natural gas, hydro power and uranium have transformed society, fuelling economic growth and industrial activity. They have provided the means to heat and light our homes, travel and transport goods with ease. In 2003, Canadians consumed 359 gigajoules of energy per person, more than double the rate of energy consumption less than half a century ago (Table B.33).

With the exception of brief periods during the recessions of 1982 and 1991, total consumption of primary energy has been on the increase since 1958 (Table B.33). Energy consumption per capita has followed the same trend, rising continuously except during the 1982 and 1991 recessions. In contrast, energy consumption per dollar of inflation-adjusted (real) gross domestic product (GDP) began to fall following the 1974 oil crisis. This decline suggests that the fourfold increase in crude oil prices that resulted from the oil crisis (Figure B.7) provided real incentives to conserve energy.

Table B.34 outlines Canadian energy resource reserves of coal, crude oil, crude bitumen, natural gas and uranium. Established crude oil reserves declined by more than half from 1976 to 2003. As a result of the decline, the reserve life of crude oil fell from about 14 years in 1976 to 7 years in 2003. In contrast, established reserves of crude bitumen increased more than tenfold from 1976 to 2003.

In 2003, hydro-electric facilities generated 333 399 GWh of electricity, accounting for 59% of total electric power generation in Canada. Quebec, British Columbia, Newfoundland and Labrador and Ontario were the largest hydro-electric power generators (Table B.35). Coal, the predominant source of fuel for thermal-electric power production in Canada (Table B.36), accounted for 72% of electricity generated at thermal-electric power stations in 2003 (Table B.37). Across Canada, the efficiency of thermal electric power plants ranged from 29% to 35% (Table B.38). In 2003, Alberta and Ontario were the leading generators of thermal-electric energy, while Ontario generated 88% of Canada's nuclear power (Table B.39).

Canada moved from consuming more energy than it produced to being a significant net exporter of energy in 1967 (Figure B.8). Since that time, primary energy production has grown to outstrip consumption by 42% (Table B.40). In 2003, Canada produced 16 million terajoules of energy, of which 11 million were available for consumption in the Canadian economy (Table B.40).

Table B.33
Basic energy indicators, 1958 to 2003

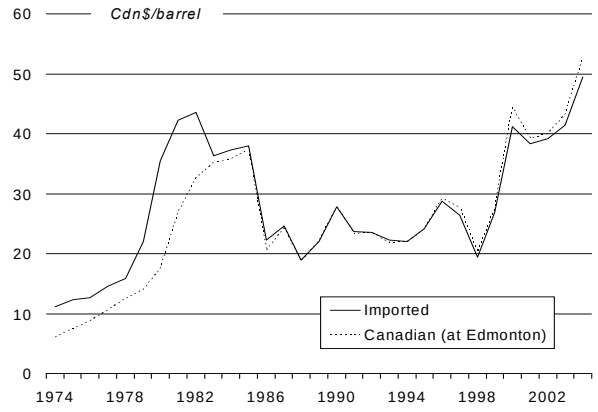
Year	Consumption[1] of primary energy	Population	Real GDP	Energy consumption per capita	Energy consumption per dollar of real GDP
	PJ	thousands	$ million chained 1997	GJ/person	MJ/$ chained 1997
1958	2 852.5	17 120	..	166.6	..
1959	3 037.5	17 522	..	173.4	..
1960	3 133.7	17 909	..	175.0	..
1961	3 294.0	18 271	245 230	180.3	13.43
1962	3 491.3	18 614	262 382	187.6	13.31
1963	3 740.3	18 964	276 306	197.2	13.54
1964	3 926.4	19 325	294 196	203.2	13.35
1965	4 131.3	19 678	312 930	209.9	13.20
1966	4 407.9	20 048	333 724	219.9	13.21
1967	4 524.2	20 412	343 454	221.6	13.17
1968	4 877.9	20 729	360 214	235.3	13.54
1969	5 141.3	21 028	378 344	244.5	13.59

Table B.33
Basic energy indicators, 1958 to 2003 (continued)

Year	Consumption[1] of primary energy	Population	Real GDP	Energy consumption per capita	Energy consumption per dollar of real GDP
	PJ	thousands	$ million chained 1997	GJ/person	MJ/$ chained 1997
1970	5 545.5	21 324	389 809	260.1	14.23
1971	5 889.7	21 962	405 860	268.2	14.51
1972	6 411.2	22 218	427 962	288.6	14.98
1973	6 937.4	22 492	457 766	308.4	15.15
1974	7 208.9	22 808	474 663	316.1	15.19
1975	7 080.7	23 143	483 316	306.0	14.65
1976	7 183.0	23 450	508 445	306.3	14.13
1977	7 295.6	23 726	526 028	307.5	13.87
1978	7 641.3	23 963	546 825	318.9	13.97
1979	8 176.0	24 202	567 631	337.8	14.40
1980	8 214.9	24 516	579 907	335.1	14.17
1981	7 862.6	24 820	600 253	316.8	13.10
1982	7 381.5	25 117	583 089	293.9	12.66
1983	7 299.9	25 367	598 941	287.8	12.19
1984	7 737.5	25 608	633 756	302.2	12.21
1985	7 908.8	25 843	664 059	306.0	11.91
1986	7 834.4	26 101	680 144	300.2	11.52
1987	8 122.2	26 449	709 058	307.1	11.45
1988	8 660.1	26 795	744 333	323.2	11.63
1989	8 945.2	27 282	763 837	327.9	11.71
1990	9 229.9	27 698	765 311	333.2	12.06
1991	9 091.0	28 031	749 294	324.3	12.13
1992	9 176.3	28 367	755 848	323.5	12.14
1993	9 314.1	28 682	773 528	324.7	12.04
1994	9 564.3	28 999	810 695	329.8	11.80
1995	9 695.2	29 302	833 456	330.9	11.63
1996	10 097.2	29 611	846 952	341.0	11.92
1997	10 200.1	29 907	882 733	341.1	11.56
1998	10 194.9	30 157	918 910	338.1	11.09
1999	10 518.3	30 404	969 750	346.0	10.85
2000	10 831.0	30 689	1 020 488	352.9	10.61
2001	10 950.4	31 021	1 038 845	353.0	10.54
2002	11 163.5	31 373	1 074 621	355.8	10.39
2003	11 362.5	31 660	1 096 359	358.9	10.36

Note:
1. Defined as the amount that was available for use in the Canadian economy. Includes the use of energy resources for non-energy purposes (e.g., petrochemical feedstocks in fertilizer production). Excludes the use of wood and wastes as energy sources.
Source:
Statistics Canada, CANSIM, tables 051-0005, 128-0002 and 380-0017.

Figure B.7
Crude oil prices, 1974 to 2004



Source:
Natural Resources Canada, Oil Division.

Table B.34
Established energy resource reserves, 1976 to 2003

Year	Coal[1]		Crude oil		Crude bitumen		Natural gas[2]		Uranium	
	Reserves	Reserve life	Reserves	Reserve life	Reserves	Reserve life	Reserves	Reserve life	Reserves	Reserve life
	Mt	years	million m^3	years	million m^3	years	billion m^3	years	kt	years
1976	4 310.7	169	1 014.6	14	150.7	40	1 738.7	26	405	74
1977	4 117.0	144	969.1	13	111.2	33	1 790.8	25	415	72
1978	4 092.6	134	942.7	13	321.5	68	1 911.8	25	438	53
1979	4 021.8	121	903.3	11	353.1	48	1 977.6	24	468	72
1980	4 192.5	114	860.7	11	333.9	32	2 028.9	28	444	66
1981	4 159.9	104	827.8	12	325.0	37	2 085.5	27	340	45
1982	5 704.0	133	780.6	12	315.6	34	2 148.4	31	376	49
1983	5 981.0	134	792.4	12	310.4	18	2 126.6	29	333	49
1984	6 120.6	107	776.3	11	328.8	28	2 106.7	27	260	25
1985	6 011.8	99	790.5	11	343.4	22	2 080.5	25	263	25
1986	6 338.9	110	774.6	11	574.4	30	2 032.8	26	265	23
1987	6 583.5	108	753.6	11	572.5	28	1 956.0	25	258	19
1988	6 542.3	93	739.2	10	566.5	26	1 931.9	19	248	21
1989	6 472.6	92	707.8	10	542.2	23	1 957.8	19	249	23
1990	6 580.7	96	657.3	10	524.0	23	1 979.2	18	295	30
1991	6 545.2	92	614.9	9	501.7	22	1 965.8	20	305	37
1992	6 522.1	99	590.4	8	482.2	20	1 929.8	15	309	34
1993	6 449.4	93	526.5	7	457.6	19	1 860.5	13	313	36
1994	6 372.2	88	532.2	7	565.0	24	1 833.3	13	300	27
1995	6 293.4	84	553.0	7	574.0	20	1 841.5	12	484	47
1996	6 210.7	82	526.5	7	660.8	24	1 726.4	11	430	38
1997	6 132.0	78	532.2	7	614.0	19	1 620.9	10	419	38
1998	6 056.9	81	528.4	7	1 336.0	35	1 562.6	10	433	43
1999	5 502.1	76	504.0	7	1 891.1	53	1 527.2	9	417	41
2000	4 722.8	68	507.7	7	1 860.0	48	1 547.9	9	437	44
2001	4 555.3	67	493.7	7	1 830.0	44	1 529.5	9	452	35
2002	4 485.3	66	471.7	7	1 840.0	38	1 514.0	9	439	34
2003	4 423.1	71	468.7	7	1 720.0	31	1 481.3	9	429	43

Notes:
1. Includes bituminous, sub-bituminous and lignite coal.
2. Includes natural gas liquids (ethane, butane, propane and pentanes plus).

Source:
Statistics Canada, Environment Accounts and Statistics Division.

Table B.35
Hydro-electric power generation by province and territory, 1994 and 2003

Province/territory	1994			2003		
	Hydro	Total electric power	Hydro as share of total	Hydro	Total electric power	Hydro as share of total
	GWh		%	GWh		%
Newfoundland and Labrador	37 606.7	38 482.6	97.7	39 801.4	42 091.5	94.6
Prince Edward Island	0.0	40.0	0.0	0.0	62.8	0.0
Nova Scotia	1 020.4	9 767.4	10.4	1 089.1	12 405.2	8.8
New Brunswick	2 772.2	15 891.2	17.4	3 233.1	20 967.7	15.4
Quebec	157 850.7	163 600.7	96.5	170 327.7	177 848.8	95.8
Ontario	39 080.7	152 429.2	25.6	36 057.2	150 409.3	24.0
Manitoba	28 146.2	28 443.4	99.0	20 245.9	21 152.2	95.7
Saskatchewan	3 392.5	15 478.1	21.9	3 416.3	19 788.7	17.3
Alberta	1 806.3	52 361.3	3.4	1 744.9	59 454.2	2.9
British Columbia	54 304.1	62 070.4	87.5	56 928.7	63 382.6	89.8
Yukon Territory	266.1	299.3	88.9	284.5	320.1	88.9
Northwest Territories	188.2	578.1	32.6	270.9[1]	721.6[1]	37.5[1]
Canada	**326 434.1**	**539 441.7**	**60.5**	**333 399.8**	**568 604.7**	**58.6**

Notes:
Figures may not add up to totals due to rounding.
1. Includes Nunavut

Sources:
Statistics Canada, 1996, *Electric Power Annual Statistics, Annual Statistics, 1994*, Catalogue no. 57-202-XPB, Ottawa.
Statistics Canada, 2005, *Electric Power Generation, Transmission and Distribution, 2003*, Catalogue no. 57-202-XIB, Ottawa.

Table B.36
Energy consumed in thermal-electric power stations by fuel type, 1980 to 2003

	Coal					Fuel oil			
Year	Canadian bituminous	Imported bituminous	Canadian sub-bituminous	Imported sub-bituminous	Lignite	Heavy	Light and diesel	Natural gas	Wood
					TJ				
1980	108 955	249 422	183 478	..	77 541	105 286	12 619	71 159	..
1981	123 737	261 758	196 493	..	83 624	70 106	11 105	51 057	..
1982	114 238	283 650	227 007	..	102 310	77 043	10 724	42 124	..
1983	126 315	279 586	254 165	..	121 137	45 627	9 559	33 454	..
1984	139 267	297 373	290 931	..	131 173	42 030	9 210	23 619	..
1985	145 449	227 090	317 016	..	134 416	47 958	9 104	23 259	..
1986	119 666	188 934	321 289	..	117 393	43 598	9 175	17 316	..
1987	151 508	229 026	340 572	..	142 376	75 702	9 987	20 619	..
1988	162 522	244 213	364 652	..	170 660	99 195	8 504	40 419	..
1989	163 602	245 290	369 774	..	155 005	154 053	12 136	102 753	..
1990	150 746	183 215	384 276	..	134 968	137 048	12 158	50 530	..
1991	170 019	212 996	430 106	..	131 390	112 131	11 813	41 525	..
1992	159 353	195 313	392 792	..	141 328	132 502	10 346	99 820	..
1993	141 190	118 909	436 468	..	144 378	93 734	11 104	126 992	..
1994	123 014	131 018	478 936	..	150 410	70 834	9 909	154 846	..
1995	122 419	146 541	477 598	..	153 209	79 934	11 088	149 890	..
1996	132 402	169 149	458 122	..	159 646	61 305	10 418	105 074	..
1997	112 114	216 821	475 008	22 193	169 137	99 336	8 691	154 899	..
1998	90 160	281 115	468 503	40 004	177 657	147 675	8 015	200 450	14 959
1999	84 148	300 861	445 127	63 881	170 501	119 554	7 782	204 930	17 112
2000	47 231	381 795	437 491	126 800	166 262	108 955	7 632	273 301	21 024
2001	51 580	351 178	450 912	140 385	169 140	127 541	8 172	333 946	27 293
2002	45 823	305 444	465 280	143 415	166 599	111 800	7 178	278 613	27 620
2003	40 062	309 723	463 203	139 640	167 154	137 307	8 540	241 835	25 365

Sources:
Statistics Canada, *Electric Power Generation, Transmission and Distribution*, Catalogue no. 57-202-XPB, Ottawa, various issues.
Statistics Canada, *Electric Power Generation, Transmission and Distribution*, Catalogue no. 57-202-XIB, Ottawa, various issues.

Table B.37
Net energy generation in thermal-electric power stations by fuel type, 1980 to 2003

	Coal					Fuel oil			
Year	Canadian bituminous	Imported bituminous	Canadian sub-bituminous	Imported sub-bituminous	Lignite	Heavy	Light and diesel	Natural gas	Wood
					TJ				
1980	34 102	89 540	58 612	..	21 133	34 564	3 102	19 175	..
1981	36 693	92 867	62 547	..	22 972	22 451	3 256	13 097	..
1982	37 070	100 930	71 820	..	27 892	25 852	3 062	11 030	..
1983	40 109	100 592	80 439	..	33 222	14 658	2 791	8 615	..
1984[1]	46 928	106 065	90 662	..	38 555	13 554	2 735	5 777	..
1985	48 576	80 331	98 869	..	38 025	15 419	2 710	5 773	..
1986[1]	42 038	69 406	109 398	..	36 947	15 385	2 865	4 349	..
1987[1]	53 808	84 830	116 663	..	45 297	27 065	2 995	5 649	..
1988[1]	58 411	90 953	125 044	..	52 989	35 833	2 463	11 727	..
1989[1]	58 285	91 097	123 637	..	48 603	54 493	3 913	32 494	..
1990[1]	53 613	66 888	132 608	..	42 661	49 113	3 715	14 887	..
1991[1]	57 684	74 519	139 965	..	40 808	39 965	3 434	12 327	..
1992[1]	56 474	71 853	145 984	..	44 792	46 861	3 193	30 620	..
1993[1]	50 148	42 944	150 070	..	46 265	33 537	3 541	42 180	..
1994	41 040	44 603	152 382	..	44 731	23 307	3 097	45 040	..
1995	41 244	49 124	152 976	..	45 861	26 223	3 895	52 634	..
1996	44 809	58 752	148 520	..	46 909	19 591	3 327	35 011	..
1997	38 510	76 698	153 122	7 745	49 155	33 222	2 724	54 897	..
1998	30 623	104 460	152 275	13 959	52 801	48 659	2 581	69 600	5 987
1999	28 498	107 224	145 601	22 418	49 652	39 708	2 367	72 474	6 055
2000	14 770	132 830	143 509	42 042	49 995	36 002	2 159	95 844	6 590
2001	16 727	115 049	146 051	40 027	50 929	42 052	2 398	114 738	7 313
2002	13 844	103 636	152 767	47 306	50 257	37 481	2 111	100 130	7 487
2003	11 545	102 218	148 987	48 595	54 613	45 977	2 624	85 489	7 613

Note:
1. The years 1984 and 1986 to 1993 are gross generation, which means that station service was not deducted to calculate net generation.
Sources:
Statistics Canada, *Electric Power Generation, Transmission and Distribution*, Catalogue no. 57-202-XPB, Ottawa, various issues.
Statistics Canada, *Electric Power Generation, Transmission and Distribution*, Catalogue no. 57-202-XIB, Ottawa, various issues.

Table B.38
Efficiency[1] of thermal-electric power stations by fuel type, 1980 to 2003

	Coal					Fuel oil			
Year	Canadian bituminous	Imported bituminous	Canadian sub-bituminous	Imported sub-bituminous	Lignite	Heavy	Light and diesel	Natural gas	Wood
					%				
1980	31.3	35.9	31.9	..	27.3	32.8	24.6	26.9	..
1981	29.7	35.5	31.8	..	27.5	32.0	29.3	25.7	..
1982	32.5	35.6	31.6	..	27.3	33.6	28.6	26.2	..
1983	31.8	36.0	31.6	..	27.4	32.1	29.2	25.8	..
1984	33.7	35.7	31.2	..	29.4	32.2	29.7	24.5	..
1985	33.4	35.4	31.2	..	28.3	32.2	29.8	24.8	..
1986	35.1	36.7	34.0	..	31.5	35.3	31.2	25.1	..
1987	35.5	37.0	34.3	..	31.8	35.8	30.0	27.4	..
1988	35.9	37.2	34.3	..	31.0	36.1	29.0	29.0	..
1989	35.6	37.1	33.4	..	31.4	35.4	32.2	31.6	..
1990	35.6	36.5	34.5	..	31.6	35.8	30.6	29.5	..
1991	33.9	35.0	32.5	..	31.1	35.6	29.1	29.7	..
1992	35.4	36.8	37.2	..	31.7	35.4	30.9	30.7	..
1993	35.5	36.1	34.4	..	32.0	35.8	31.9	33.2	..
1994	33.4	34.0	31.8	..	29.7	32.9	31.3	29.1	..
1995	33.7	33.5	32.0	..	29.9	32.8	35.1	35.1	..
1996	33.8	34.7	32.4	..	29.4	32.0	31.9	33.3	..
1997	34.3	35.4	32.2	34.9	29.1	33.4	31.3	35.4	..
1998	34.0	37.2	32.5	34.9	29.7	33.0	32.2	34.7	40.0
1999	33.9	35.6	32.7	35.1	29.1	33.2	30.4	35.4	35.4
2000	31.3	34.8	32.8	33.2	30.1	33.0	28.3	35.1	31.3
2001	32.4	32.8	32.4	28.5	30.1	33.0	29.3	34.4	26.8
2002	30.2	33.9	32.8	33.0	30.2	33.5	29.4	35.9	27.1
2003	28.8	33.0	32.2	34.8	32.7	33.5	30.7	35.4	30.0

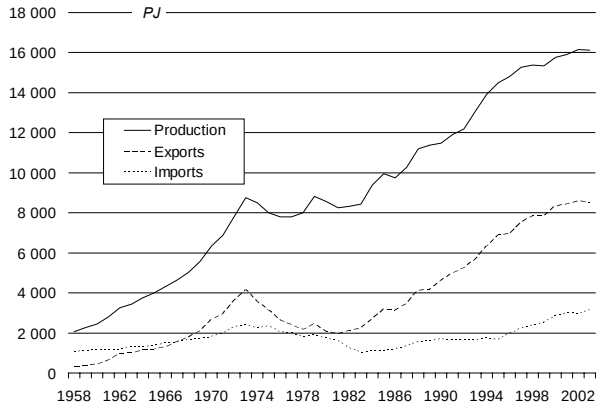
Note:
1. Efficiency is the electrical energy output as a percentage of primary energy input.
Sources:
Statistics Canada, *Electric Power Generation, Transmission and Distribution*, Catalogue no. 57-202-XPB, Ottawa, various issues.
Statistics Canada, *Electric Power Generation, Transmission and Distribution*, Catalogue no. 57-202-XIB, Ottawa, various issues.

Table B.39
Installed capacity and generated electricity by province and territory, 2003

	Installed generating capacity[1]					Generation				
Province/territory	Hydro-electric	Thermal-electric[2]	Nuclear	Wind and tidal	Total	Hydro-electric energy	Thermal-electric energy[2]	Nuclear energy	Wind and tidal energy	Total electric energy
	MW					MWh				
Newfoundland and Labrador	6 736	726	.	.	7 462	39 801 363	2 290 170	.	.	42 091 533
Prince Edward Island	.	108	.	11	118	.	42 937	.	19 889	62 826
Nova Scotia	404	1 913	.	5	2 322	1 089 135	11 282 907	.	33 140	12 405 182
New Brunswick	916	2 874	680	.	4 470	3 233 098	12 992 341	4 742 252	.	20 967 691
Quebec	35 021	1 882	675	59	37 637	170 327 736	3 802 567	3 548 324	170 150	177 848 777
Ontario	8 410	12 246	9 800	1	30 457	36 057 248	51 985 545	62 361 956	4 563	150 409 312
Manitoba	5 024	383	.	.	5 407	20 245 931	906 248	.	.	21 152 179
Saskatchewan	853	2 922	.	11	3 786	3 416 301	16 314 089	.	58 289	19 788 679
Alberta	910	9 718	.	169	10 797	1 744 916	57 292 095	.	417 142	59 454 153
British Columbia	11 994	2 238	.	.	14 233	56 928 681	6 453 897	.	.	63 382 578
Yukon Territory	77	48	.	1	125	284 544	34 685	.	898	320 127
Northwest Territories and Nunavut	30	149	.	.	179	270 861	450 776	.	.	721 637
Canada	**70 374**	**35 206**	**11 155**	**256**	**116 991**	**333 399 814**	**163 848 257**	**70 652 532**	**704 071**	**568 604 674**

Notes:
1. Nameplate rating in megawatts.
2. Includes steam, internal combustion and combustion turbines.
Source:
Statistics Canada, 2005, *Electric Power Generation, Transmission and Distribution, 2003*, Catalogue no. 57-202-XIB, Ottawa.

Figure B.8
Primary energy production, exports and imports, 1958 to 2003



Source:
Statistics Canada, CANSIM, table 128-0002.

Table B.40
Production and consumption[1] of primary energy resources, 1958 to 2003

	Coal		Crude oil		Natural gas[2]		Electricity[3]		Total	
Year	Production	Consumption	Production	Consumption	Production	Consumption	Production	Consumption	Production	Consumption
					TJ					
1958	263 975	637 271	1 020 859	1 490 275	437 088	366 256	325 683	358 649	2 047 605	2 852 451
1959	240 377	625 320	1 144 630	1 644 153	517 304	433 488	350 028	334 498	2 252 338	3 037 459
1960	244 418	559 287	1 192 301	1 715 098	624 773	496 872	381 003	362 454	2 442 495	3 133 711
1961	234 489	547 655	1 404 934	1 802 978	774 922	579 330	373 937	363 994	2 788 282	3 293 957
1962	229 599	556 731	1 601 832	1 903 300	1 044 080	661 570	374 490	369 691	3 250 001	3 491 293
1963	239 665	598 128	1 709 818	2 049 921	1 127 634	720 897	373 937	371 316	3 451 054	3 740 263
1964	253 348	620 641	1 835 513	2 091 638	1 255 120	809 498	408 360	404 624	3 752 340	3 926 401
1965	255 521	647 683	1 955 978	2 167 589	1 356 473	894 794	421 667	421 274	3 989 639	4 131 339
1966	247 496	634 962	2 136 681	2 327 897	1 466 721	981 519	467 769	463 525	4 318 667	4 407 903
1967	247 777	629 097	2 332 727	2 371 570	1 568 068	1 044 722	478 186	478 859	4 626 758	4 524 248
1968	234 133	683 468	2 520 354	2 544 142	1 776 261	1 159 897	488 768	490 434	5 019 516	4 877 941
1969	227 407	659 869	2 746 152	2 653 888	2 047 114	1 294 439	538 818	533 133	5 559 491	5 141 328
1970	354 634	708 448	3 087 416	2 860 028	2 349 711	1 418 190	567 381	558 794	6 359 142	5 545 461
1971	405 139	673 351	3 297 078	3 118 881	2 566 442	1 518 032	593 628	579 442	6 862 288	5 889 706
1972	460 770	635 417	3 803 963	3 424 584	2 899 986	1 710 604	671 751	640 604	7 836 470	6 411 208
1973	496 434	654 390	4 385 206	3 770 655	3 108 262	1 817 662	745 212	694 703	8 735 114	6 937 409
1974	526 092	664 922	4 120 340	3 930 715	3 041 698	1 850 945	808 912	762 283	8 497 041	7 208 865
1975	633 668	657 563	3 528 342	3 805 636	3 092 605	1 873 331	770 960	744 198	8 025 575	7 080 727
1976	619 975	709 029	3 235 522	3 769 982	3 107 651	1 912 329	824 819	791 664	7 787 967	7 183 004
1977	685 448	772 789	3 240 618	4 003 822	2 977 742	1 699 212	881 594	819 730	7 785 402	7 295 553
1978	743 553	788 597	3 194 640	4 017 147	3 106 827	1 957 312	948 475	878 300	7 993 495	7 641 356
1979	811 421	876 372	3 600 201	4 327 941	3 382 338	2 059 052	1 019 185	912 675	8 813 145	8 176 040
1980	891 070	928 409	3 444 041	4 216 120	3 180 730	2 116 374	1 052 072	953 991	8 567 913	8 214 894
1981	969 542	947 942	3 093 450	3 911 507	3 080 003	2 010 520	1 114 624	992 669	8 257 619	7 862 638
1982	1 028 279	1 001 681	3 052 121	3 359 122	3 163 161	2 040 386	1 093 191	980 277	8 336 752	7 381 466
1983	1 066 011	1 048 015	3 232 271	3 201 037	2 980 532	2 027 274	1 150 257	1 020 347	8 429 071	7 296 673
1984	1 396 400	1 167 377	3 430 899	3 183 745	3 311 332	2 292 108	1 235 057	1 094 325	9 373 688	7 737 555
1985	1 487 132	1 122 086	3 516 525	3 085 568	3 622 687	2 532 461	1 313 821	1 168 658	9 940 165	7 908 773
1986	1 382 118	1 039 979	3 531 205	3 055 190	3 458 952	2 480 595	1 381 010	1 258 688	9 753 285	7 834 452
1987	1 393 936	1 117 744	3 690 859	3 172 058	3 766 024	2 574 349	1 416 413	1 258 110	10 267 232	8 122 261
1988	1 614 195	1 200 307	3 877 941	3 359 461	4 313 054	2 809 862	1 390 669	1 290 430	11 195 859	8 660 060
1989	1 718 400	1 197 786	3 769 304	3 423 980	4 552 627	3 025 526	1 331 644	1 297 953	11 371 975	8 945 245
1990	1 673 101	1 136 171	3 765 187	3 874 090	4 574 109	2 899 032	1 321 912	1 320 656	11 334 309	9 229 949
1991	1 747 976	1 099 786	3 765 443	3 726 587	4 805 528	2 922 760	1 408 181	1 341 838	11 727 128	9 090 971
1992	1 553 530	1 120 353	3 931 692	3 615 091	5 298 028	3 116 689	1 414 322	1 324 135	12 197 572	9 176 268
1993	1 651 313	994 715	4 116 941	3 741 690	5 832 901	3 196 872	1 479 535	1 380 835	13 080 690	9 314 112
1994	1 735 269	1 054 689	4 299 874	3 808 804	6 331 888	3 312 684	1 546 239	1 388 145	13 913 270	9 564 322
1995	1 800 811	1 056 083	4 457 769	3 801 848	6 711 568	3 434 306	1 532 656	1 402 976	14 502 804	9 695 213
1996	1 832 286	1 099 131	4 590 726	3 984 463	6 932 462	3 563 509	1 585 629	1 450 067	14 941 103	10 097 170
1997	1 897 322	1 168 601	4 842 646	4 087 294	7 012 563	3 540 975	1 531 890	1 403 258	15 284 421	10 200 128
1998	1 651 482	1 287 709	5 021 730	4 090 494	7 269 299	3 488 847	1 426 237	1 327 829	15 368 748	10 194 879

Table B.40
Production and consumption[1] of primary energy resources, 1958 to 2003 (continued)

Year	Coal		Crude oil		Natural gas[2]		Electricity[3]		Total	
	Production	Consumption	Production	Consumption	Production	Consumption	Production	Consumption	Production	Consumption
	TJ									
1999	1 589 310	1 278 044	4 788 758	4 167 500	7 498 476	3 695 016	1 481 669	1 377 703	15 358 213	10 518 263
2000	1 509 905	1 330 940	4 999 607	4 251 781	7 734 303	3 852 022	1 524 557	1 396 249	15 768 372	10 830 992
2001	1 532 994	1 421 952	5 056 168	4 388 726	7 857 807	3 775 073	1 447 914	1 364 650	15 894 883	10 950 401
2002	1 429 897	1 322 247	5 359 627	4 454 025	7 876 101	3 955 247	1 505 333	1 431 988	16 170 958	11 163 507
2003	1 326 114	1 322 645	5 679 573	4 631 977	7 667 499	3 974 520	1 457 467	1 433 359	16 130 653	11 362 501

Notes:
1. Defined as the amount that was available for use in the Canadian economy. Includes the use of energy resources for non-energy purposes (e.g., petrochemical feedstocks in fertilizer production). Excludes the use of wood and wastes as energy sources.
2. Includes natural gas liquids (ethane, butane, propane and pentanes plus).
3. Includes primary steam.
Source:
Statistics Canada, CANSIM, table 128-0002.

Ecosystems

Human activity has had a profound impact on the structure and function of many ecosystems. Natural areas are altered by human activities which contributed to loss of habitats and extinction of animal and plant species. This section focuses on the impacts human activities have on air, land, water and wildlife.

Air

The atmosphere, an envelope of gases surrounding the earth, is made up of nitrogen (78%), oxygen (21%) argon (0.9%) and other gases. The atmosphere provides the air we breathe, shields us from ultraviolet radiation, affects air circulation and weather patterns and keeps the earth warm.

Human activities can affect both the air and the atmosphere. Traffic emissions affect urban air quality; industrial emissions of sulphur oxides and nitrogen oxides can lead to acid rain; chlorofluorocarbons, hydrochlorofluorocarbons and other substances deplete the ozone layer; and carbon dioxide, methane and nitrous oxide contribute to global warming. Because air circulates, air pollution and emissions produced locally can travel across international boundaries and affect the entire world.

Criteria air contaminants are those for which ambient air quality standards have been established by government. In 2003, criteria air contaminants including sulphur dioxide, carbon monoxide, nitrogen oxides, volatile organic compounds and particulate matter made up more than 90% of pollutants released by industrial facilities to air (Table B.41). Table B.42 breaks down criteria air contaminant emissions for 2000, by source.

Table B.43 compares emissions of common greenhouse gases: carbon dioxide, methane, nitrous oxide by source for 1990 and 2002. Changes in the atmospheric concentration of these and other greenhouse gases have been linked to increases in the earth's temperature.

Table B.41
Top ten substances released to air, 2003

Substance	Releases	Share of total
	t	%
Sulphur dioxide	1 946 069.4	42.0
Carbon monoxide	1 047 899.4	22.6
Oxides of nitrogen (expressed as NO_2)	850 142.4	18.4
Volatile organic compounds (VOCs)	271 283.1	5.9
Total particulate matter (TPM)	202 145.3	4.4
Methanol	22 225.4	0.5
Ammonia (total)[1]	17 756.4	0.4
Hydrochloric acid	10 747.8	0.2
Sulphuric acid	10 509.1	0.2
Xylene (all isomers)	7 496.7	0.2

Note:
1. Refers to the total of both ammonia (NH_3) and ammonium ion (NH_4^+) in solution.
Source:
Environment Canada, Pollution Data Branch, 2005, National Pollutant Release Inventory Database, www.ec.gc.ca/pdb/npri/npri_dat_rep_e.cfm (accessed May 10, 2005).

Table B.42
Criteria air contaminant emissions, 2000

Emission category/sector	Particulate matter[1]			SO_x[4]	NO_x[5]	VOC[6]	CO
	Total	PM_{10}[2]	$PM_{2.5}$[3]				
	t						
Industrial sources including fuel combustion							
Abrasives manufacture	394	235	215	859	96	794	239
Aluminum industry	12 495	7 537	4 380	49 246	892	1 645	226 028
Asbestos industry	42	34	20	475	151	1	15
Asphalt paving industry	35 896	6 202	2 018	136	201	924	949
Bakeries	0	0	0	0	4	6 724	2
Cement and concrete industry	12 127	7 818	3 420	37 056	37 388	276	14 796
Chemicals industry	7 176	4 538	2 722	10 822	28 675	4 128	17 754
Clay products industry	1 728	510	364	414	164	10	392
Coal mining industry	10 380	6 400	2 844	1 958	1 538	807	46
Ferrous foundries	2 225	1 825	1 377	1 437	334	1 646	4 135
Grain industries	57 614	11 873	1 903	0	0	0	0
Iron and steel industries	21 131	12 706	8 696	27 472	14 917	19 631	38 484
Iron ore mining industry	45 767	27 222	13 151	17 482	10 117	3 231	64 777
Mining and rock quarrying	98 334	13 297	3 241	5 988	10 641	384	2 930
Non-ferrous mining and smelting industry	14 782	11 552	5 810	766 533	3 861	57	718
Oil sands	4 221	3 010	611	92 021	43 985	34 304	39 323
Other petroleum and coal products industry	577	295	88	1	124	204	20
Paint and varnish manufacturing	72	59	22	0	24	2 566	11
Petrochemical industry	158	140	110	383	11 809	7 763	4 122
Petroleum refining	7 713	5 024	3 211	128 353	31 927	27 485	21 951
Plastics and synthetic resins fabrication	50	37	26	54	287	10 095	532
Pulp and paper industry	48 674	29 974	22 949	73 626	51 611	23 507	161 556
Upstream oil and gas industry	1 690	1 528	1 522	349 382	338 885	739 760	81 774
Wood industry	118 887	67 592	34 778	2 688	14 726	46 213	548 620
Other industries	57 957	36 529	25 451	24 806	40 040	60 392	45 949
Subtotal, industrial sources including fuel combustion	**560 089**	**255 935**	**138 931**	**1 591 196**	**642 396**	**992 547**	**1 275 122**
Non-industrial fuel combustion							
Commercial fuel combustion	5 022	3 797	3 064	20 548	31 506	6 549	8 080
Electric power generation (utilities)	121 609	55 418	21 737	639 780	298 241	2 406	29 197
Residential fuel combustion	4 639	3 865	3 623	14 809	36 943	2 283	13 954
Residential fuelwood combustion	107 168	101 418	101 308	1 428	9 988	147 447	662 032
Subtotal, non-industrial fuel combustion	**238 437**	**164 498**	**129 732**	**676 565**	**376 677**	**158 686**	**713 263**
Transportation							
Air transportation	2 151	1 319	1 013	3 504	57 556	9 726	57 219
Heavy-duty diesel vehicles	15 542	15 542	14 350	9 706	514 518	23 417	124 895
Heavy-duty gasoline trucks	256	249	191	408	15 386	8 512	134 844
Light-duty diesel trucks	887	887	818	554	7 162	3 425	6 107
Light-duty diesel vehicles	296	296	272	95	1 965	843	1 927
Light-duty gasoline trucks	1 213	1 179	992	6 131	120 116	148 494	2 302 568
Light-duty gasoline vehicles	1 068	1 038	986	8 500	190 091	219 152	3 150 457
Marine transportation	5 610	5 610	5 361	32 976	111 416	9 349	13 613
Motorcycles	13	12	9	19	848	1 274	8 559
Off-road use of diesel	41 510	41 510	38 189	15 631	371 032	46 276	220 126
Off-road use of gasoline	6 360	6 360	5 863	1 159	53 504	251 274	2 333 895
Rail transportation	2 571	2 567	2 365	4 193	109 481	5 400	20 776
Tire wear and brake linings	5 112	5 055	1 747	0	0	0	0
Subtotal, transportation	**82 589**	**81 623**	**72 157**	**82 875**	**1 553 074**	**727 142**	**8 374 986**
Incineration							
Crematorium	0	0	0	4	22	1	10
Industrial and commercial incineration	25	19	13	278	348	331	1 107
Municipal incineration	578	354	313	695	1 596	989	3 421
Other incineration and utilities	516	303	230	563	4 334	723	1 641
Subtotal, incineration	**1 120**	**676**	**555**	**1 540**	**6 300**	**2 043**	**6 179**
Miscellaneous							
Cigarette smoking	879	879	879	0	6	10	3 148
Dry cleaning	0	0	0	0	2	841	1
Fuel marketing	0	0	0	11	5	91 062	2
General solvent use	0	0	0	0	0	309 452	0
Marine cargo handling industry	2 902	1 395	423	0	0	1	0
Meat cooking	1 528	1 528	1 528	0	0	0	0
Pesticides and fertilizer application	12 054	5 906	1 687	0	0	0	0
Printing	12	4	4	0	34	34 614	27
Structural fires	4 344	4 300	3 910	0	2	4 211	8 729
Surface coatings	0	0	0	0	0	110 752	0

Table B.42
Criteria air contaminant emissions, 2000 (continued)

Emission category/sector	Particulate matter[1] Total	PM_{10}[2]	$PM_{2.5}$[3]	SO_x[4]	NO_x[5]	VOC[6]	CO
	t						
Subtotal, miscellaneous	**21 718**	**14 012**	**8 432**	**11**	**49**	**550 944**	**11 907**
Open sources							
Agriculture (animals)	263 315	148 387	23 455	0	0	214 826	0
Agriculture (tilling and wind erosion)	1 713 507	833 911	23 243	0	0	0	0
Construction operations	3 374 356	742 355	15 036	0	0	0	0
Dust from paved roads	2 885 947	553 141	132 338	0	0	0	0
Dust from unpaved roads	7 057 123	2 238 143	333 493	0	0	0	0
Forest fires	90 969	75 759	63 465	90	20 917	85 979	693 373
Landfill sites	4 224	486	130	1	169	8 576	693
Mine tailings	47 626	3 810	953	0	0	0	0
Prescribed burning	31 363	22 756	21 387	146	3 942	10 866	206 863
Subtotal, open sources	**15 468 430**	**4 618 749**	**613 499**	**237**	**25 029**	**320 246**	**900 929**
Grand total	**16 372 382**	**5 135 494**	**963 305**	**2 352 424**	**2 603 525**	**2 751 607**	**11 282 385**

Notes:
Figures may not add up to totals due to rounding.
1. Total particulate matter is made up of solid and liquid particles under 100 micrometres in diameter that are released into the atmosphere.
2. PM_{10} is the fraction of total particulate matter that is less than or equal to 10 micrometres in diameter.
3. $PM_{2.5}$ is the fraction of total particulate matter that is less than or equal to 2.5 micrometres in diameter.
4. SO_x is made up of gaseous oxides of sulphur, mainly sulphur dioxide (SO_2). In some cases, emissions may contain small amounts of sulphur trioxide (SO_3) and sulphurous and sulphuric acid vapour.
5. NO_x is made up of gaseous nitric oxide (NO) and nitrogen dioxide (NO_2).
6. Volatile organic compounds (VOCs) are made up of photochemically reactive hydrocarbon compounds (i.e., those that participate in chemical reactions when exposed to sunlight). They are major contributors to smog in urban areas.
Source:
Environment Canada, Pollution Data Branch, 2004, *Criteria Air Contaminant Emission Summaries*, www.ec.gc.ca/pdb/ape/ape_tables/canada2000_e.cfm (accessed February 2, 2005).

Table B.43
Greenhouse gas (GHG) emissions by source and sink category, 1990 and 2002

GHG source and sink category	Carbon dioxide (CO_2) 1990	2002	Methane (CH_4) 1990	2002	Nitrous oxide (N_2O) 1990	2002	CO_2-equivalents[1] 1990	2002	Change 1990 to 2002
	kt								%
Energy	432 000	537 000	1 600.0	2 100.0	27.0	37.0	473 000	592 000	25.2
Stationary combustion sources	276 000	341 000	180.0	220.0	6.4	7.8	282 000	348 000	23.4
Electricity and heat generation	94 700	128 000	1.8	4.7	1.8	2.4	95 300	129 000	35.4
Fossil fuel industries	49 500	70 500	78.0	120.0	1.0	1.5	51 500	73 400	42.5
Petroleum refining	26 000	34 000	0.4	0.5	0.3	0.4	26 100	34 100	30.7
Fossil fuel production	23 600	36 500	78.0	120.0	0.7	1.1	25 400	39 300	54.7
Mining	6 150	11 700	0.1	0.2	0.1	0.3	6 190	11 800	90.6
Manufacturing industries	54 100	49 500	1.7	1.7	1.2	1.2	54 500	49 900	-8.4
Iron and steel	6 420	6 370	0.2	0.2	0.2	0.2	6 490	6 430	-0.9
Non ferrous metals	3 210	3 290	0.1	0.1	0.0	0.1	3 230	3 300	2.2
Chemical	7 060	6 390	0.2	0.1	0.1	0.1	7 100	6 430	-9.4
Pulp and paper	13 400	8 860	0.8	0.8	0.4	0.4	13 500	9 000	-33.3
Cement	3 370	3 470	0.1	0.1	0.0	0.1	3 390	3 490	2.9
Other manufacturing	20 600	21 100	0.4	0.4	0.4	0.4	20 800	21 200	1.9
Construction	1 860	1 230	0.0	0.0	0.1	0.0	1 880	1 240	-34.0
Commercial and institutional	25 700	35 600	0.5	1.2	0.5	0.7	25 800	35 800	38.8
Residential	41 300	41 800	100.0	94.0	1.7	1.7	44 000	44 300	0.7
Agriculture and forestry	2 400	2 090	0.0	0.0	0.1	0.1	2 420	2 110	-12.8
Transportation	146 000	181 000	31.0	30.0	21.0	29.0	153 000	190 000	24.2
Domestic aviation	10 400	12 800	0.7	0.6	1.0	1.3	10 700	13 200	23.4
Road transportation	103 000	131 000	16.0	14.0	12.0	19.0	107 000	137 000	28.0
Gasoline automobile	51 600	47 800	9.0	4.7	6.3	7.5	53 700	50 200	-6.5
Light duty gasoline trucks	20 400	37 800	4.0	5.0	4.2	9.8	21 800	40 900	87.6
Heavy duty gasoline vehicles	2 990	3 900	0.4	0.6	0.4	0.6	3 140	4 090	30.3
Motorcycles	225	268	0.2	0.2	0.0	0.0	230	274	19.1
Diesel automobiles	657	662	0.0	0.0	0.0	0.0	672	677	0.7
Light duty diesel trucks	577	738	0.0	0.0	0.0	0.1	591	755	27.7
Heavy duty diesel vehicles	24 300	39 200	1.2	1.9	0.7	1.1	24 500	39 600	61.6
Propane and natural gas vehicles	2 160	821	1.7	1.3	0.0	0.0	2 210	853	-61.4
Railways	6 320	5 280	0.4	0.3	2.5	2.1	7 110	5 950	-16.3
Domestic marine	4 730	5 150	0.4	0.4	1.0	1.1	5 050	5 490	8.7
Others	21 800	26 400	13.0	16.0	4.4	5.2	23 400	28 400	21.4
Off road	15 100	15 900	6.1	4.9	4.2	5.0	16 500	17 500	6.1
Pipelines	6 700	10 600	6.7	11.0	0.2	0.3	6 900	10 900	58.0

Table B.43
Greenhouse gas (GHG) emissions by source and sink category, 1990 and 2002 (continued)

GHG source and sink category	Carbon dioxide (CO_2)		Methane (CH_4)		Nitrous oxide (N_2O)		CO_2-equivalents[1]		
	1990	2002	1990	2002	1990	2002	1990	2002	Change 1990 to 2002
	kt								%
Fugitive sources	9 800	16 000	1 300.0	1 900.0	0.0	0.0	38 000	55 000	44.7
Coal mining	0	0	91.0	47.0	0.0	0.0	1 900	990	-47.9
Oil and natural gas	9 800	16 000	1 200.0	1 800.0	0.0	0.0	36 000	54 000	50.0
Oil	27	77	410.0	640.0	0.0	0.0	8 600	13 000	51.2
Natural gas	19	29	820.0	1 100.0	0.0	0.0	17 000	24 000	41.2
Venting	4 500	8 100	0.0	0.0	0.0	0.0	4 500	8 100	80.0
Flaring	5 300	7 400	24.0	31.0	0.0	0.0	5 800	8 100	39.7
Industrial processes	32 000	39 000	0.0	0.0	37.0	7.0	53 000	50 000	-5.7
Mineral production	7 770	8 730	0.0	0.0	0.0	0.0	7 770	8 730	12.4
Cement	5 580	6 740	0.0	0.0	0.0	0.0	5 580	6 740	20.8
Lime	1 750	1 660	0.0	0.0	0.0	0.0	1 750	1 660	-5.1
Limestone and soda ash use	439	335	0.0	0.0	0.0	0.0	439	335	-23.7
Chemical industry	5 010	6 240	0.0	0.0	37.0	7.0	16 500	8 300	-49.7
Ammonia production	5 010	6 240	0.0	0.0	0.0	0.0	5 010	6 240	24.6
Nitric acid production	0	0	0.0	0.0	2.5	2.6	777	813	4.6
Adipic acid production	0	0	0.0	0.0	35.0	4.0	10 700	1 250	-88.3
Metal production	9 690	11 500	0.0	0.0	0.0	0.0	19 900	19 000	-4.5
Iron and steel production	7 060	7 120	0.0	0.0	0.0	0.0	7 060	7 120	0.8
Aluminum production	2 630	4 360	0.0	0.0	0.0	0.0	10 000	9 210	20.0
SF_6 used in magnesium smelters	0	0	0.0	0.0	0.0	0.0	2 900	2 700	-30.0
Consumption of halocarbons	0	0	0.0	0.0	0.0	0.0	0	900	…
Other and undifferentiated production	9 200	13 000	0.0	0.0	0.0	0.0	9 200	13 000	41.3
Solvent and other product use	0	0	0.0	0.0	1.3	1.5	420	470	11.9
Agriculture	8 000	-500	980.0	1 200.0	100.0	110.0	59 000	59 000	0.0
Enteric fermentation	0	0	760.0	900.0	0.0	0.0	16 000	19 000	18.8
Manure management	0	0	220.0	270.0	12.0	15.0	8 300	10 000	20.5
Agricultural soils	8 000	-500	0.0	0.0	90.0	100.0	30 000	30 000	0.0
Direct sources	8 000	-500	0.0	0.0	70.0	70.0	30 000	20 000	-33.3
Indirect sources	0	0	0.0	0.0	20.0	20.0	5 000	7 000	40.0
Land use change and forestry (non-CO_2 only)	0	0	70.0	100.0	5.0	10.0	3 000	6 000	100.0
Prescribed burns	0	0	20.0	20.0	0.8	0.6	700	500	-28.6
Wildfires in the wood production forest	0	0	50.0	100.0	4.0	10.0	2 000	5 000	150.0
Waste	250	290	900.0	1 100.0	3.0	3.4	20 000	24 000	20.0
Solid waste disposal on land	0	0	880.0	1 000.0	0.0	0.0	19 000	22 000	15.8
Wastewater handling	0	0	17.0	19.0	2.8	3.2	1 200	1 400	16.7
Waste incineration	250	290	0.4	0.3	0.2	0.2	320	350	9.4
Land use change and forestry[2]	-200 000	-20 000	0.0	0.0	0.0	0.0	-200 000	-20 000	-90.0
Changes in forest and woody biomass stocks	-200 000	-50 000	0.0	0.0	0.0	0.0	-200 000	-50 000	-75.0
Forest and grassland conversion	10 000	10 000	0.0	0.0	0.0	0.0	10 000	10 000	0.0
Abandonment of managed lands	-700	-700	0.0	0.0	0.0	0.0	-700	-700	0.0
CO_2 emissions and removals from soil	10 000	10 000	0.0	0.0	0.0	0.0	10 000	10 000	0.0
Total	**471 000**	**576 000**	**3 500.0**	**4 500.0**	**170.0**	**170.0**	**609 000**	**731 000**	**20.0**

Notes:
Figures may not add up to totals due to rounding or varying degrees of uncertainty in individual estimates.
1. CO_2-equivalent emissions are the weighted sum of all greenhouse gas emissions. The following global warming potentials are used as the weights: CO_2 = 1; CH_4 = 21; N_2O = 310; HFCs = 140 to 11 700; PFCs = 6 500 to 9 200; SF_6 = 23 900.
2. CO_2 emissions and removals in the Land use change and forestry category are not included in the national totals.
Source:
Environment Canada, 2004, *Canada's Greenhouse Gas Inventory, 1990-2002*, www.ec.gc.ca/pdb/ghg/1990_02_report/toc_e.cfm (accessed December 12, 2004).

Land

Canada is the second largest country in the world, with over 9.9 million square kilometres of land.[1] This land supports many uses, from agriculture and forestry to urban development, parks and recreation.

Table B.44 presents the volumes of wood harvested by province from 1980 to 2002, while table B.45 shows the area of timber-productive forest land burned from 1980 to 2003.

In 2000, farmers in Canada applied fertilizer to over 24 million hectares of land to improve crop yield.[2] Sales of commercial fertilizer have levelled-off in Eastern Canada, while in Western Canada sales declined in 2001 and 2002 (Figure B.9). Pesticides,

1. Natural Resources Canada, 2004, "Land and Freshwater Areas," *The Atlas of Canada*, http://atlas.gc.ca/site/english/learningresources/facts/surfareas.html (accessed March 23, 2005).
2. Statistics Canada, 2002, "Land inputs, by province, by Census Agricultural Region (CAR) and Census Division (CD), 2000," *Census of Agriculture, 2001,* www.statcan.ca/english/freepub/95F0301XIE/tables/html/Table8Can.htm (accessed March 23, 2005).

including herbicides, insecticides and fungicides are used to control weeds, insects and crop diseases. The risk to the environment is determined by the mobility, persistence and toxicity of the pesticide to organisms other than its target, as well as the amount used. The area of farmland treated with pesticides is illustrated in figures B.10 and B.11.

The National Pollutant Release Inventory Database measures the volume of pollutants released on-site by over 8 thousand industrial facilities. In 2003, hydrogen sulphide made up more than 80% of the tonnage of substances released to land (Table B.46).

Table B.44
Volume of roundwood harvested by province and territory, 1980 to 2002

Year	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.[1]	**Canada**
	thousand m^3												
1980	2 795[r]	381	4 686	8 387	31 686	21 322	2 335	3 330	5 933	74 654	115	..	**155 624[r]**
1981	2 568	371[r]	4 112	7 795	34 234	22 808	1 803	3 555	6 586	60 780	124	..	**144 736[r]**
1982	2 379	357[r]	3 105	6 320	29 133	19 778	1 498	2 526	5 714	56 231	161	..	**127 202[r]**
1983	2 429	381[r]	2 596	7 442	36 288	23 736	1 520	2 612	7 344	71 443	192	..	**155 983[r]**
1984	2 889	400[r]	3 894	8 378	36 519	28 130	1 698	2 726	8 457	74 556	177	..	**167 824[r]**
1985	2 509	411[r]	3 515	7 896	35 400	28 225	1 717	3 016	8 979	76 868	186	..	**168 722[r]**
1986	2 408	424[r]	4 004	8 720	38 127	30 186	1 703	3 529	10 387	77 503	199	..	**177 190[r]**
1987	2 524	480	4 789	7 869	39 503	29 692	1 887	3 666	10 496	90 591	188	..	**191 685**
1988	2 513	476[r]	5 039	9 199	39 381	29 338	1 883	3 818	11 990	86 807	172	..	**190 616[r]**
1989	2 535	416[r]	4 772	9 281	36 192	29 642	1 848	3 685	12 293	87 414	176	..	**188 254[r]**
1990	2 876[2]	448[r]	4 639[2]	8 824[2]	30 148[2]	25 420[2]	1 563[2]	2 758[2]	11 911	73 861	82	46	**162 576[r]**
1991	2 680	452[r]	4 348	8 643	28 943[2]	23 829[3]	1 278	2 957[2]	12 926[2]	74 706	79	46	**160 887[r]**
1992	2 821[2]	510[2]	4 248[2]	9 205	31 001[r]	24 286[3]	1 598	3 081[2]	14 594[2]	78 579	162	49	**170 134[r]**
1993	3 131[2]	534[2]	4 585[2]	8 959	34 091[e]	25 432[3]	1 539	4 433[r]	14 897	78 004	193	203	**175 999[r]**
1994	2 445	519[2]	5 106[2]	9 269	38 231[e]	25 952[3]	1 786	4 468	19 790	75 093	421	181	**183 261[2]**
1995	2 983	638	5 483[2]	10 055	41 438[e]	26 260[3]	1 987	4 258	20 287	74 622[3]	357[r]	127[2]	**188 497[r]**
1996	2 742[2]	557[3]	6 012[2]	10 902[3]	38 267[e]	25 871[3]	2 148	4 126	20 037	72 252[3]	254[r]	202[2]	**183 369[r]**
1997	2 558[2]	514[r]	6 989[2]	11 253[3]	42 543[e]	26 595[3]	2 183	4 205	22 217	69 298[3]	253[r]	123	**188 730[r]**
1998	2 398[2]	520	5 903[r]	11 534[2]	43 427[e]	24 126[2]	2 328	3 348	17 172	65 938[2]	110[r]	142	**176 944[r]**
1999	2 720[2]	693	6 164	11 294	45 646[e]	24 814[2]	2 171	3 882	23 729	76 933	145[r]	71	**198 258[r]**
2000	2 868[2]	716[2]	6 470[r]	11 872	43 485[e]	28 118[2]	2 188	4 197	23 418	78 457[r]	33	22	**201 845[r]**
2001	2 556[2]	626[2]	6 182[r]	10 186	40 579[e]	24 099[2]	2 079	4 119	23 474	73 637	39	22[2]	**187 598[r]**
2002	2 559[2]	626[2]	6 066	10 184[2]	41 525[e]	26 327[2]	2 106	4 309	24 694[p]	73 637[2]	42	22[2]	**192 096[2]**

Notes:
1. Includes Nunavut.
2. Estimated by provincial or territorial forestry agency.
3. Estimated by the Canadian Forest Service or by Statistics Canada.

Source:
Canadian Council of Forest Ministers, 2004, National Forestry Database Program, nfdp.ccfm.org (accessed April 11, 2005).

Table B.45
Area of stocked timber-productive forest land burned, 1980 to 2003

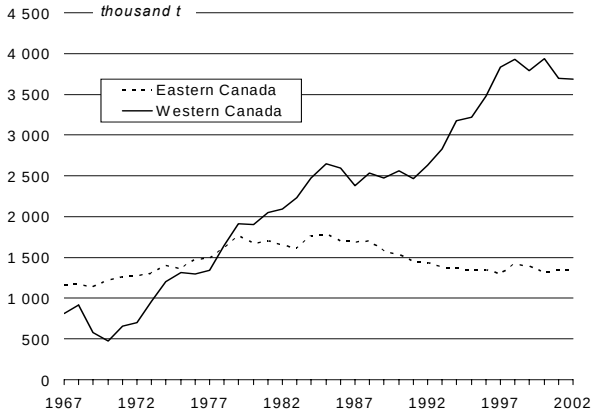
Year	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.[1]	National parks	**Canada**
	ha													
1980	680	..	559	2 116[r]	4 902	330 825	304 049	89 237	465 451[r]	32 743	111 537	12 975	..	**1 355 074[r]**
1981	2 893	22	169	92	2 170	40 817	220 336[r]	..	944 494[r]	57 277	12 735	25 643	..	**1 306 648[r]**
1982	4 392	25	359	5 407	7 202	297	7 094	..	462 674[r]	280 676	68 127	2 536	..	**838 789[r]**
1983	107	50	92	1 129	206 952	74 663	66 962	9 478	1 215[r]	32 848	14 805	1 188	..	**409 489[r]**
1984	1 565	8	193	270	2 397	2 219	51 099	47 281	35 259	12 227	6 995	134	21 366	**181 013**
1985	40 457	4	220	1 348[r]	1 952	127	5 367	9 020	3 820	54 231	11 407	6	4 927	**132 886[r]**
1986	23 511	85	268	37 216	173 296	50 598	5 495	4 031	1 587	9 474	3 132	11	2 663	**311 367**
1987	10 622	16	312	895	27 849	5 461	84 266	129 332	24 295	22 308	1 150	10	..	**306 516**
1988	7	2	89[r]	1 778	273 066	35 994	295 930	24 187	5 149[r]	3 284	288	3	..	**639 777[r]**
1989	2 651	2	159	280	2 108 206	4 990	1 539 180	137 404	2 994[r]	11 089	70 439	..	..	**3 877 394[r]**
1990	2 601	4	477	5 198	76 825	3 200	6 728	71 198	22 143	52 575	16 704	0	25 041	**282 694**
1991	9 576	23	1 022	2 732	356 234	4 971	55 266	118 850	1 357	11 249	61 227	0	1 224	**623 731**
1992	1 014	8	805	4 668	24 295	10 331	185 299	12 768	720	17 212	3 785	0	1 941	**262 846**
1993	21	6	120	534	125 211	2 116	43 400	227 208	12 894	1 376	..	0	2 999	**415 885**
1994	692	7	67	239	2 830	410	552 571	79 641	8 610	20 737	..	0	76 436	**742 240**
1995	128	14	149	395	407 299	60 739	445 425	320 993	163 376	26 888	..	0	7 082	**1 432 488[r]**
1996	8 519	0	172	1 591	410 342[r]	179 207	..	4 755[2]	430	2 670	..	0	..	**607 686[r]**
1997	153	..	184	145	147 417	16 010	..	1 904	3 046	286	..	0	339	**169 484**
1998	4 630	..	168	275	16 721	57 659	..	..	234 095	..	..	0	..	**..**

Table B.45
Area of stocked timber-productive forest land burned, 1980 to 2003 (continued)

Year	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.[1]	National parks	**Canada**
								ha						
1999	20 779	..	1 174	1 135	88 472	72 481	..	..	52 887	..	..	0	..	**..**
2000	68	..	359	269	603	613	..	..	3 802	14 376[r]	..	0	..	**..**
2001	184	..	333	565	1 274	1 610	..	..	74 538	5 467	..	0	..	**83 971**
2002	1 238	..	149	230	405 375	18 468	..	..	361 091	..	..	0	..	**..**
2003	..	..	943	..	18 421	..	..	..	..	..	..	..	..	**..**

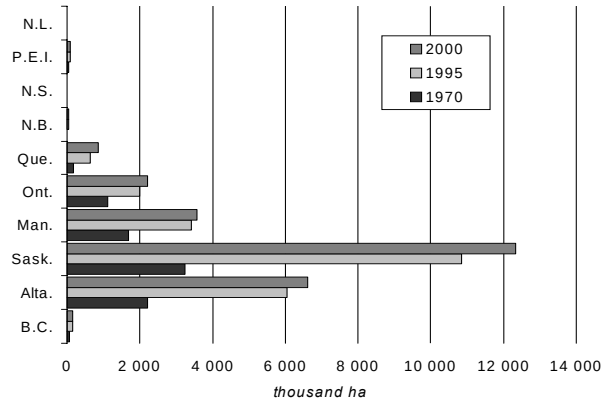
Notes:
1. Includes Nunavut.
2. Estimated by provincial or territorial forestry agency.
Source:
Canadian Council of Forest Ministers, 2004, National Forestry Database Program, nfdp.ccfm.org (accessed April 11, 2005).

Figure B.9
Fertilizers sold in Eastern and Western Canada[1], 1967 to 2002



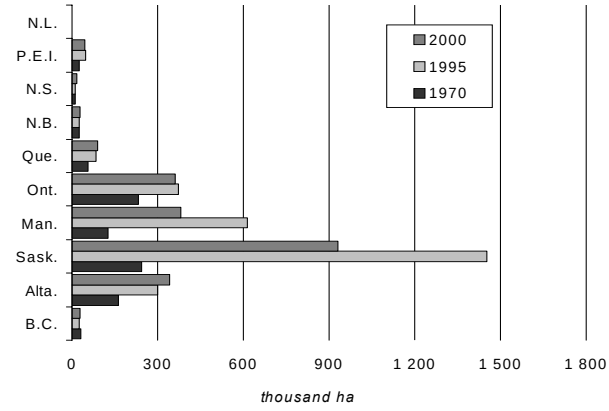
Note:
1. Eastern Canada corresponds to provinces east of Manitoba, while western Canada corresponds to provinces west of Ontario.
Source:
Korol, M. and G. Rattray, 2003, *Canadian Fertilizer Consumption, Shipments and Trade, 2001/2002*, Farm Inputs Markets Unit, Farm Income Policy and Programs Directorate, Agriculture and Agri-Food Canada, Ottawa.

Figure B.10
Area of farmland treated with herbicides by province, 1970, 1995 and 2000



Sources:
Statistics Canada, Census of Agriculture.
Statistics Canada, 2002, Census of Agriculture, www.statcan.ca/english/freepub/95F0301XIE/tables/html/Table8Can.htm (accessed February 16, 2005).

Figure B.11
Area of farmland treated with insecticides by province, 1970[1], 1995 and 2000



Note:
1. Fungicides were also included.
Sources:
Statistics Canada, Census of Agriculture.
Statistics Canada, 2002, Census of Agriculture, www.statcan.ca/english/freepub/95F0301XIE/tables/html/Table8Can.htm (accessed February 16, 2005).

Table B.46
Top ten substances released to land, 2003

Substance	Releases[1]	Share of total
	t	%
Hydrogen sulphide	210 112.5	83.9
Zinc (and its compounds)	7 260.6	2.9
Ammonia (total)[2]	7 180.2	2.9
Asbestos (friable form)	6 352.7	2.5
Manganese (and its compounds)	3 993.3	1.6
Methanol	3 937.9	1.6
Ethylene glycol	2 633.1	1.1
Lead (and its compounds)	1 488.2	0.6
Vanadium (except when in an alloy) and its compounds	1 223.5	0.5
Phosphorous (total)	1 196.1	0.5

Notes:
1. Data include disposals.
2. Refers to the total of both ammonia (NH_3) and ammonium ion (NH_4^+) in solution.
Source:
Environment Canada, Pollution Data Branch, 2005, National Pollutant Release Inventory Database, www.ec.gc.ca/pdb/npri/npri_dat_rep_e.cfm (accessed May 10, 2005).

Water

With 20% of the world's fresh water resources and 7% of the world's total renewable water flow, water remains a precious part of Canada's natural wealth.[1] Used for power generation, transportation, recreation, irrigation, manufacturing, agriculture and drinking water, Canadian water use per capita is the second highest in the world.[2] We also use our rivers, lakes and marine areas to dispose of municipal wastewater and wastes from industry. Some activities for which water is used can make it unfit for use by humans or wildlife.

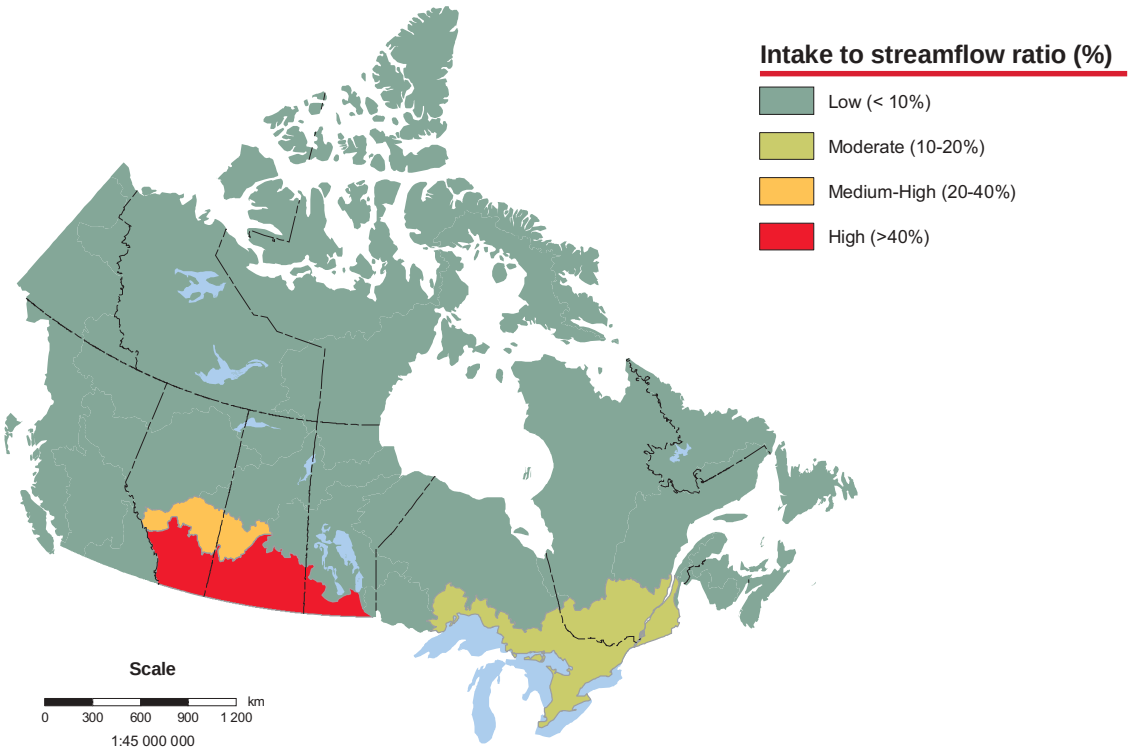
Map B.1 illustrates the proportion of surface fresh water that is used by Canadians within each of Canada's major drainage areas. Although responsible for only 14% of total water intake, the South Saskatchewan, Missouri and Assiniboine-Red and the North Saskatchewan drainage areas have the highest ratios of water intake to streamflow (Table B.47).

The Great Lakes - St. Lawrence drainage area also stands out with water intake of 30.6 billion m^3, used mainly for industrial (89%) and municipal (10%) uses. In contrast, 71% of total surface fresh water intake in the South Saskatchewan, Missouri and Assiniboine-Red drainage area, 2.9 billion m^3, was for agricultural use (Table B.47).

In 2003, ammonia and nitrate made up 89% of the total tonnage of substances released by industrial facilities into water (Table B.48).

1. Statistics Canada, 2003, "Fresh Water Resources," *Human Activity and the Environment, Annual Statistics 2003*, Catalogue no. 16-201-XPE, Ottawa.
2. *Ibid*

Map B.1
Water use and availability, by drainage area



Source:
Statistics Canada, Environment Accounts and Statistics Division.

Table B.47
Streamflow and surface fresh water intake in Canada by drainage area

Code	Drainage area[1]	Total streamflow[2]	Surface fresh water intake				Water intake as share of streamflow
			Municipal[3]	Industrial[4]	Agricultural[5]	Total	
		km^3	million m^3				%
1	Pacific Coastal and Yukon	595.90	192.68	597.69	78.73	869.10	0.15
2	Fraser - Lower Mainland	125.26	428.61	219.81	467.98	1 116.40	0.89
3	Columbia and Okanagan - Similkameen	65.69	71.54	109.38	228.17	409.10	0.62
4	Peace - Athabasca	91.55	28.01	169.82	21.69	219.49	0.24
5	Lower Mackenzie and Arctic Coast - Islands	507.13	6.57	5.62	0.00	12.22	0.00
6	North Saskatchewan	7.38	142.20	1 457.41	86.57	1 686.19	22.85
7	South Saskatchewan, Missouri and Assiniboine - Red	9.50	435.73	753.62	2 891.82	4 081.17	42.96
8	Winnipeg	23.90	11.48	197.23	1.14	209.85	0.88
9	Lower Saskatchewan - Nelson	60.27	14.09	31.90	24.10	70.09	0.12
10	Churchill	22.11	6.34	3.28	8.36	17.97	0.08
11	Keewatin - Southern Baffin	169.75	0.16	0.00	0.00	0.16	0.00
12	Northern Ontario	189.06	12.47	86.68	0.00	99.54	0.05
13	Northern Quebec	530.75	5.87	59.94	0.00	65.83	0.01
14	Great Lakes - St. Lawrence	226.96	3 087.12	27 229.02	271.64	30 587.41	13.48
15	North Shore - Gaspé	257.32	78.41	134.29	4.39	216.45	0.08
16	Saint John - St. Croix	24.57	97.39	109.78	2.77	209.93	0.85
17	Maritime Coastal	114.40	139.74	132.07	10.83	282.63	0.25
18	Newfoundland - Labrador	294.04	114.40	193.48	0.00	308.51	0.10
	Canada	**3 315.54**	**4 872.83**	**31 491.03**	**4 098.19**	**40 462.05**	**1.22**

Notes:
1. These major drainage areas and associated flow measures are adapted from Laycock (1987) (see full reference below). Some of these drainage area aggregates have more than one outflow. Drainage areas at the US-Canada border exclude inflow from United States.
2. Streamflow is represented by the long-term annual average.
3. Municipal water intake data is derived from the Municipal Water Use Database, Environment Canada, 1998.
4. Industrial water intake data is derived from the Industrial Water Use Survey, Statistics Canada and Environment Canada, 1996.
5. Agricultural water use estimates are from Statistics Canada.

Source:
Laycock, A.H., 1987, "The Amount of Canadian Water and its Distribution," in *Canadian Aquatic Resources*, no. 215 of *Canadian Bulletin of Fisheries and Aquatic Sciences*, M.C. Healey and R.R. Wallace (eds.), 13-42, Fisheries and Oceans Canada, Ottawa.

Table B.48
Top ten substances released to water, 2003

Substance	Releases	Share of total
	t	%
Ammonia (total)[1]	48 722.8	47.6
Nitrate ion in solution at pH >= 6.0	42 809.9	41.8
Phosphorus (total)	6 504.0	6.4
Manganese (and its compounds)	1 352.4	1.3
Methanol	1 172.3	1.1
Ethylene glycol	443.5	0.4
Chlorine	330.0	0.3
Zinc (and its compounds)	274.6	0.3
Copper (and its compounds)	111.2	0.1
Formaldehyde	77.4	0.1

Note:
1. Refers to the total of both ammonia (NH_3) and ammonium ion (NH_4^+) in solution.
Source:
Environment Canada, Pollution Data Branch, 2005, National Pollutant Release Inventory Database, www.ec.gc.ca/pdb/npri/npri_dat_rep_e.cfm (accessed May 10, 2005).

Wildlife

In the past, wildlife represented a major source of food, clothing and income for fur traders, settlers and First Nations peoples. Today, while many people prefer to simply view wildlife in a natural setting, hunting remains a popular recreational activity. Some continue to hunt and trap for their livelihood.

Table B.49 lists the number of Canada geese, American black ducks and mallards harvested in Canada from 1975 to 2003. While the number of Canada geese harvested in 2003 rose 87% compared to 1975, the number of American black ducks and mallards harvested dropped 64% and 70% respectively.

Tables B.50 and B.51 show the number and value of pelts harvested in 2002/03. Facing reduced demand for furs, the total number and value of pelts harvested decreased substantially in the late-1980s, although the drop in wild pelts was more pronounced (Figures B.12 and B.13).

As of 2004, 34 species of plants and animals were extinct or extirpated in Canada (Tables B.52 and B.53). Habitat alteration, whether through deforestation, conversion of wetlands, or land clearing for agriculture and urban development, is believed to have contributed to the loss of numerous species. Hunting and trapping activities led to the extinction and extirpation of several species before hunting laws were adopted.

Table B.49
Harvest estimates for selected waterfowl species, 1975 to 2003

Year	Canada geese	American black ducks	Mallards
	number		
1975	358 166	307 357	1 730 971
1976	317 237	350 523	1 935 892
1977	333 256	356 490	1 557 116
1978	395 547	380 599	1 522 619
1979	416 641	319 798	1 609 608
1980	450 717	363 865	1 533 574
1981	360 948	321 980	1 296 931
1982	396 177	336 937	1 213 930
1983	469 528	309 129	1 327 598
1984	420 069	306 578	1 059 242
1985	452 481	299 753	911 066
1986	453 807	296 071	879 116
1987	507 265	295 388	1 020 597
1988	395 656	300 219	668 539
1989	510 349	261 319	743 996
1990	501 634	243 004	734 599
1991	472 157	225 931	629 129
1992	380 445	206 508	579 799
1993	434 138	203 307	536 987
1994	414 192	175 452	625 404
1995	395 988	187 156	603 333
1996	500 079	163 597	641 079

Table B.49
Harvest estimates for selected waterfowl species, 1975 to 2003 (continued)

Year	Canada geese	American black ducks	Mallards
	number		
1997	489 459	165 462	718 686
1998	531 331	158 368	663 907
1999	565 219	174 933	633 182
2000	612 036	154 913	689 434
2001	636 997	124 068	591 749
2002	650 258	122 635	546 582
2003	670 778	109 218	511 469

Source:
Environment Canada, Canadian Wildlife Service, 2004, National Harvest Survey Database, www.cws-scf.ec.gc.ca/nwrc-cnrf/migb/harvest/hews_e.cfm (accessed October 21, 2004).

Table B.50
Pelts harvested by province and territory, 2002/03

Species	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nvt.	**Canada**
	number													
Wild[1]														
Badger	0	0	0	0	0	0	163	..	270	0	0	0	0	**..**
Bear	57	0	83	45	1 745	129	1 412	..	81	165	0	8	93	**..**
Beaver	2 168	267	4 330	8 672	45 508	65 024	19 960	..	11 124	4 471	425	2 549	0	**..**
Coyote (prairie wolf)	96	470	1 649	2 025	4 760	2 004	7 890	..	25 554	1 324	31	2	0	**..**
Ermine (weasel)	2 003	11	660	1 425	14 288	9 188	4 490	..	3 222	3 632	174	270	0	**..**
Fisher	0	0	145	1 037	5 036	8 335	2 207	..	1 338	313	2	18	0	**..**
Fox	6 187	782	557	1 795	18 264	5 049	2 697	..	2 698	357	42	1 020	1 875	**..**
Lynx	699	0	0	0	3 296	1 853	1 127	..	1 347	1 120	166	533	0	**..**
Marten	1 873	0	0	2 283	22 905	34 362	17 897	..	4 210	14 074	1 810	7 864	0	**..**
Mink	3 273	195	850	892	6 041	9 409	5 663	..	414	859	97	397	0	**..**
Muskrat	1 499	2 157	12 804	19 306	39 158	59 670	10 687	..	2 148	1 691	193	18 005	0	**..**
Otter	1 323	0	601	599	3 265	6 532	2 741	..	308	718	19	16	0	**..**
Racoon	0	974	3 083	4 999	10 803	35 940	3 183	..	73	134	0	0	0	**..**
Skunk	0	4	10	21	167	294	0	..	26	4	0	0	0	**..**
Squirrel	1 239	93	630	669	9 310	4 484	6 292	..	53 731	10 312	4 986	325	0	**..**
Wildcat or bobcat	0	0	1 261	565	0	61	27	..	6	128	0	0	0	**..**
Wolf	25	0	0	0	468	643	364	..	287	167	187	79	449	**..**
Wolverine	0	0	0	0	0	8	39	..	35	120	131	106	29	**..**
Other[2]	157	0	0	0	0	261	0	..	0	0	0	656	8 511	**..**
Total wild	**20 599**	**4 953**	**26 663**	**44 333**	**185 014**	**243 246**	**86 839**	**85 530**[3]	**106 872**	**39 589**	**8 263**	**31 848**	**10 957**	**894 706**[4]
Ranch-raised[5]														
Fox	1 600	1 310	1 790	1 400	1 920	600	60	180	x	x	.	.	.	**10 850**
Mink	x	42 300	458 700	x	55 500	282 400	28 600	0	x	204 200	.	.	.	**1 129 600**
Total ranch-raised	**x**	**43 610**	**460 490**	**x**	**57 420**	**283 000**	**28 660**	**180**	**41 190**	**x**	**.**	**.**	**.**	**1 140 450**

Notes:
1. Data on wildlife furs are on a "fur year basis" which is from July 1 to June 30.
2. Includes hair seals and other fur-bearing animals.
3. Estimated.
4. Includes an estimate for Saskatchewan.
5. The ranched fur estimates operate on a calendar year basis, with most ranch peltings occurring in the fall.

Source:
Statistics Canada, 2004, *Fur Statistics*, Vol. 2, no. 1, Catalogue no. 23-013-XIE, Ottawa.

Table B.51
Value of pelts harvested by province and territory, 2002/03

Species	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nvt.	**Canada**
	$													
Wild[1]														
Badger	0	0	0	0	0	0	6 611	..	9 326	0	0	0	0	**..**
Bear	5 799	0	9 326	4 578	218 100	11 023	134 408	..	5 981	14 858	0	4 200	85 676	**..**
Beaver	54 005	6 815	114 577	216 020	1 116 311	1 448 084	389 220	..	218 809	100 687	11 475	42 899	0	**..**
Coyote (prairie wolf)	4 136	21 363	72 143	87 237	159 412	58 156	449 730	..	1 472 677	66 107	1 798	95	0	**..**
Ermine (weasel)	8 513	25	2 330	6 056	53 151	35 649	20 070	..	15 337	19 213	731	912	0	**..**
Fisher	0	0	4 557	35 849	218 865	274 055	78 106	..	47 726	12 285	70	573	0	**..**
Fox	364 977	41 429	26 768	84 419	844 012	282 575	110 687	..	108 523	14 787	1 722	32 570	45 630	**..**
Lynx	131 104	0	0	0	353 727	252 749	169 568	..	223 966	140 941	23 074	81 821	0	**..**
Marten	148 791	0	0	91 685	1 031 412	1 562 097	895 566	..	203 006	667 248	94 120	462 228	0	**..**
Mink	66 769	3 109	12 340	13 478	101 972	152 802	98 933	..	6 988	14 869	1 455	6 807	0	**..**

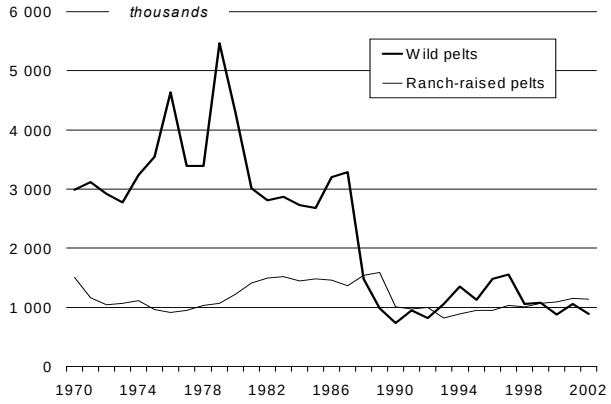
Table B.51
Value of pelts harvested by province and territory, 2002/03 (continued)

Species	N.L.	P.E.I.	N.S.	N.B.	Que.	Ont.	Man.	Sask.	Alta.	B.C.	Y.T.	N.W.T.	Nvt.	**Canada**
							$							
Muskrat	5 831	9 884	56 191	75 100	185 609	229 133	26 611	..	4 146	4 261	598	41 582	0	**..**
Otter	159 448	0	70 395	87 382	305 735	894 884	502 508	..	60 611	133 469	2 755	2 578	0	**..**
Racoon	0	14 138	45 293	75 535	185 704	549 553	50 833	..	967	2 041	0	0	0	**..**
Skunk	0	24	55	194	1 263	2 240	0	..	182	31	0	0	0	**..**
Squirrel	1 239	69	498	669	14 058	4 305	4 467	..	98 865	18 871	10 471	505	0	**..**
Wildcat or bobcat	0	0	258 079	125 424	0	12 903	7 223	..	2 364	18 889	0	0	0	**..**
Wolf	5 199	0	0	0	40 276	57 169	43 483	..	33 490	18 744	28 611	13 977	94 730	**..**
Wolverine	0	0	0	0	0	1 613	10 160	..	9 212	30 766	31 702	25 395	7 215	**..**
Other[2]	7 905	0	0	0	0	606	0	..	0	0	0	35 207	415 703	**..**
Total wild	**963 716**	**96 856**	**672 552**	**903 626**	**4 829 607**	**5 829 596**	**2 998 184**	**1 907 720[3]**	**2 522 176**	**1 278 067**	**208 582**	**751 349**	**648 954**	**23 610 985[4]**
Ranch-raised[5]														
Fox	186 768	152 916	208 947	163 422	224 122	70 038	7 004	21 011	x	x	.	.	.	**1 266 521**
Mink	x	1 581 597	21 115 502	x	2 321 325	11 795 044	1 148 016	0	x	8 355 730	.	.	.	**48 646 874**
Total ranch-raised	**x**	**1 734 513**	**21 324 449**	**x**	**2 545 447**	**11 865 082**	**1 155 020**	**21 011**	**1 607 026**	**x**	**.**	**.**	**.**	**49 913 395**

Notes:
1. Data on wildlife furs are on a "fur year basis" which is from July 1 to June 30.
2. Includes hair seals and other fur-bearing animals.
3. Estimated.
4. Includes an estimate for Saskatchewan.
5. The ranched fur estimates operate on a calendar year basis, with most ranch peltings occurring in the fall.

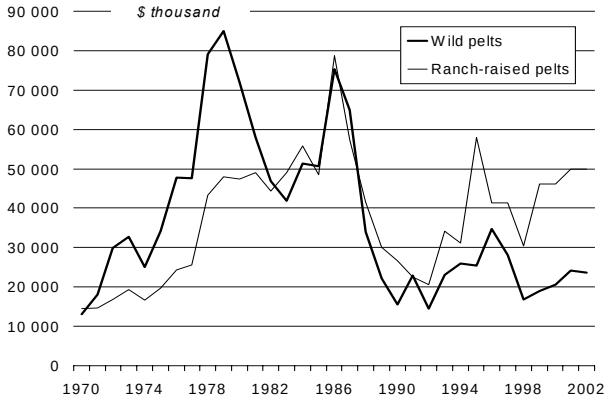
Source:
Statistics Canada, 2004, *Fur Statistics*, Vol. 2, no. 1, Catalogue no. 23-013-XIE, Ottawa.

Figure B.12
Number of pelts harvested, 1970 to 2002



Source:
Statistics Canada, CANSIM, table 003-0013.

Figure B.13
Value of pelts harvested, 1970 to 2002



Source:
Statistics Canada, CANSIM, table 003-0013.

Table B.52
Species extinct and extirpated, 2004

Species[1]	Group	Extinction date	Probable cause(s) of extinction[2] or extirpation[3]
Extinct[2]			
Benthic Hadley Lake stickleback	fish	1999	introduced predators
Limnetic Hadley Lake stickleback	fish	1999	introduced predators
Banff longnose dace	fish	1986	introduced predators; habitat alteration
Blue walleye	fish	1965	commercial fishing; introduced predators
Deepwater cisco	fish	1952	commercial fishing; introduced predators
Eelgrass limpet	mollusc	1929	loss of food source
Caribou (*dawsoni* subspecies)	mammal (terrestrial)	1920s	unknown
Passenger pigeon	bird	1914	hunting and predation
Sea mink	mammal (marine)	1894	trapping
Labrador duck	bird	1875	hunting; habitat alteration
Macoun's shining moss	moss	1864	habitat alteration
Great auk	bird	1844	hunting

Table B.52
Species extinct and extirpated, 2004 (continued)

Species[1]	Group	Extinction date	Probable cause(s) of extinction[2] or extirpation[3]
Extirpated[3]			
Karner blue	arthropods	1991	loss of food source; habitat alteration
Frosted elfin	arthropods	1988	successional change
Greater prairie-chicken	bird	1987	habitat alteration
Black-footed ferret	mammal (terrestrial)	1974	loss of food source
Striped bass (St. Lawrence Estuary population)	fish	1968	illegal fishing
Dwarf wedgemussel	mollusc	1968	habitat alteration
Greater sage grouse (*phaios* subspecies)	bird	1960s	hunting; habitat alteration
Pacific pond turtle	reptile	1959	commercial harvesting; habitat alteration
Gravel chub	fish	1958	habitat alteration
Pacific gophersnake	reptile	1957	habitat alteration
Spring blue-eyed Mary	plant	1954	habitat alteration
Timber rattlesnake	reptile	1941	hunting; habitat alteration
Paddlefish	fish	1917	habitat alteration; over-fishing
Tiger salamander (Great Lakes population)	amphibian	1915	habitat alteration
Island marble	arthropods	before 1910	loss of food source; habitat alteration
Puget Oregonian snail	mollusc	1905	unknown
Pygmy short-horned lizard (British Columbia population)	reptile	1898	habitat alteration
Illinois tick-trefoil	plant	1888	habitat alteration
Grizzly bear (Prairie population)	mammal (terrestrial)	1880s	hunting
Atlantic walrus (northwest Atlantic population)	mammal (marine)	mid 19th century	hunting
Incurved grizzled moss	moss	1828	unknown
Grey whale (Atlantic population)	mammal (marine)	1800s	hunting

Notes:
1. Any indigenous species, subspecies, variety, or geographically or genetically distinct population of wild fauna and flora.
2. A species that no longer exists.
3. A species no longer existing in the wild in Canada, but occurring elsewhere.

Source:
Environment Canada, Canadian Wildlife Service, Committee on the Status of Endangered Wildlife in Canada, 2004, *Canadian Species at Risk - November 2004*, www.cosewic.gc.ca (accessed January 11, 2005).

Table B.53
Species[1] extinct and at risk, 2004

Group	Status assessment					**Total**
	Extinct[2]	Extirpated[3]	Endangered[4]	Threatened[5]	Special concern[6]	
	number					
Mammals						
Terrestrial	1	2	9	7	16	**35**
Marine	1	2	11	7	11	**32**
Birds	3	2	23	10	22	**60**
Fish	5	3	22	23	30	**83**
Amphibians	0	1	6	5	7	**19**
Reptiles	0	4	7	13	9	**33**
Molluscs	1	2	12	2	4	**21**
Arthropods[7]	0	3	6	5	2	**16**
Vascular plants	0	2	68	44	34	**148**
Lichens	0	0	2	1	4	**7**
Mosses	1	1	6	3	2	**13**
Total	**12**	**22**	**172**	**120**	**141**	**467**

Notes:
1. Any indigenous species, subspecies, variety, or geographically or genetically distinct population of wild fauna and flora.
2. A species that no longer exists.
3. A species no longer existing in the wild in Canada, but occurring elsewhere.
4. A species facing imminent extirpation or extinction.
5. A species likely to become endangered if limiting factors are not reversed.
6. A species whose characteristics make it particularly sensitive to human activities or natural events.
7. Formerly described as lepidopterans.

Source:
Environment Canada, Canadian Wildlife Service, Committee on the Status of Endangered Wildlife in Canada, 2004, *Canadian Species at Risk, November 2004*, www.cosewic.gc.ca (accessed January 11, 2005).

C) Response

Legislation

The *Canadian Environmental Protection Act* (CEPA) provides enforcement officers with the authority to address cases of alleged non-compliance with the Act. Enforcement activities include inspection to verify compliance, investigation of alleged violations, measures to compel compliance without resorting to formal court action, and measures to compel compliance through court action.

Enforcement activities declined between 1991/92 and 1996/97 but have since risen significantly due to an increase in the number of inspections conducted and warnings issued (Table C.1). The number of prosecutions varies considerably from year to year with as many as 27 handed down in 2001/02, to only 8 in 2003/04.

Table C.1
***Canadian Environmental Protection Act* enforcement activities, 1991/92 to 2003/04[1]**

Enforcement activity	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04
On-site inspections[2]	1 616	1 278	1 571	1 335	963	708	1 523	1 555	779	1 446	1 628	1 934	2 334
Off-site inspections[2,3]	..	..	..	..	..	..	..	1 058	2 526	1 801	3 009	2 870	2 079
Investigations[4]	115	96	55	64	45	33	56	78	64	20	57	36	32
Warnings[5]	82	105	133	127	85	30	204	421	473	450	517	347	672
Directions[6]	6	4	1	1	0	2	0	8	9	22	5	3	8
Prosecutions[7]	17	26	3	9	13	5	8	2	26	11	27	4	8
Convictions	10	18	11	12	6	7	3	1	1	7	7	3	14
Total	**1 846**	**1 527**	**1 774**	**1 548**	**1 112**	**785**	**1 794**	**3 123**	**3 878**	**3 757**	**5 250**	**5 197**	**5 147**

Notes:
1. Data is based on the federal government "fiscal year" which is from April 1 to March 31.
2. Inspections verify compliance with the *Canadian Environmental Protection Act*. They may be on-site (at the site of a facility, plant, structure, border crossing, airport or other port of entry, on a ship, aircraft, or other means of transport) or off-site. Off-site inspections were previously called administrative verifications.
3. The tracking of off-site inspections or administrative verifications only started in 1998/99. However, on-site inspection numbers prior to this time may have included some administrative verifications.
4. Investigations involve gathering, from a variety of sources, evidence and information relevant to a suspected violation.
5. Written warnings indicate the existence of a minor violation, in order that the alleged offender can take notice and return to compliance.
6. Written directions oblige the regulatee responsible for the potential violation to take all reasonable measures to remedy any dangerous conditions and/or to reduce any danger to the environment.
7. A legal proceeding for the purpose of determining the guilt or innocence of an accused (i.e. person and/or organization) under CEPA.

Source:
Environment Canada, Information Management Services, Enforcement Branch, National Programs Directorate.

Protected areas

From 1989 to 2003, Canada's total protected land area increased from 29 million hectares to 82 million hectares (Table C.2). The share of total land protected varies provincially; in 2003, for example, it ranged from 2.6% in Prince Edward Island to 13.0% in British Columbia.

Table C.2
Total area protected by province and territory, 1989 and 2003

	1989		2003		Change in protected area
Province/territory	Total area protected[1]	Protected area as a share of total land	Total area protected[1]	Protected area as a share of total land	as a share of total land 1989 to 2003
	ha	%	ha	%	
Newfoundland and Labrador	367 500	0.9	1 701 412	4.3	3.4
Prince Edward Island	6 000	1.0	14 780	2.6	1.5
Nova Scotia	138 700	2.4	465 363	8.2	5.7
New Brunswick	88 800	1.2	233 443	3.1	1.9
Quebec	622 800	0.4	5 217 586	3.5	3.1
Ontario	5 152 900	5.2	9 142 039	9.2	4.0
Manitoba	315 400	0.5	5 402 416	8.5	8.0
Saskatchewan	1 936 000	3.0	2 243 230	3.5	0.5
Alberta	5 642 000	8.7	8 009 229	12.3	3.6
British Columbia	4 958 300	5.4	12 017 617	13.0	7.6
Yukon Territory	3 218 300	6.8	5 678 119	12.0	5.2
Northwest Territories and Nunavut	6 978 550	2.0	31 752 615	9.3	7.2
Canada	**29 425 250**	**3.0**	**81 877 849**	**8.4**	**5.4**

Note:
1. Defined by World Wildlife Fund Canada as those areas that are permanently protected through legislation and that prohibit industrial uses such as logging, mining, hydro-electric development, oil and gas and other large scale developments.

Sources:
World Wildlife Fund Canada, 2000, *Endangered Spaces; The Wilderness Campaign that Changed the Canadian Landscape 1989-2000*, Toronto.
World Wildlife Fund Canada, 2003, *The Nature Audit: Setting Canada's Conservation Agenda for the 21st Century*, Toronto.

Environmental protection expenditures

Total environmental protection expenditures by Canadian businesses reached $6.8 billion in 2002, up from $5.4 billion in 2000 (Tables C.3 and C.4). Operating expenditures on environmental protection by industry totalled $3.8 billion in 2002, up from almost $3.3 billion in 2000, representing an 17% increase. Capital expenditures on environmental protection increased 35%, from $2.2 billion in 2000 to $2.9 billion in 2002. The industry with the highest total environmental protection expenditures in 2002 was the Oil and Gas Extraction Industry ($1.1 billion).

Two-thirds of the total capital expenditures on pollution prevention were directed towards processes aimed at preventing the release of substances to air (Table C.5) in 2002. Capital expenditures on pollution abatement and control (PAC) projects were also directed largely at mitigating the release of air pollutants, accounting for 64% of PAC capital spending in 2002 (Table C.6). Pollution prevention and pollution abatement and control expenditures on water totalled $225 and $203 million respectively, representing 16% and 22% of total capital expenditures by these types of activities in 2002.

Table C.7 outlines expenditures on PAC and water purification and supply from 1990/91 to 2001/02 for all levels of government in Canada. Of the $6.7 billion spent on PAC in 2001/02 by government, 41%, or $2.8 billion, was allocated to sewage collection and disposal, and 29% ($2.0 billion) to waste collection and disposal. A further 12% was spent on other pollution control activities and 18% on other environmental services. Expenditures allocated to water purification and supply increased from $7 million in 1990/91 to $308 million in 2001/02 at the federal government level, while they decreased from $1 131 million to $488 million at the provincial level.

Table C.3
Operating expenditures on environmental protection by type of activity and industry, 1995 to 2002, selected years

Year/industry	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	Pollution abatement and control processes (end-of-pipe), waste management and sewerage services	Pollution prevention processes	Fees, fines and licences	Other	Total
	$ million								
1995									
Logging	3.2	10.8	21.2	44.4	8.7	0.2	8.8	2.6	99.8
Crude petroleum and natural gas	7.9	4.1	47.7	1.1	97.6	9.5	2.3	19.7	189.8
Mining	23.5	8.8	68.3	7.4	105.5	9.5	3.8	12.2	239.0
Electric power systems	8.7	19.3	25.7	x	45.0	x	x	79.8	283.6
Food	7.6	3.2	2.0	0.5	61.3	2.3	3.4	2.0	82.3
Beverage	1.1	0.5	0.9	0.0	12.7	0.2	0.8	2.0	18.3
Pulp and paper	68.9	7.5	8.0	6.1	145.0	31.3	12.3	23.3	302.5
Refined petroleum and coal products	4.4	0.6	34.7	x	58.0	x	x	3.8	102.1
Chemicals	26.6	7.7	23.4	0.7	80.3	5.7	1.4	9.8	155.4
Non-metallic mineral products	4.1	1.3	9.0	0.3	13.6	3.9	1.5	2.3	36.0
Primary metals	35.5	4.1	27.6	4.0	208.9	84.1	4.5	10.8	379.4
Pipeline transport and gas distribution systems	5.5	1.9	3.4	0.3	8.8	1.1	1.6	8.5	31.1
Operating expenditures, excluding 'other manufacturing'	**197.1**	**69.6**	**271.7**	**88.5**	**845.4**	**210.1**	**60.1**	**176.9**	**1 919.5**
Other manufacturing[1,2]	..	..	..	..	..	..	..	..	466.6
Total	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**2 386.1**
1996									
Logging	3.5	8.5	24.8	84.3	13.4	0.1	6.0	1.8	142.5
Crude petroleum and natural gas	18.2	5.1	85.2	7.6	98.2	3.6	3.8	34.3	256.0
Mining	29.5	7.4	68.6	5.6	117.2	14.9	5.3	22.8	271.3
Electric power systems	8.8	22.5	13.4	x	95.7	x	42.0	23.5	297.6
Food and tobacco products	9.3	2.7	4.9	1.5	69.9	3.1	4.8	4.6	100.7
Beverage	1.1	0.4	0.4	0.0	14.0	0.1	2.4	2.3	20.6
Pulp and paper	92.1	12.6	7.6	18.0	236.8	31.8	9.6	21.3	429.8
Refined petroleum and coal products	22.7	2.6	5.1	x	114.8	42.1	x	22.2	212.5
Chemicals	37.5	9.1	38.3	x	102.3	x	x	15.4	216.5
Non-metallic mineral products	4.2	1.5	5.3	0.1	14.3	0.3	2.5	3.3	31.5
Primary metals	33.2	5.3	40.7	6.9	293.3	80.0	6.8	19.6	485.8
Transportation equipment	5.2	2.1	4.7	0.1	99.5	3.7	0.8	9.7	125.8
Pipeline transport and gas distribution systems	1.4	2.6	5.7	x	11.4	0.0	x	12.6	35.7
Operating expenditures, excluding 'other manufacturing'	**266.8**	**82.3**	**304.6**	**142.7**	**1 280.9**	**265.8**	**89.7**	**193.3**	**2 626.0**

Table C.3
Operating expenditures on environmental protection by type of activity and industry, 1995 to 2002, selected years (continued)

Year/industry	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	Pollution abatement and control processes (end-of-pipe), waste management and sewerage services	Pollution prevention processes	Fees, fines and licences	Other	Total
	$ million								
Other manufacturing[2]	..	..	..	..	..	..	..	..	357.7
Total	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**2 983.8**
1997									
Logging	1.6	3.1	10.5	68.8	7.9	1.7	0.5	2.0	96.1
Crude petroleum and natural gas	17.4	13.4	107.4	1.6	61.1	15.2	6.8	26.0	248.8
Mining	20.4	7.5	54.9	3.2	122.4	39.0	4.1	20.0	271.6
Electric power systems	6.4	x	x	25.6	70.2	x	30.2	28.7	240.3
Food and tobacco products	8.3	x	x	0.6	70.6	x	9.7	3.4	115.8
Beverage	0.6	0.5	1.4	0.0	13.4	1.3	2.8	2.2	22.2
Wood products[3]	5.9	2.2	5.9	10.4	28.9	8.9	6.6	2.8	71.7
Pulp and paper	52.6	11.9	6.4	25.4	251.1	95.7	9.2	26.1	478.3
Refined petroleum and coal products	7.3	3.8	32.8	0.5	111.2	66.0	0.2	13.5	235.3
Chemicals	31.9	7.0	30.6	1.3	104.7	34.1	2.2	15.1	226.9
Non-metallic mineral products	1.8	3.2	6.2	0.0	17.6	5.5	1.4	3.4	39.1
Primary metals	44.0	5.6	28.5	6.0	319.0	60.5	4.9	16.9	485.4
Transportation equipment	6.5	2.7	2.8	3.8	101.7	12.0	1.4	8.7	139.5
Pipeline transport and gas distribution systems	1.4	2.6	5.0	0.3	13.4	2.9	0.9	8.3	34.8
Operating expenditures, excluding 'other manufacturing'	**206.1**	**81.0**	**298.2**	**147.4**	**1 293.2**	**421.8**	**80.9**	**177.2**	**2 705.9**
Other manufacturing[2]	..	..	..	..	..	..	..	..	291.2
Total	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**2 997.1**
1998[4]									
Logging	3.0	5.0	19.1	70.4	5.4	4.4	1.4	7.8	116.5
Oil and gas extraction	16.0	8.6	110.2	1.3	55.0	26.4	9.2	31.7	258.4
Mining	20.6	4.8	55.8	2.3	104.9	38.7	4.6	17.2	248.8
Electric power generation, transmission and distribution	6.6	34.2	5.7	12.0	x	5.3	32.7	x	295.6
Natural gas distribution	0.3	1.6	0.6	0.1	2.4	0.7	0.1	3.2	8.9
Food	11.0	2.6	0.2	3.7	78.4	14.2	9.6	4.0	123.7
Beverage and tobacco products[5]	0.8	0.5	0.9	..	13.3	1.6	2.3	1.8	21.2
Wood products	8.5	2.4	15.8	29.4	x	21.4	5.6	x	137.6
Pulp, paper and paperboard mills	43.7	3.6	3.3	11.4	241.9	62.8	8.0	12.8	387.5
Petroleum and coal products[5]	7.3	2.4	4.2	..	101.5	56.4	1.1	14.4	187.3
Chemicals	25.0	6.5	42.3	1.3	101.5	34.5	2.5	18.3	231.9
Non-metallic mineral products	2.5	3.3	2.8	1.0	20.8	5.9	2.8	4.1	43.2
Primary metals	37.2	5.8	16.9	5.8	275.7	61.4	2.7	13.6	419.2
Transportation equipment	5.8	2.3	18.0	0.1	89.8	10.8	0.9	11.7	139.4
Pipeline transportation[6]	2.0	0.7	4.2	0.3	8.1	4.4	1.4	11.2	32.2
Operating expenditures, excluding 'other manufacturing'	**190.2**	**84.3**	**300.1**	**139.2**	**1 304.8**	**348.8**	**84.9**	**199.1**	**2 651.4**
Other manufacturing[2]	..	..	..	..	..	..	..	..	338.8
Total	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**2 990.2**
2000[7]									
Logging	3.8	9.4	29.6	106.4	3.8	3.8	1.2	3.4	161.4
Oil and gas extraction	19.7	15.0	117.4	3.0	81.2	35.7	12.9	39.7	324.7
Mining	25.5	14.4	53.2	4.1	99.9	44.1	8.7	17.7	267.6
Electric power generation, transmission and distribution	9.1	16.4	23.0	6.8	106.3	28.9	10.5	54.9	255.8
Natural gas distribution[8]	0.2	0.3	0.5	..	1.7	0.4	0.1	3.0	6.1
Food	15.5	3.6	7.6	0.5	84.8	11.1	13.4	4.2	140.7
Beverage and tobacco products[8]	1.1	1.1	0.0	..	14.0	1.1	4.7	1.3	23.4
Wood products	8.5	5.0	18.8	17.5	69.1	11.2	7.7	5.9	143.7
Pulp, paper and paperboard mills	51.1	5.1	12.2	6.8	263.3	67.7	6.0	13.3	425.4
Petroleum and coal products	7.3	7.0	11.2	0.9	85.6	75.5	9.6	15.9	212.9
Chemicals	29.9	6.3	22.5	1.1	106.9	42.4	1.8	21.3	232.0
Non-metallic mineral products	2.9	1.9	5.0	0.7	21.4	6.1	2.8	2.8	43.6
Primary metals	40.4	8.6	28.4	2.0	327.2	64.4	4.3	15.3	490.6
Fabricated metal products[9]	3.1	1.5	1.5	0.1	52.8	5.2	0.4	5.0	69.6
Transportation equipment	6.5	4.6	2.5	0.1	119.3	15.8	1.5	19.9	170.2
Pipeline transportation[6]	5.2	6.8	18.2	3.9	6.4	10.1	3.8	6.5	61.0
Operating expenditures, excluding 'other manufacturing'	**229.8**	**106.8**	**351.7**	**153.8**	**1 443.8**	**423.6**	**89.3**	**230.0**	**3 028.9**

Table C.3
Operating expenditures on environmental protection by type of activity and industry, 1995 to 2002, selected years (continued)

Year/industry	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	Pollution abatement and control processes (end-of-pipe), waste management and sewerage services	Pollution prevention processes	Fees, fines and licences	Other	Total
	$ million								
Other manufacturing[2]	..	..	..	..	..	..	..	..	241.7
Total	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**3 270.6**
2002[7]									
Logging	3.6	8.9	21.5	82.2	5.3	6.4	2.8	5.0	135.6
Oil and gas extraction	32.5	18.2	155.9	9.6	177.1	53.7	15.4	77.1	539.5
Mining	27.0	11.3	73.7	3.3	91.5	34.8	7.7	28.8	278.1
Electric power generation, transmission and distribution	17.1	20.7	28.6	12.0	83.7	88.1	10.3	65.3	325.8
Natural gas distribution	1.2	0.8	0.8	0.6	1.9	2.0	0.1	2.4	9.9
Food	22.9	12.5	19.5	0.6	97.3	33.8	17.1	7.9	211.6
Beverage and tobacco products	1.0	0.4	2.0	0.0	9.3	1.2	4.3	1.3	19.5
Wood products	8.9	4.0	21.0	27.4	42.2	10.1	3.8	8.3	125.9
Pulp, paper and paperboard mills	41.6	6.5	12.9	1.8	265.1	69.2	8.2	16.5	421.8
Petroleum and coal products	7.1	3.0	76.4	0.1	80.1	68.0	2.6	7.1	244.3
Chemicals	41.2	6.9	20.4	5.2	133.0	69.8	3.0	23.0	302.5
Non-metallic mineral products	5.3	2.0	20.7	0.1	27.1	6.0	5.4	10.2	76.9
Primary metals	38.1	11.1	11.2	5.6	366.1	69.2	5.1	16.2	522.5
Fabricated metal products[9]	4.6	6.8	0.1	2.6	57.2	4.9	0.6	7.5	84.4
Transportation equipment	7.4	4.5	11.9	0.1	134.2	14.8	0.8	28.3	201.9
Pipeline transportation[6]	3.1	3.9	13.0	1.6	17.1	10.3	1.5	7.6	58.3
Operating expenditures, excluding 'other manufacturing'	**262.8**	**121.7**	**489.8**	**152.8**	**1 558.0**	**542.3**	**88.6**	**312.4**	**3 558.4**
Other manufacturing[2]	..	..	..	..	..	..	..	..	273.6
Total	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**..**	**3 832.0**

Notes:
Figures may not add up to totals due to rounding.
1. In 1995, the transportation equipment industry is included in 'other manufacturing' because of data quality constraints.
2. Detail of the expenditure breakdown by type of environmental protection activity is only available for the listed industries.
3. Before 1997 the wood products industry was included with 'other manufacturing'.
4. Before the 1998 reference year establishments were selected based on the 1980 Standard Industrial Classification System (SIC). However, beginning with reference year 1998, industry selection was based on the North American Industry Classification System (NAICS). For further information, see Statistics Canada, 2001, *Environmental Protection Expenditures in the Business Sector 1998*, catalogue no. 16F0006XIE, Ottawa.
5. Operating expenditures on wildlife and habitat protection are included with operating expenditures on reclamation and decommissioning.
6. Before the 1998 reference year, pipeline transportation was included with gas distribution systems.
7. As of reference year 1998, the Survey of Environmental Protection Expenditures is conducted every two years.
8. Operating expenditures on wildlife and habitat protection are included with operating expenditures on other.
9. Before 2000 the fabricated metal products industry was included with 'other manufacturing'.
Source:
Statistics Canada, *Environmental Protection Expenditures in the Business Sector*, Catalogue no. 16F0006XIE, Ottawa, various issues.

Table C.4
Capital expenditures on environmental protection by type of activity and industry, 1995 to 2002, selected years

Year/industry	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	Pollution abatement and control processes (end-of-pipe)	Pollution prevention processes	Total
	$ million						
1995							
Logging	0.1	x	0.2	x	3.3	0.6	7.9
Crude petroleum and natural gas	3.2	5.9	82.1	1.1	209.1	16.5	317.9
Mining	11.0	0.6	21.7	0.1	45.6	5.4	84.5
Electric power systems	9.4	x	10.4	x	47.4	16.1	146.0
Food	2.4	x	0.8	x	13.1	7.8	24.4
Beverage	1.4	0.1	0.7	0.0	1.6	3.7	7.5
Pulp and paper	11.3	2.2	6.6	3.8	670.0	128.5	822.3
Refined petroleum and coal products	16.1	0.5	0.3	0.0	67.1	12.4	96.5
Chemicals	10.5	0.2	16.8	0.9	34.7	20.2	83.3
Non-metallic mineral products	2.3	0.2	0.9	0.4	42.6	6.4	52.8
Primary metals	7.2	0.5	0.3	0.1	55.6	45.8	109.5
Pipeline transport and gas distribution systems	2.8	2.1	4.1	1.7	13.4	5.5	29.7

Table C.4
Capital expenditures on environmental protection by type of activity and industry, 1995 to 2002, selected years (continued)

Year/industry	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	Pollution abatement and control processes (end-of-pipe)	Pollution prevention processes	Total
				$ million			
Capital expenditures, excluding 'other manufacturing'	**77.7**	**38.0**	**144.9**	**49.3**	**1 203.5**	**268.9**	**1 782.3**
Other manufacturing[1,2]	..	..	..	..	..	..	308.0
Total	**..**	**..**	**..**	**..**	**..**	**..**	**2 090.3**
1996							
Logging	0.4	0.3	1.4	1.9	10.1	1.3	15.4
Crude petroleum and natural gas	6.7	3.8	79.5	3.7	158.4	18.5	270.6
Mining	1.7	1.5	11.1	0.4	49.2	13.6	77.5
Electric power systems	7.0	22.4	6.4	16.9	37.0	7.9	97.6
Food and tobacco products	1.7	x	0.1	x	37.4	29.1	68.8
Beverage	2.1	0.2	0.7	0.0	3.5	1.6	8.0
Pulp and paper	16.9	2.4	13.7	1.4	297.4	319.0	650.8
Refined petroleum and coal products	3.1	3.6	4.5	0.0	42.1	44.4	97.7
Chemicals	24.6	0.4	6.5	0.1	45.1	17.2	93.9
Non-metallic mineral products	2.0	x	1.3	x	33.6	6.3	43.5
Primary metals	5.3	x	0.7	x	61.8	180.5	250.0
Transportation equipment	0.8	0.2	3.3	0.7	25.3	31.0	61.4
Pipeline transport and gas distribution systems	0.8	2.8	7.4	2.3	20.6	11.6	45.6
Capital expenditures, excluding 'other manufacturing'	**73.3**	**40.1**	**136.5**	**27.6**	**821.4**	**681.8**	**1 780.7**
Other manufacturing[2]	..	..	..	..	..	..	135.0
Total	**..**	**..**	**..**	**..**	**..**	**..**	**1 915.8**
1997							
Logging	0.0	0.6	0.8	0.8	0.9	4.6	7.6
Crude petroleum and natural gas	7.7	8.7	63.4	3.2	59.2	40.7	183.0
Mining	2.3	5.2	7.7	0.8	31.0	33.4	80.4
Electric power systems	x	18.9	x	17.5	57.4	9.8	113.9
Food and tobacco products	x	0.1	x	x	39.5	31.5	73.8
Beverage	0.8	0.1	0.8	0.0	3.4	1.4	6.5
Wood products[3]	3.4	1.0	x	x	49.3	21.6	77.4
Pulp and paper	6.2	1.9	3.5	3.0	180.0	136.8	331.5
Refined petroleum and coal products	2.8	3.1	13.4	3.8	38.7	63.2	124.8
Chemicals	7.4	5.3	9.4	0.8	64.5	65.0	152.5
Non-metallic mineral products	0.3	0.7	1.9	0.0	19.8	9.4	32.1
Primary metals	18.5	0.4	x	x	107.7	161.9	290.4
Transportation equipment	0.8	0.2	x	x	24.8	93.2	121.2
Pipeline transport and gas distribution systems	0.6	6.2	5.0	1.3	14.1	43.3	70.6
Capital expenditures, excluding 'other manufacturing'	**60.9**	**52.3**	**113.8**	**32.3**	**690.3**	**716.0**	**1 665.7**
Other manufacturing[2]	..	..	..	..	..	..	82.9
Total	**..**	**..**	**..**	**..**	**..**	**..**	**1 748.6**
1998[4]							
Logging	0.5	0.1	0.2	3.0	1.5	2.1	7.4
Oil and gas extraction	4.3	9.9	69.4	0.9	55.5	46.5	186.5
Mining	2.1	5.8	8.1	3.8	33.4	28.1	81.2
Electric power generation, transmission and distribution	4.9	19.2	1.7	20.7	56.5	21.0	124.0
Natural gas distribution	0.1	0.6	0.6	0.2	1.0	14.5	16.8
Food	2.5	0.9	1.3	5.8	37.6	12.7	60.8
Beverage and tobacco products	1.0	0.2	0.1	0.2	2.6	1.5	5.5
Wood products	3.1	0.6	6.4	2.4	66.0	17.8	96.3
Pulp, paper and paperboard mills	13.2	0.5	4.6	1.1	89.1	179.2	287.7
Petroleum and coal products	0.5	3.0	5.4	1.2	82.2	48.6	141.0
Chemicals	18.6	3.3	7.0	0.4	65.7	94.3	189.2
Non-metallic mineral products[5]	4.0	0.1	2.5	..	32.6	15.1	54.3
Primary metals	4.6	0.4	1.4	1.3	102.9	73.4	184.0
Transportation equipment	0.7	0.2	1.0	0.2	16.3	30.4	48.7
Pipeline transportation[6]	0.6	6.4	2.9	0.5	41.6	63.7	115.6
Capital expenditures, excluding 'other manufacturing'	**60.7**	**51.0**	**112.5**	**41.6**	**684.6**	**648.7**	**1 599.1**
Other manufacturing[2]	..	..	..	..	..	..	135.0
Total	**..**	**..**	**..**	**..**	**..**	**..**	**1 734.2**
2000[7]							

Table C.4
Capital expenditures on environmental protection by type of activity and industry, 1995 to 2002, selected years (continued)

Year/industry	Environmental monitoring	Environmental assessments and audits	Reclamation and decommissioning	Wildlife and habitat protection	Pollution abatement and control processes (end-of-pipe)	Pollution prevention processes	Total
				$ million			
Logging	0.0	0.1	0.1	3.4	0.1	1.2	4.8
Oil and gas extraction	11.8	14.1	73.8	5.9	244.8	114.8	465.1
Mining	1.5	0.8	5.0	2.9	65.0	67.4	142.6
Electric power generation, transmission and distribution[8]	7.8	36.5	..	4.0	56.0	78.1	182.4
Natural gas distribution	0.2	1.0	0.3	0.2	0.5	0.6	2.8
Food	3.3	4.8	4.7	0.2	45.5	27.8	86.3
Beverage and tobacco products	0.2	0.0	0.2	0.5	0.9	2.5	4.4
Wood products[8]	1.3	6.7	..	1.0	51.2	63.1	123.3
Pulp, paper and paperboard mills	3.2	0.9	2.7	1.8	85.8	140.4	234.8
Petroleum and coal products	1.6	0.3	3.0	0.3	119.1	90.3	214.6
Chemicals	4.5	1.1	13.4	0.4	60.6	67.5	147.6
Non-metallic mineral products	2.0	2.4	3.3	0.0	85.5	13.2	106.3
Primary metals	1.9	0.5	1.8	0.4	37.1	63.6	105.3
Fabricated metal products[9]	0.6	0.1	0.5	0.1	5.7	7.9	14.9
Transportation equipment	0.2	0.5	0.8	0.0	13.7	187.9	203.1
Pipeline transportation[6]	1.3	1.9	3.0	0.6	9.9	17.4	33.9
Capital expenditures, excluding 'other manufacturing'	**41.4**	**71.7**	**112.5**	**21.8**	**881.4**	**943.7**	**2 072.5**
Other manufacturing[2]	..	..	..	..	..	..	105.4
Total	**..**	**..**	**..**	**..**	**..**	**..**	**2 177.9**
2002[7]							
Logging	0.0	0.0	0.1	x	x	0.6	5.8
Oil and gas extraction	111.3	23.7	92.4	5.5	85.9	243.7	562.4
Mining	2.5	3.9	21.8	1.6	36.3	31.1	97.3
Electric power generation, transmission and distribution	9.3	26.9	15.7	13.5	218.3	228.2	511.9
Natural gas distribution	x	x	0.8	x	x	x	18.0
Food	10.3	2.6	4.0	2.7	59.5	46.4	125.4
Beverage and tobacco products	0.7	0.1	3.3	0.0	1.9	6.4	12.3
Wood products	x	0.4	0.2	0.6	x	29.0	62.7
Pulp, paper and paperboard mills	3.8	0.1	0.8	0.3	57.4	152.9	215.3
Petroleum and coal products	30.7	7.2	39.8	7.0	226.7	499.9	811.3
Chemicals	x	x	10.7	x	26.4	x	94.5
Non-metallic mineral products	1.5	0.1	1.1	3.2	38.7	24.4	69.0
Primary metals	8.8	1.1	11.2	0.7	87.4	31.1	140.1
Fabricated metal products[9]	x	x	0.2	x	x	x	14.9
Transportation equipment	0.5	0.3	0.7	0.5	29.7	27.3	58.9
Pipeline transportation[6]	x	x	4.7	x	x	32.0	49.7
Capital expenditures, excluding 'other manufacturing'	**192.3**	**75.1**	**207.4**	**40.0**	**907.7**	**1 427.2**	**2 849.7**
Other manufacturing[2]	..	..	..	..	..	..	97.0
Total	**..**	**..**	**..**	**..**	**..**	**..**	**2 946.6**

Notes:
Figures may not add up to totals due to rounding.
1. In 1995, the transportation equipment industry is included in 'other manufacturing' because of data quality constraints.
2. Detail of the expenditure breakdown by type of environmental protection activity is only available for the listed industries.
3. Before 1997 the wood products industry was included with 'other manufacturing'.
4. Before the 1998 reference year establishments were selected based on the 1980 Standard Industrial Classification System (SIC). However, beginning with reference year 1998, industry selection was based on the North American Industry Classification System (NAICS). For further information, see Statistics Canada, 2001, *Environmental Protection Expenditures in the Business Sector 1998*, catalogue no. 16F0006XIE, Ottawa.
5. Capital expenditures on wildlife and habitat protection are included with capital expenditures on reclamation and decommissioning.
6. Before the 1998 reference year, pipeline transportation was included with gas distribution systems.
7. As of reference year 1998, the Survey of Environmental Protection Expenditures is conducted every two years.
8. Capital expenditures on reclamation and decommissioning are included with capital expenditures on environmental assessments and audits.
9. Before 2000 the fabricated metal products industry was included with 'other manufacturing'.

Source:
Statistics Canada, *Environmental Protection Expenditures in the Business Sector*, Catalogue no. 16F0006XIE, Ottawa, various issues.

Table C.5
Capital expenditures on pollution prevention by medium and by industry, 2002

Industry	Air	Surface water	On-site contained solid and liquid waste	Noise, radiation and vibration	Other	**Total**
			$ million			
Logging	0.0	0.1	0.5	0.0	0.0	**0.6**
Oil and gas extraction	184.0	34.6	19.0	3.5	2.7	**243.7**
Mining	x	20.5	7.6	0.0	x	**31.1**
Electric power generation, transmission and distribution	164.9	27.7	x	x	x	**228.2**
Natural gas distribution	x	x	x	0.0	0.0	**x**
Food	23.8	9.4	4.3	0.0	8.8	**46.4**
Beverage and tobacco products	1.8	0.4	2.8	0.0	1.3	**6.4**
Wood products	x	5.4	15.6	x	0.4	**29.0**
Pulp, paper and paperboard mills	65.3	x	3.8	x	x	**152.9**
Petroleum and coal products	425.0	48.6	x	x	x	**499.9**
Chemicals	x	16.9	12.9	0.6	x	**x**
Non-metallic mineral products	3.5	2.0	1.2	0.2	17.5	**24.4**
Primary metals	15.5	7.2	7.2	0.0	1.2	**31.1**
Fabricated metal products	x	x	0.3	0.2	2.1	**x**
Transportation equipment	18.5	3.5	3.9	0.2	1.3	**27.3**
Pipeline transportation	5.3	x	20.5	x	x	**32.0**
Total	**950.5**	**224.7**	**138.3**	**12.9**	**100.8**	**1 427.2**

Source:
Statistics Canada, 2004, *Environmental Protection Expenditures in the Business Sector, 2002*, Catalogue no. 16F0006XIE, Ottawa.

Table C.6
Capital expenditures on pollution abatement and control (end-of-pipe) by medium and by industry, 2002

Industry	Air	Surface water	On-site contained solid and liquid waste	Noise, radiation and vibration	**Total**
			$ million		
Logging	x	x	x	x	**x**
Oil and gas extraction	48.4	21.2	13.7	2.7	**85.9**
Mining	7.5	22.9	5.7	0.2	**36.3**
Electric power generation, transmission and distribution	166.8	36.5	14.9	0.3	**218.3**
Natural gas distribution	x	0.0	x	0.1	**x**
Food	15.0	37.6	x	x	**59.5**
Beverage and tobacco products	0.2	0.8	0.8	0.1	**1.9**
Wood products	x	x	x	x	**x**
Pulp, paper and paperboard mills	32.3	16.5	8.1	0.5	**57.4**
Petroleum and coal products	155.8	35.1	28.5	7.3	**226.7**
Chemicals	15.8	5.0	3.4	2.2	**26.4**
Non-metallic mineral products	27.8	2.0	7.9	1.0	**38.7**
Primary metals	66.1	13.9	7.2	0.2	**87.4**
Fabricated metal products	1.3	1.5	x	0.1	**x**
Transportation equipment	x	x	4.4	0.1	**29.7**
Pipeline transportation	x	0.1	x	x	**x**
Total	**580.6**	**203.3**	**104.8**	**18.9**	**907.7**

Source:
Statistics Canada, 2004, *Environmental Protection Expenditures in the Business Sector, 2002*, Catalogue no. 16F0006XIE, Ottawa.

Table C.7
Government expenditures on pollution abatement and control (PAC) and water purification and supply, 1990/91 to 2001/02

Level of government/activity	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02
	$ million											
All levels[1]												
Sewage collection and disposal[2]	2 001.1	1 953.3	2 051.3	2 186.1	2 297.4	2 742.2	2 547.5	2 692.8	2 433.2	2 438.6	2 580.8[r]	2 770.3
Waste collection and disposal	1 220.3	1 324.7	1 427.2	1 346.2	1 578.1	1 366.4	1 343.5	1 395.8	1 462.7	1 622.2	1 738.2[r]	1 960.8
Other pollution control activities	397.6	318.9	263.8	239.6	240.3	204.2	186.7	179.3	319.8	447.3	643.5[r]	777.4
Other environmental services	1 096.3	1 289.0	1 272.6	1 329.2	1 317.1	1 338.7	1 274.5	1 353.8	1 231.9	1 110.0	1 146.4[r]	1 195.3
Total PAC	**4 715.3**	**4 885.9**	**5 014.8**	**5 101.1**	**5 432.9**	**5 651.5**	**5 352.2**	**5 621.8**	**5 447.6**	**5 618.0**	**6 108.8[r]**	**6 703.8**
Water purification and supply	2 470.5	2 377.3	2 426.0	2 747.5	2 965.6	3 014.0	3 029.4	3 082.0	3 118.7	3 053.9	3 113.2[r]	3 229.0
PAC and water	**7 185.8**	**7 263.2**	**7 440.8**	**7 848.6**	**8 398.4**	**8 665.5**	**8 381.6**	**8 703.8**	**8 566.3**	**8 671.9**	**9 222.0[r]**	**9 932.8**
Federal[3]												
Sewage collection and disposal	0.0	0.0	0.0	229.4	320.7	313.7	300.7	371.5	341.5	309.3	319.4[r]	300.9
Waste collection and disposal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0[r]	0.0

Table C.7
Government expenditures on pollution abatement and control (PAC) and water purification and supply, 1990/91 to 2001/02 (continued)

Level of government/activity	1990/91	1991/92	1992/93	1993/94	1994/95	1995/96	1996/97	1997/98	1998/99	1999/00	2000/01	2001/02
	$ million											
Other pollution control activities	117.9	20.2	4.3	11.2	14.7	13.9	5.7	4.7	4.0	155.5	314.8[r]	415.9
Other environmental services	620.2	720.9	747.0	728.7	745.3	703.2	635.6	761.8	785.4	579.6	595.1[r]	601.9
Total PAC	**738.1**	**741.1**	**751.4**	**969.4**	**1 080.8**	**1 030.7**	**942.0**	**1 138.0**	**1 130.9**	**1 044.3**	**1 229.2[r]**	**1 318.7**
Water purification and supply	7.1	7.8	9.6	235.1	344.7	360.0	328.9	392.0	360.7	318.1	324.7[r]	308.0
PAC and water	**745.2**	**748.9**	**761.0**	**1 204.5**	**1 425.5**	**1 390.8**	**1 270.9**	**1 529.9**	**1 491.7**	**1 362.5**	**1 553.9[r]**	**1 626.7**
Provincial/territorial												
Sewage collection and disposal[2]	75.3	100.9	97.8	90.6	132.8	256.3	186.8	181.4	131.2	91.3	74.2[r]	118.4
Waste collection and disposal	132.4	164.1	176.7	121.5	295.8	71.3	30.5	27.8	65.6	69.9	44.8[r]	58.6
Other pollution control activities	327.3	375.8	328.2	309.9	235.8	202.2	187.4	181.0	321.7	295.9	333.0[r]	375.6
Other environmental services	443.4	535.0	467.0	516.7	531.3	564.0	531.0	494.9	327.5	439.1	440.4[r]	487.7
Total PAC	**978.4**	**1 175.7**	**1 069.7**	**1 038.7**	**1 195.5**	**1 093.8**	**935.8**	**885.0**	**846.0**	**896.2**	**892.4[r]**	**1 040.3**
Water purification and supply	1 130.6	1 012.5	991.5	872.3	948.6	985.8	987.1	822.5	666.7	784.5	508.4[r]	488.0
PAC and water	**2 109.0**	**2 188.3**	**2 061.3**	**1 911.0**	**2 144.1**	**2 079.6**	**1 922.9**	**1 707.5**	**1 512.7**	**1 680.7**	**1 400.8[r]**	**1 528.3**
Local												
Sewage collection and disposal	2 002.0	1 954.3	2 055.8	1 950.5	2 040.7	2 419.7	2 313.6	2 394.4	2 126.5	2 162.6	2 278.8[r]	2 469.8
Waste collection and disposal	1 125.9	1 228.2	1 297.4	1 253.4	1 293.1	1 310.9	1 331.8	1 392.3	1 411.1	1 583.3	1 723.1[r]	1 921.4
Other pollution control activities and other environmental services[4]	82.3	80.9	102.6	126.8	144.2	133.0	129.4	129.8	138.1	114.8	158.7[r]	133.2
Total PAC	**3 210.2**	**3 263.4**	**3 455.7**	**3 330.7**	**3 478.0**	**3 863.6**	**3 774.8**	**3 916.5**	**3 675.8**	**3 860.6**	**4 160.6[r]**	**4 524.4**
Water purification and supply	2 078.2	2 039.6	2 105.0	2 296.8	2 479.4	2 555.7	2 524.9	2 525.9	2 575.0	2 527.4	2 636.5[r]	2 710.9
PAC and water	**5 288.5**	**5 303.0**	**5 560.8**	**5 627.5**	**5 957.4**	**6 419.3**	**6 299.7**	**6 442.3**	**6 250.8**	**6 388.1**	**6 797.0[r]**	**7 235.3**

Notes:
Fiscal year ending nearest to March 31, except for local government expenditures (calendar year).
Figures may not add up to totals due to rounding.
1. Expenditures presented for all levels of government do not equal the sum of federal, provincial/territorial and local expenditures. The data have been consolidated, excluding intergovernmental transactions between the three levels of government, which provides a more accurate account of total government expenditures.
2. May include some expenditures on water purification and supply.
3. The increase shown from 1998/99 is a result of a program restructure within the Department of Environment Canada, as described within the 1999 and 2000 Public Accounts (Vol. II, Part I).
4. Includes expenditures for other pollution control activities (such as clean-up and air pollution control) and other environmental services (such as environmental assessments).
Sources:
Statistics Canada, Public Institutions Division and Environment Accounts and Statistics Division.

Environmental practices

Pollution prevention attempts to eliminate waste and pollution before it is created in manufacturing processes. It involves continuous improvement through changes in product design, technology, operations and behaviour. Table C.8 examines pollution prevention methods adopted by industry. In 2002, the most widely used methods of pollution prevention were 'good operating practices or pollution prevention training' (74%), prevention of leaks and spills (70%) and 'recirculation, recovery, reuse or recycling' (65%).

Environmental management practices are used by businesses to facilitate reducing or preventing of pollution or the conserving of resources. In 2002, 71% of reporting establishments indicated using at least one environmental management practice (Table C.9). The most widely reported practice was the use of an environmental management system (56%), followed by the preparation of environmental performance reports (41%).

In 2002, 971 kg of non-hazardous solid waste were generated per capita; an increase of 2% from 2000 (Table C.10). Nationally, 22% of the total non-hazardous waste generated was diverted from disposal. Nova Scotia had the highest diversion rate (30%) followed closely by British Columbia (29%) and Prince Edward Island (28%). The lowest per capita disposal rate was in Nova Scotia with 417 kg per capita. The highest disposal rate for 2002 was 928 kg per capita in Alberta. Almost half (49%) of waste came from industrial, commercial and institutional sources, while residential sources accounted for 40% of waste disposal (Table C.11). The remaining 12% was disposed of by construction and demolition sources.

Over 6.6 million tonnes of non-hazardous material were processed for recycling in 2002 (Table C.12). Mixed paper and organic material made up the bulk of the recycled material, accounting for 23% and 18% respectively of the total for 2002.

Table C.8
Pollution prevention methods by industry, 1995 to 2002, selected years

Year/industry	Product design or reformulation	Equipment or process modifications	Recirculation, recovery, reuse or recycling	Materials, feedstock or solvent substitution	Improved management or purchasing techniques	Prevention of leaks and spills	Good operating practices or training	Energy conservation	Other
					%[1]				
1995									
Logging	0	25	31	6	..	38	..	19	6
Crude petroleum and natural gas	7	39	48	42	..	71	..	77	10
Mining	5	25	50	36	..	59	..	39	7
Electric power systems	18	27	73	82	..	46	..	73	18
Food	4	26	69	13	..	51	..	33	1
Beverage	13	33	75	17	..	33	..	46	4
Pulp and paper	11	46	44	16	..	54	..	25	3
Refined petroleum and coal products	8	0	39	15	..	54	..	46	0
Chemicals	20	37	69	41	..	59	..	30	8
Non-metallic mineral products	19	23	68	34	..	49	..	38	9
Primary metals	9	51	65	42	..	42	..	37	7
Pipeline transport and gas distribution systems	8	23	62	39	..	69	..	77	0
Other manufacturing[2]	7	28	69	43	..	42	..	36	3
Total	**10**	**32**	**64**	**33**	**..**	**50**	**..**	**37**	**5**
1996									
Logging	4	4	46	17	..	63	..	25	0
Crude petroleum and natural gas	3	41	66	41	..	79	..	76	0
Mining	5	23	58	27	..	49	..	42	21
Electric power systems	12	24	77	59	..	47	..	82	6
Food and tobacco products	12	25	60	29	..	52	..	43	7
Beverage	13	43	83	15	..	38	..	43	5
Pulp and paper	5	41	47	27	..	51	..	37	13
Refined petroleum and coal products	13	13	50	19	..	75	..	44	13
Chemicals	20	36	71	43	..	62	..	30	17
Non-metallic mineral products	9	30	73	39	..	42	..	39	9
Primary metals	5	37	70	39	..	49	..	38	6
Transportation equipment	18	43	80	57	..	51	..	57	6
Pipeline transport and gas distribution systems	4	7	68	43	..	75	..	71	4
Other manufacturing[2]	13	29	72	40	..	39	..	38	4
Total	**11**	**31**	**66**	**37**	**..**	**49**	**..**	**42**	**8**
1997									
Logging	9	3	34	14	..	80	..	6	6
Crude petroleum and natural gas	34	40	74	49	..	94	..	66	6
Mining	4	23	59	24	..	50	..	54	3
Electric power systems	7	20	53	53	..	93	..	73	13
Food and tobacco products	14	30	67	30	..	63	..	59	6
Beverage	25	18	57	21	..	50	..	32	14
Wood products[3]	16	21	58	35	..	61	..	35	9
Pulp and paper	8	27	72	31	..	58	..	41	12
Refined petroleum and coal products	39	44	72	50	..	78	..	61	0
Chemicals	27	23	61	36	..	69	..	39	5
Non-metallic mineral products	12	25	75	31	..	39	..	33	8
Primary metals	11	43	70	37	..	51	..	54	2
Transportation equipment	19	32	64	56	..	57	..	56	5
Pipeline transport and gas distribution systems	17	11	50	44	..	78	..	72	11
Other manufacturing[2]	12	18	63	41	..	30	..	33	18
Total	**15**	**24**	**64**	**37**	**..**	**51**	**..**	**42**	**10**
1998[4]									
Logging	0	15	33	3	..	82	..	12	3
Oil and gas extraction	27	35	71	40	..	88	..	75	6
Mining	6	18	67	21	..	53	..	42	8
Electric power generation, transmission and distribution	13	22	65	52	..	87	..	74	4
Natural gas distribution	0	25	38	25	..	75	..	63	0
Food	13	26	72	34	..	55	..	61	3
Beverage and tobacco products	8	16	50	24	..	63	..	50	11
Wood products[3]	23	25	62	22	..	58	..	40	12
Pulp, paper and paperboard mills	10	24	76	38	..	73	..	54	7
Petroleum and coal products	26	32	74	26	..	79	..	63	0
Chemicals	30	24	72	27	..	71	..	33	4
Non-metallic mineral products	18	20	67	27	..	49	..	51	9
Primary metals	14	28	82	31	..	55	..	54	6
Transportation equipment	21	25	69	51	..	69	..	56	9

Table C.8
Pollution prevention methods by industry, 1995 to 2002, selected years (continued)

Year/industry	Product design or reformulation	Equipment or process modifications	Recirculation, recovery, reuse or recycling	Materials, feedstock or solvent substitution	Improved management or purchasing techniques	Prevention of leaks and spills	Good operating practices or training	Energy conservation	Other
					%[1]				
Pipeline transportation[5]	25	25	58	33	..	92	..	75	0
Other manufacturing[2]	15	20	56	31	..	39	..	35	20
Total	**17**	**23**	**66**	**31**	**..**	**59**	**..**	**45**	**10**
2000[6]									
Logging	0	24	46	20	35	79	78	..	28
Oil and gas extraction	18	86	76	36	58	96	91	..	26
Mining	10	40	84	33	51	92	92	..	18
Electric power generation, transmission and distribution	21	40	62	39	55	79	84	..	19
Natural gas distribution	25	78	56	0	56	100	82	..	0
Food	22	46	61	26	36	65	72	..	12
Beverage and tobacco products	6	41	52	11	33	76	80	..	10
Wood products[3]	24	47	70	27	42	67	75	..	17
Pulp, paper and paperboard mills	17	68	83	36	34	87	89	..	16
Petroleum and coal products	48	54	76	34	44	91	94	..	6
Chemicals	40	54	77	40	45	82	88	..	15
Non-metallic mineral products	22	48	73	31	40	66	76	..	22
Primary metals	16	57	76	34	33	78	80	..	10
Fabricated metal products[7]	13	39	60	29	34	68	77	..	15
Transportation equipment	33	59	69	53	58	82	88	..	22
Pipeline transportation[5]	40	49	49	35	55	98	95	..	11
Other manufacturing[2]	26	40	56	37	41	55	67	..	11
Total	**24**	**48**	**67**	**34**	**42**	**73**	**79**	**..**	**14**
2002[6]									
Logging	5	25	61	9	34	84	85	..	19
Oil and gas extraction	30	77	71	42	48	92	91	..	16
Mining	9	35	77	32	39	82	79	..	34
Electric power generation, transmission and distribution	14	38	63	36	34	80	78	..	16
Natural gas distribution	11	44	82	22	82	100	100	..	33
Food	16	16	55	21	25	66	69	..	17
Beverage and tobacco products	8	31	40	15	17	46	50	..	9
Wood products[3]	16	40	63	19	37	63	74	..	22
Pulp, paper and paperboard mills	10	70	81	30	30	85	90	..	21
Petroleum and coal products	39	63	72	47	43	85	84	..	0
Chemicals	16	40	63	25	35	78	79	..	13
Non-metallic mineral products	23	49	64	29	30	54	62	..	16
Primary metals	12	51	73	32	25	70	70	..	16
Fabricated metal products[7]	14	49	64	33	41	66	73	..	10
Transportation equipment	32	52	61	48	51	71	69	..	24
Pipeline transportation[5]	42	70	54	35	58	100	98	..	0
Other manufacturing[2]	29	48	62	38	43	59	66	..	11
Total	**22**	**49**	**65**	**31**	**37**	**70**	**74**	**..**	**16**

Notes:
This table includes reported data only.
The question on pollution prevention methods differed in reference years 1995 and 1996. Therefore, comparisons from 1995 to 1998 provide a general view but should be treated with caution.
1. Number of establishments indicating they used the pollution prevention method as a percentage of all establishments that provided a response.
2. Includes all other manufacturing industries not already specified.
3. Before 1997 the wood products industry was included with 'other manufacturing'.
4. Before the 1998 reference year, establishments were selected based on the 1980 Standard Industrial Classification System (SIC). However, beginning with reference year 1998, industry selection was based on the North American Industry Classification System (NAICS). For further information, see Statistics Canada, 2001, *Environmental Protection Expenditures in the Business Sector 1998*, catalogue no. 16F0006XIE, Ottawa.
5. Before the 1998 reference year, pipeline transportation was included with gas distribution systems.
6. As of reference year 1998, the Survey of Environmental Protection Expenditures is conducted every two years.
7. Before 2000 the fabricated metal products industry was included with 'other manufacturing'.
Source:
Statistics Canada, *Environmental Protection Expenditures in the Business Sector*, Catalogue no. 16F0006XIE, Ottawa, various issues.

Table C.9
Environmental management practices by industry, 1998, 2000 and 2002

Year/industry	Environmental management system	Life cycle analysis	ISO 14000 certification	Environmental voluntary agreements	'Green' procurement policy	Eco-labelling of products	Annual environmental performance report	Other	Total[2]
					%[1]				
1998									
Logging	59	10	17	16	3	5	50	10	72
Oil and gas extraction	88	47	3	77	24	6	40	20	93
Mining	72	22	5	51	18	..	55	39	91
Electric power generation, transmission and distribution	74	27	27	68	8	12	52	50	93
Natural gas distribution	92	25	8	91	42	..	67	..	100
Food	50	9	4	12	12	2	13	8	63
Beverage and tobacco products	55	14	3	25	23	19	14	7	78
Wood products	50	9	5	14	9	6	28	12	69
Pulp, paper and paperboard mills	70	11	17	65	11	16	63	21	95
Petroleum and coal products	74	52	7	58	11	11	49	50	88
Chemicals	69	28	17	46	17	9	34	28	89
Non-metallic mineral products	61	17	5	11	14	3	31	14	75
Primary metals	58	13	6	28	11	..	18	13	82
Transportation equipment	62	19	23	26	19	2	23	17	81
Pipeline transportation	91	43	5	86	14	..	52	33	100
Total	**64**	**19**	**10**	**37**	**14**	**6**	**34**	**20**	**82**
2000									
Logging	76	2	50	26	9	17	61	12	86
Oil and gas extraction	82	23	10	82	27	5	62	13	92
Mining	66	16	3	49	16	2	67	20	84
Electric power generation, transmission and distribution	53	14	17	47	18	8	44	14	73
Natural gas distribution	91	30	0	82	46	10	80	x	100
Food	48	10	4	10	14	3	25	10	64
Beverage and tobacco products	41	1	3	23	7	1	36	10	67
Wood products	42	5	11	23	13	11	38	7	63
Pulp, paper and paperboard mills	65	12	25	57	11	11	71	15	89
Petroleum and coal products	71	36	15	46	13	24	61	15	80
Chemicals	60	15	5	36	14	7	46	14	78
Non-metallic mineral products	60	8	2	18	17	4	36	9	78
Primary metals	55	9	11	34	10	1	38	8	74
Fabricated metal products	41	8	7	13	8	6	15	5	57
Transportation equipment	65	16	30	20	19	0	33	11	76
Pipeline transportation	81	14	0	93	14	0	86	0	100
Total	**58**	**12**	**11**	**34**	**14**	**6**	**45**	**11**	**75**
Other manufacturing[3]	32	7	10	10	12	3	17	8	60
Total including 'other manufacturing'	**52**	**11**	**11**	**29**	**13**	**5**	**38**	**10**	**72**
2002									
Logging	82	11	66	23	20	24	48	4	88
Oil and gas extraction	90	34	5	81	23	4	81	16	97
Mining	75	19	9	53	19	0	72	23	88
Electric power generation, transmission and distribution	64	27	22	50	20	15	54	0	72
Natural gas distribution	92	36	18	92	27	0	92	25	100
Food	38	7	3	11	11	1	24	4	53
Beverage and tobacco products	36	5	3	20	5	0	29	9	55
Wood products	48	7	18	23	18	15	40	9	61
Pulp, paper and paperboard mills	75	10	38	43	8	6	76	18	93
Petroleum and coal products	73	38	19	50	9	22	67	0	88
Chemicals	61	19	11	37	12	3	45	11	76
Non-metallic mineral products	40	15	13	21	14	4	24	8	62
Primary metals	54	9	20	29	9	0	39	7	67
Fabricated metal products	54	6	23	13	13	0	23	0	68
Transportation equipment	66	22	46	23	18	4	34	12	75
Pipeline transportation	100	29	2	98	33	0	76	0	100
Total	**61**	**15**	**23**	**35**	**14**	**5**	**47**	**9**	**74**
Other manufacturing[3]	38	10	19	10	12	3	23	7	63
Total including 'other manufacturing'	**56**	**14**	**19**	**29**	**14**	**5**	**41**	**9**	**71**

Notes:
This table includes reported data only.
1. Number of establishments indicating they used the practice as a percentage of all establishments that provided a response.
2. Number of establishments indicating they used at least one environmental practice as a percentage of the total number of establishments that provided a response.
3. Includes all other manufacturing industries not already specified. Information on environmental management practices used by the 'other manufacturing' category was not collected in 1998.
Source:
Statistics Canada, *Environmental Protection Expenditures in the Business Sector*, Catalogue no. 16F0006XIE, Ottawa, various issues.

Table C.10
Waste disposal, diversion and generation per capita, all sources, by province and territory, 2000 and 2002

Province/territory	Disposal[1]		Diversion[2]		Generation[3]		Rate of diversion per capita	
	2000[r]	2002	2000[r]	2002	2000[r]	2002	2000[r]	2002
	kg per capita						%	
Newfoundland and Labrador	742	725	80	74	822	799	10	9
Prince Edward Island	x	x	x	x	x	x	20	28
Nova Scotia	416	417	150	182	566	598	26	30
New Brunswick	550	551	152	164	702	715	22	23
Quebec[4]	787	745	209	234	996	979	21	24
Ontario	764	797	202	200	966	997	21	20
Manitoba	798	776	188	217	986	993	19	22
Saskatchewan	804	799	147	147	951	946	15	16
Alberta	914	928	140	189	1 054	1 117	13	17
British Columbia	636	667	278	269	914	936	30	29
Yukon Territory, Northwest Territories and Nunavut	x	x	x	x	x	x	3	10
Canada	**753**	**760**	**199**	**211**	**952**	**971**	**21**	**22**

Notes:
1. Total amount of non-hazardous waste disposed of in public and private waste disposal facilities. This includes waste that is exported out of the source province or country for disposal. This does not include waste disposed of in hazardous waste disposal facilities or waste managed by the waste generator on-site.
2. Diversion represents the quantity of non-hazardous materials diverted from disposal facilities and represents the sum of all materials processed for recycling or reuse at an off-site recycling facility.
3. Total generation is the sum of total non-hazardous residential and non-residential solid waste disposed of in an off-site disposal facility and total materials processed for recycling at an off-site recycling facility. Note that these data only include those materials that are managed (disposed of or recycled) off-site by a municipality or waste management firm.
4. These data are derived from a survey administered by RECYC-QUÉBEC. In order to make these data comparable with other provincial data, some waste quantities generated by the construction and demolition sector have been removed from the RECYC-QUÉBEC totals.

Source:
Statistics Canada, 2004, *Waste Management Industry Survey: Business and Government Sectors, 2002*, Catalogue no. 16F0023XIE, Ottawa.

Table C.11
Disposal of waste by source and by province and territory, 2000 and 2002[1]

Province/territory	Residential sources[2]		Industrial, commercial and institutional sources[3]		Construction and demolition sources[4]		Total waste disposed	
	2000[r]	2002	2000[r]	2002	2000[r]	2002	2000[r]	2002
	t							
Newfoundland and Labrador	x	216 218	146 843	140 377	x	19 999	398 818	376 593
Prince Edward Island	x	x	x	x	x	x	x	x
Nova Scotia	171 627	169 649	x	176 625	x	42 921	391 827	389 194
New Brunswick	198 603	203 506	x	154 812	x	55 288	415 058	413 606
Quebec[5]	2 679 000	2 876 000	2 655 000	2 261 000	472 200	406 800	5 806 200	5 543 800
Ontario	3 318 478	3 438 408	4 606 409	5 193 240	1 006 714	1 013 985	8 931 600	9 645 633
Manitoba	451 505	412 612	x	405 954	x	77 990	914 511	896 556
Saskatchewan	272 104	278 692	x	441 109	x	75 323	821 946	795 124
Alberta	824 990	866 398	x	1 380 306	x	643 590	2 750 004	2 890 294
British Columbia	890 789	936 774	1 264 056	1 346 669	426 490	461 458	2 581 336	2 744 901
Yukon Territory, Northwest Territories and Nunavut	x	x	x	x	x	x	x	x
Canada	**9 069 170**	**9 455 204**	**11 203 613**	**11 563 999**	**2 896 087**	**2 816 528**	**23 168 870**	**23 835 730**

Notes:
Figures may not add up to totals due to rounding.
1. Total amount of non-hazardous waste disposed of in public and private waste disposal facilities. This includes waste that is exported out of the source province or country for disposal. This does not include waste disposed of in hazardous waste disposal facilities or waste managed by the waste generator on-site.
2. Waste from residential sources includes solid waste from all households that is picked up by the municipality (either using its own staff or through contracting firms) or that is self-hauled to depots, transfer stations and disposal facilities.
3. Industrial, Commercial, and Institutional (IC&I) non-hazardous solid wastes are those wastes generated by all IC&I sources in a municipality, and are excluded from the residential waste stream. These include: industrial materials generated by manufacturing, and primary and secondary industries that are managed off-site; commercial materials generated by shopping centres, restaurants, offices, etc.; and materials generated by institutional facilities such as schools, hospitals, government facilities, seniors homes, universities, etc.
4. Construction and demolition non-hazardous waste refers to waste from construction and demolition activities. It generally includes materials such as brick, painted wood, rubble, drywall, metal, cardboard, doors, windows, wiring, etc. It excludes materials from land clearing on areas not previously developed, asphalt and clean sand or gravel.
5. These data are derived from a survey administered by RECYC-QUÉBEC. In order to make these data comparable with other provincial data, some waste quantities generated by the construction and demolition sector have been removed from the RECYC-QUÉBEC totals.

Source:
Statistics Canada, 2004, *Waste Management Industry Survey: Business and Government Sectors, 2002*, Catalogue no. 16F0023XIE, Ottawa.

Table C.12
Materials prepared for recycling by type and by province and territory, 2002[1]

Type of material	N.L.	P.E.I.	N.S.	N.B.	Que.[2]	Ont.	Man.	Sask.	Alta.	B.C.	Y.T., N.W.T. and Nvt.	**Canada**
						t						
Newsprint	x	x	22 131	6 764	..	544 752	45 165	15 564	57 201	104 065	x	800 043
Cardboard and boxboard	x	x	12 476	12 231	..	407 325	x	18 207	46 230	178 251	x	705 856
Mixed paper	x	x	2 627	4 265	946 000[3]	328 443	4 245	14 194	28 466	190 047	x	1 519 958
Glass	x	x	2 824	x	71 000	173 905	2 619	x	x	34 231	x	339 132
Ferrous metals	x	x	2 775	x	111 000	267 254	x	x	x	127 925	x	808 596
Copper and aluminum	x	x	x	x	11 000	19 927	x	x	x	1 965	x	44 070
Other metals	x	0	x	x	..	49 071	x	x	10 595	40 376	x	117 560
Plastics	x	x	1 560	1 038	52 000	42 770	2 548	910	8 280	34 100	x	152 266
Construction and demolition	0	x	53 359	30 153	213 000	225 282	581	x	x	162 168	0	702 202
Organics	0	x	62 341	62 725	246 000	293 328	16 261	x	261 069	198 996	x	1 170 790
Other materials	x	0	1 117	1 262	93 000	63 442	9 067	x	41 730	32 997	x	259 321
Total	**38 386**	**x**	**169 724**	**122 957**	**1 743 000**	**2 415 498**	**250 880**	**146 607**	**589 642**	**1 105 121**	**x**	**6 619 794**

Notes:
Figures may not add up to totals due to rounding.
1. This table covers only those companies and local waste management organizations that reported they prepared non-hazardous material for recycling.
2. These data are derived from a survey administered by RECYC-QUÉBEC. In order to make these data comparable with other provincial data, some waste quantities generated by the construction and demolition sector have been removed from the RECYC-QUÉBEC totals.
3. Includes all paper fibres.
Source:
Statistics Canada, 2004, *Waste Management Industry Survey: Business and Government Sectors, 2002*, Catalogue no. 16F0023XIE, Ottawa.

Environment industry

Revenues derived from environment-related activities reached $15.8 billion in 2002 (Table C.13). Environmental services accounted for 44% of total environmental revenues, while 42% of these revenues were derived from environmental goods. Environment-related construction services made up the remaining share (14%). The wholesale trade industry posted the highest share of business sector total environmental revenues at 29%, followed by the waste management and remediation services industry at 24% and the construction industry at 13%.

As in previous years, businesses in Ontario and Quebec reported the highest environmental revenues in 2002, estimated at $6.9 billion and $3.1 billion respectively (Table C.14).

Table C.13
Total and environmental revenues by industry, 2002

Industry[1]	Establishments[2]	Total employment[3]	Total revenues[4]	Environmental revenues			
				Environmental goods	Environmental services	Environment-related construction[5]	Total
	number		$ million				
Agriculture, forestry, fishing and hunting	14	249	21.0	4.5	8.4	0.0	12.9
Mining and oil and gas extraction	29	1 698	913.3	x	131.6	x	140.4
Utilities	15	1 975	52.5	10.4	x	x	29.4
Construction	82	16 728	2 705.6	42.4	128.4	1 906.7	2 077.5
Chemical manufacturing	51	3 457	1 141.2	206.0	34.7	0.0	240.8
Plastic and rubber products manufacturing	39	3 238	968.0	383.0	x	x	404.4
Non-metallic mineral product manufacturing	15	1 237	279.8	x	0.0	x	154.6
Primary metal manufacturing	12	743	101.6	61.2	9.8	0.0	71.0
Fabricated metal product manufacturing	38	3 624	708.4	x	x	x	167.2
Machinery manufacturing	147	9 712	1 845.3	770.3	37.2	7.8	815.3
Computer and electronic product manufacturing	53	2 004	325.4	108.4	4.2	0.0	112.6
Electrical equipment, appliance and component manufacturing	13	1 154	943.0	201.4	0.2	0.0	201.6
Rest of manufacturing sector	39	2 848	535.6	270.1	27.0	0.0	297.1
Wholesale trade	2 845	24 195	6 127.7	3 884.2	693.8	11.0	4 588.9
Retail trade	20	1 168	154.3	51.3	2.8	0.0	54.2
Finance and insurance services	20	1 444	305.0	x	39.9	x	48.4
Legal services	48	8 786	1 575.7	0.0	104.9	0.0	104.9
Architectural and landscape architectural services	17	112	13.6	0.0	5.3	0.0	5.3
Engineering services	560	28 891	4 034.7	76.9	914.7	122.8	1 114.3
Surveying and mapping (including geophysical) services	22	814	91.6	x	x	x	32.4
Testing laboratories	103	3 665	342.4	x	x	x	202.4
Computer systems design and related services	28	1 973	262.4	x	13.8	x	25.6

Table C.13
Total and environmental revenues by industry, 2002 (continued)

Industry[1]	Establishments[2]	Total employment[3]	Total revenues[4]	Environmental revenues			
				Environmental goods	Environmental services	Environment-related construction[5]	Total
	number			$ million			
Environmental consulting services	1 510	8 062	769.6	32.3	610.4	2.4	645.2
Management consulting and other scientific and technical consulting services	123	1 270	152.8	31.1	46.5	10.2	87.8
Scientific research and development services	39	1 239	144.0	43.6	43.5	0.0	87.1
All other professional, scientific and technical services	22	471	39.7	x	x	x	25.3
Management of companies and enterprises	19	1 886	359.2	x	18.2	x	83.7
Administrative and support services	44	2 007	318.0	x	85.2	x	100.6
Waste management and remediation services	1 938	23 757	3 941.0	42.8	3 671.9	27.3	3 742.0
Other services	62	1 313	265.9	x	81.3	x	126.7
Canada	**7 967**	**159 720**	**29 438.6**	**6 647.3**	**6 996.7**	**2 155.8**	**15 799.8**

Notes:
Figures may not add up to totals due to rounding.
1. Industry groups are based on the North American Industry Classification System (NAICS).
2. All companies operating in Canada that are involved in whole or in part in the production of environmental goods, the provision of environmental services and the undertaking of environment-related construction activities. The total number of establishments does not include engineering construction establishments (NAICS 23711, 23712, 23731, 23799) due to the methodology used to derive the estimates.
3. Total employment of establishments that were considered to be in scope for the purposes of the survey.
4. Total revenues of establishments that were considered to be in scope for the purposes of the survey.
5. Revenues from environment-related construction services were derived from demand-side estimates of environmental protection expenditures.
Source:
Statistics Canada, 2004, *Environment Industry Survey: Business Sector, 2002*, Catalogue no. 16F0008XIE, Ottawa.

Table C.14
Total and environmental revenues by province and territory, 2002

Province/territory	Establishments[1]	Total employment[2]	Total revenues[3]	Environmental goods	Environmental services	Environment-related construction[4]	Total environmental revenues
	number			$ million			
Newfoundland and Labrador	134	2 059	246.4	26.4	64.1	25.7	116.2
Prince Edward Island	46	1 276	102.0	13.8	14.4	38.1	66.3
Nova Scotia	380	5 143	673.7	145.3	176.7	38.4	360.4
New Brunswick	261	3 561	496.0	117.4	135.7	55.1	308.2
Quebec	1 697	32 437	5 132.9	1 538.9	1 295.3	232.7	3 066.9
Ontario	2 467	62 548	13 904.3	3 407.8	2 838.2	661.3	6 907.3
Manitoba	246	4 177	601.0	184.4	163.1	47.8	395.3
Saskatchewan	286	3 998	858.1	126.8	136.0	53.1	315.8
Alberta	1 085	25 855	4 563.5	576.8	1 056.7	666.4	2 299.8
British Columbia	1 305	18 212	2 814.2	507.6	1 094.3	326.7	1 928.6
Yukon Territory, Northwest Territories and Nunavut	60	454	46.5	2.1	22.1	10.5	34.8
Canada	**7 967**	**159 720**	**29 438.6**	**6 647.3**	**6 996.7**	**2 155.8**	**15 799.8**

Notes:
Figures may not add up to totals due to rounding.
1. All companies operating in Canada that are involved in whole or in part in the production of environmental goods, the provision of environmental services and the undertaking of environment-related construction activities. The total number of establishments does not include engineering construction establishments (NAICS 23711, 23712, 23731, 23799) due to the methodology used to derive the estimates.
2. Total employment of establishments that were considered to be in scope for the purposes of the survey.
3. Total revenues of establishments that were considered to be in scope for the purposes of the survey.
4. Revenues from environment-related construction services were derived from demand-side estimates of environmental protection expenditures.
Source:
Statistics Canada, 2004, *Environment Industry Survey: Business Sector, 2002*, Catalogue no. 16F0008XIE, Ottawa.

Research and development

In 2002/03, expenditures on research and development in the higher education sector reached approximately $7.4 billion (Table C.15). Forty-two percent ($3.1 billion) was spent in the natural sciences and engineering fields, 39% ($2.9 billion) in the health sciences and the remaining 19% ($1.4 billion) in the social sciences and humanities.

In 2002/03, federal spending on research and development aimed at pollution prevention and protection of the environment reached $315 million (Table C.16). This accounted for 7% of total federal research and development expenditures in 2002/03, and marks an increase of $166 million over the amount spent in 1995/96 on this objective. Additional expenditures on environmental research and development may be included in other socio-economic objective categories. For example, research on energy conservation may be included under “Production, distribution and rational utilization of energy”.

Table C.15
Research and development expenditures and source of funds in the higher education sector, 2002/03

Education sector	Total expenditures	Share of total	Source of funds: Federal government	Provincial governments	Business enterprise	Higher education	Private non-profit organizations	Foreign
	$ million		%					
Social sciences and humanities[1]	1 414.1	19.0	16.2	11.7	1.7	62.6	7.9	0.0
Health sciences[2]	2 929.1	39.4	25.7	8.5	8.9	42.9	12.7	1.4
Other natural sciences and engineering[3]	3 085.6	41.5	27.1	13.4	11.6	41.9	4.0	2.0
Total	**7 428.8**	**100.0**	**24.5**	**11.2**	**8.7**	**46.2**	**8.1**	**1.4**

Notes:
1. Social sciences embrace all disciplines involving the study of human actions and conditions and the social, economic and institutional mechanisms affecting humans. Included are such disciplines as anthropology, business administration and commerce, communications, criminology, demography, economics, geography, history, languages, literature and linguistics, law, library science, philosophy, political sciences, psychology, religious studies, social work, sociology, and urban and regional studies.
2. Health sciences consist of programmes directed towards the protection and improvement of human health.
3. Other natural sciences consist of disciplines, other than health sciences, concerned with understanding, developing or utilizing the natural world. Included are the engineering, mathematical and physical sciences.

Source:
Statistics Canada, 2004, *Science Statistics*, Catalogue no. 88-001-XIE, Vol. 28, no. 10, Ottawa.

Table C.16
Federal government research and development expenditures by socio-economic objective, 1995/96 to 2002/03

Socio-economic objective	1995/96		1996/97		1997/98		1998/99		1999/00		2000/01		2001/02		2002/03	
	Intra-mural	Extra-mural	Intra-mural	Extra-mural	Intra-mural	Extra-mural	Intra-mural	Extra-mural	Intra-mural	Extra-mural	Intra-mural	Extra-mural	Intra-mural	Extra-mural	Intra-mural	Extra-mural
	$ million															
Exploration and exploitation of the earth	161	42	186	39	178	25	179	29	186	99	207	46	125	69	141	59
Infrastructure and general planning of land use																
Transport	8	48	10	45	34	32	38	28	42	23	37	20	71	24	54	25
Telecommunications	64	4	34	9	33	21	32	35	24	34	28	15	44	23	48	24
Other	16	3	74	1	54	13	50	15	42	16	48	20	30	25	39	28
Pollution prevention and protection of the environment	99	50	96	45	97	73	98	83	122	88	143	112	142	148	174	141
Public health	37	305	76	306	80	282	87	318	103	390	116	519	152	709	186	866
Production, distribution and rational utilization of energy	201	63	273	64	209	57	170	65	171	68	187	64	248	117	214	75
Agricultural production and technology																
Agriculture	288	61	320	57	317	37	308	44	334	67	333	70	345	75	287	90
Fishing	51	4	37	4	30	8	42	10	43	13	51	14	47	15	55	16
Forestry	75	25	71	24	73	24	74	24	77	43	83	27	75	27	74	41
Industrial production and technology	64	295	104	326	119	429	123	406	137	398	165	518	164	741	189	657
Social structures and relationships	44	35	102	30	110	31	125	90	50	87	53	106	47	130	60	149
Exploration and exploitation of space	62	232	65	213	59	190	92	270	68	269	187	154	175	193	181	179
Non-oriented research	21	185	47	204	51	237	54	229	150	256	150	188	181	365	202	213
Other civil research	3	3	13	5	15	1	13	2	14	1	16	17	15	17	14	2
Defence	115	102	124	88	127	124	136	120	167	121	150	119	134	142	152	100
Other	289	232	4	97	3	74	4	68	4	57	3	62	5	67	5	72
Total	**1 598**	**1 689**	**1 636**	**1 557**	**1 588**	**1 659**	**1 627**	**1 835**	**1 734**	**2 030**	**1 957**	**2 070**	**2 000**	**2 887**	**2 075**	**2 737**

Notes:
The research and development intramural expenditures are managed and carried out primarily by federal government employees. Non-program (indirect costs) are excluded.
The management and conduct of the research and development extramural expenditures are entrusted to a non-federal organization.

Sources:
Statistics Canada, 1999, *Science Statistics*, Catalogue no. 88-001-XIB, Vol. 23, no. 5, Ottawa.
Statistics Canada, 2000, *Science Statistics*, Catalogue no. 88-001-XIB, Vol. 24, no. 5, Ottawa.
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