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Human Activity and the Environment

Economy and the environment

2011

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.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0s	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
*	significantly different from reference category ($p < 0.05$)

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Highlights

Human Activity and the Environment 2011: Economy and the environment, presents information on the relationship between Canada's economy and the environment. Statistics on Canada's environment are first looked at from an international perspective and are then presented for the following main themes: natural wealth, natural resource stocks, flows of energy and materials and environmental protection efforts.

Natural wealth

- In 2009, Canada's natural wealth—the dollar value of selected natural resource stocks and land—stood at $3 trillion.
- From 2005 to 2009, natural wealth per capita averaged about $89,000; over the same period produced wealth stood at $121,000 per capita.

Natural resource stocks

- Stocks of crude bitumen increased eight-fold between 1990 and 2008.
- From 1971 to 2004, water yield decreased an average of 3.5 km^3 per year in Southern Canada, which is equivalent to an overall loss of 8.5% of the water yield over this time period.
- Settled areas in Canada grew by 14.1% between 2001 and 2006, moving from 14,040 km^2 to 16,020 km^2.

Energy use and greenhouse gases (GHG)

- Between 1990 and 2007, GHG emissions resulting from household consumption increased 15% to 329 megatonnes. Households accounted for 45% of Canadian GHG emissions in 2007.

Environmental protection efforts

- In 2011, 9.8% of Canada's land and freshwater area was considered protected.
- The largest proportions of land and freshwater areas protected are found in the North.
- In 2008, Canadians sent 777 kg of waste per capita for disposal on average, representing a rise of 1.1% over 2002.
- Waste diversion and recycling activities have been on the rise in Canada. Nationally, diversion rates rose from 21.6% in 2002 to 24.7% in 2008.
- Businesses operating in Canada spent $9.1 billion in 2008 to protect the environment, up 5.3% from 2006.
- Of households with thermostats almost half (49%) had programmable ones in 2009. Slightly more than six out of ten households (61%) that had a thermostat lowered the temperature during the winter while they slept.
- Sixty-three percent of Canadian households had a low-flow shower head in 2009 while 42% had a low-volume toilet.

Related products

Selected publications from Statistics Canada

11-526-S	Households and the Environment: Energy Use
11-526-X	Households and the Environment
16-001-M	Environment Accounts and Statistics Analytical and Technical Paper Series
16-002-X	EnviroStats
16-257-X	Environment Accounts and Statistics Product Catalogue
16-505-G	Concepts, Sources and Methods of the Canadian System of Environmental and Resource Accounts
16F0006X	Environmental Protection Expenditures in the Business Sector
16F0023X	Waste Management Industry Survey: Business and Government Sectors

Selected technical and analytical products from Statistics Canada

16-001-M2008005	Canadian Industry's Expenditures to Reduce Greenhouse Gas Emissions
16-001-M2008006	Controlling the Temperature in Canadian Homes
16-001-M2009007	The Water Yield for Canada As a Thirty-year Average (1971 to 2000): Concepts, Methodology and Initial Results
16-001-M2009010	Drinking Water Decisions of Canadian Municipal Households
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16-001-M2010012	Greenhouse Gas Emissions from Private Vehicles in Canada, 1990 to 2007
16-001-M2010013	Recycling by Canadian Households, 2007
16-001-M2010014	Using a Trend-cycle Approach to Estimate Changes in Southern Canada's Water Yield from 1971 to 2004
16-002-X200800210623	Canadian industry's expenditures to reduce greenhouse gas emissions
16-002-X200800310684	Thermostat use in Canadian homes
16-002-X200800310686	Who uses water-saving fixtures in the home?

16-002-X200800410749	Greenhouse gas emissions: a focus on Canadian households
16-002-X200800410752	Households' use of water and wastewater services
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- *Capital expenditures on pollution abatement and control (end-of-pipe) by medium and industry*
- *Capital expenditures on pollution prevention by medium and industry*
- *Expenditures on environmental protection by industry and activity*

Section 1

Introduction

Human Activity and the Environment 2011: Economy and the environment gathers together statistics describing the relationship between Canada's economy and environment. The report starts with a discussion of how the economy and the environment can be linked in conceptual terms (Section 2). It then presents Canada's environment in the international context (Section 3). Sections 4, 5 and 6 highlight Canada's endowment of natural resources and underline their role in our economy with statistics on timber, energy, minerals, land and fresh water. Section 7 focuses on the flow of materials and energy between the economy and the environment with statistics on the intensity of energy use and resulting greenhouse gas emissions. Finally, Section 8 presents a selection of statistics on what households, businesses and governments are doing to reduce their impact on the environment.

Section 2

Linking the environment and the economy

The economy and environment are closely linked. Canada benefits from rich endowments of forests, cropland, fresh water, wildlife and other environmental features. These endowments are increasingly seen as a form of natural wealth with real value[1] to the economy.[2] This value might be financial, in the sense that it can be measured in dollars and cents. Or it might simply be the value that humans place on the environment because they believe it has worth. Either way, the environment today is understood to be fundamentally linked to the economy and its success.

This understanding has led, in turn, to new ways of measuring the environment. Much effort is devoted to measuring the key environmental **stocks** that support economic activities and the related **flows** of materials between the environment and the economy that impact these stocks. This measurement is sometimes carried out using monetary units, where and when value can be meaningfully defined in financial terms. Even when this is possible, measurement in physical terms first is essential. And when monetary values are not meaningful, physical measurement is the only possibility.

The environment is seen to comprise three key stocks: land, non-renewable natural resources and ecosystems. All three provide essential flows into the economy. Land is important primarily because of the space that it provides for economic activities to take place. Non-renewable resources—minerals, oil, natural gas, coal and other sub-soil stocks—are important because they are sources of key raw materials and energy needed to create the goods and services that are traded in the economy. Ecosystems are the most complex of the three and, so, deserve a fuller description.

"An ecosystem is a system in which the interaction between different organisms and their environment generates a cyclic interchange of materials and energy."[3] Ecosystems can also be defined as biological communities that are hierarchical, integrated, dynamic and self-sustaining. They can be divided into three major groups: terrestrial, freshwater and marine. Each is further subdivided according to the unique features that it comprises. For example, terrestrial ecosystems may be divided into forest, grassland, tundra, desert and alpine ecosystems.

Ecosystems are immensely diverse. They can be as small as a wetland beside a river or as large as the Amazon rainforest. They provide many flows into the economy. Some are flows of material goods, such as timber from forests and water from rivers, lakes and aquifers. Other flows are not material in nature, but are the beneficial outcomes—or services—that are the result of important ecosystem functions; examples include water purification, absorption of pollutants and climate regulation. A more complete listing of ecosystem goods and services is provided in Table 2.1.

Thinking of the environment in terms of stocks and flows aligns very well with the broad concept of sustainability. Stocks of land, resources and ecosystems are an important part of what should be passed on to future generations so that economic production and consumption—not to mention the environment itself—may continue (see **Text box: Economic production**- for a fuller discussion).

1. The World Bank, 2006, *Where Is the Wealth of Nations? - Measuring Capital for the 21st Century*, *http://siteresources.worldbank.org/INTEEI/214578-1110886258964/20744844/Introduction.pdf* (accessed March 11, 2011).
2. It is important to note that value to the economy is far from the only reason humans might value the environment. Equally or more important is the value humans ascribe to it because of its "inherent" worth.
3. United Nations Statistics Division, Department for Economic and Social Information and Policy Analysis, 1997, "Glossary of Environment Statistics," *Studies in Methods*, Series F, No. 67, New York.

Economic production

Economic production is a function of three key factors: labour, capital services and environmental inputs. In turn, each of these factors is a function of an underlying stock. Labour is a function of the population and its characteristics (level of health and education, age distribution, etc.). Capital services are a function of stocks of produced and financial capital employed by the population. Environmental inputs are functions of the stocks of land, non-renewable resources and ecosystems found within the country. The size of each of these stocks is what determines the possibilities for production (and income generation) now and in the future.

While labour and capital services were considered the primary determinants of production traditionally in economics, the contemporary view is that environmental stocks are a third and equally significant determinant. All these stocks are subject to deterioration over time and must be maintained if production is to be sustainable. In the cases of labour and capital services, maintenance requires investments in health and education for the population and replacement of worn-out machinery, equipment, and so forth. For environmental stocks, maintenance implies the need to restrict environmental flows to levels that will not result in long term and permanent declines of their availability (or the availability of substitutes).

Statistics Canada publishes three sets of statistics[4] that help shed light on the links between the environment and the economy. These statistics cover the following:

- The quantities (in physical and monetary terms) of environmental stocks as well as changes in these stocks due to natural or economic processes. These statistics cover land, non-renewable natural resources and ecosystems.

- The flows of material and energy between the economy and the environment. These statistics cover flows related to the activities of businesses, governments and households and measure both the flows into the economy from the environment (for example, raw materials) and the flows in the opposite direction (for example, pollution).

- Spending by businesses, government and households for the purpose of protecting the environment.

Many of the statistics presented in the remainder of this report are taken from these three sets.

4. These sets of statistics are more formally known as environmental accounts. For more information, please refer to Statistics Canada, 2006, *Concepts Sources and Methods of the Canadian System of Environmental and Resource Accounts*, Catalogue no. 16-505-G.

Table 2.1
Ecosystem goods and services

Ecosystem service	Ecosystem function	Examples of services
Atmospheric stabilization	Stabilization of atmospheric chemical composition	CO_2/O_2 balance, stratospheric ozone, SO_2 levels
Climate stabilization	Regulation of global temperature, precipitation and other climate processes affected by land use	Greenhouse gas production, cloud formation
Disturbance avoidance	Integrity of ecosystem responses to environmental fluctuations	Storm protection, flood control, drought recovery and how vegetation structure helps control environmental variability
Water stabilization	Stabilization of hydrological flows	Supply water for agriculture use (irrigation), industrial use or transportation
Water supply	Storage and retention of water	Water storage by watersheds, reservoirs and aquifers
Erosion control and sediment retention	Retention of soil within an ecosystem	Prevention of soil loss by wind, runoff, other processes, storage of silt in lakes,wetlands, drainage
Soil formation	Soil formation process	Weathering of rock and accumulation of organic material
Nutrient cycling	Storage, internal cycling, processing and acquisition of nutrients	Nitrogen fixation, nitrogen/phosphorus, etc. nutrient cycles
Waste treatment	Recovery of mobile nutrients and removal or breakdown of excess nutrients and compounds	Waste treatment, pollution control, detoxification
Pollination	Movement of floral pollinators	Providing pollinators for plants
Biological control	Regulation of pest populations	Predator control of prey species
Habitat	Habitat for resident and transient populations	Nurseries, habitat for migratory species, regional habitats for locally harvested species, wintering grounds
Raw materials	Natural resource primary production	Lumber, fuels, fodder, crops, fisheries
Genetic resources	Sources of unique biological materials and products	Medicine, products for materials, science, genes for plant resistance and crop pests, ornamental species
Recreation	Provides opportunities for recreation	Ecotourism, sportfishing, swimming,boating, etc.
Cultural	Opportunities for non-commercial uses	Aesthetic, artistic, education, spiritual, scientific, aboriginal sites

Source(s): Sauer, A., 2002, *The Values of Conservation Easements* discussion paper, World Resources Institute, presented by West Hill Foundation for Nature, December 1, 2002. Costanza, R., R. D'Arge, R. de Groot, S. Farber, M. Grasso, B. Hannon, K. Limburg, S. Naeem, R.V. O'Neill, J. Paruelo, R.G. Raskin, P. Sutton and M. van den Belt, 1997, "The value of the world's ecosystem services and natural capital," *Nature,* Vol. 387, pages 253 to 260. From Olewiler, N., 2004, *The Value of Natural Capital in Settled Areas of Canada*, published by Ducks Unlimited and the Nature Conservancy of Canada, 36 pages.

Section 3

Canada's environment in the international context

Every country has natural endowments. Table 3.1 and Map 3.1 place Canada's environment in the international context using a few basic statistics. As can be seen, Brazil—with its rainforests containing more plant and animal species and habitats than any other nation—is the most biologically diverse country in the world according to the Global Environmental Facility biodiversity index (Table 3.1). It is followed by the United States and Australia. These countries all have broad ranges of plant and animal species and supporting habitats.

Canada, due to a colder climate, offers a more challenging habitat for plants and animals and supports fewer species as a result. Despite having the world's 2nd largest land area, Canada ranks 17th in terms of biological diversity potential.

Another important environmental stock is arable land, or land fit for the cultivation of crops. Arable land provides a nation with the capacity to provide food and other key materials. The United States has the world's largest supply of arable land with 12.3% of the global supply. In contrast, Canada, despite its larger land area, has 3.2% of the global stock.

Table 3.1
Natural capital endowments, for selected countries

	Population [1]	Land area	Selected indicators of natural capital									
			Arable land [2]		Global Environmental Facility (GEF) [3] biodiversity index		Renewable fresh water [4]		Forest area		Estimated value of natural capital [5] per capita	
	millions	km²		global rank	index value	global rank	km³ peryear	global rank	km²	global rank	$ U.S. per capita	global rank
World	**6,692**	**130,134,750**	**14,212,000**	**...**	**...**	**...**	**54,111**	**...**	**40,152,175**	**...**	**..**	**...**
Brazil	192	8,514,880	590,000	5	100.0	1	8,233	1	4,714,920	2	6,752	18
India	1,140	3,287,260	1,597,000	2	39.9	8	1,892	9	677,598	11	1,928	51
France	62	549,190	185,000	17	5.3	48	204	43	156,352	37	6,335	21
Canada	**33**	**9,976,183**	**457,000**	**7**	**21.5**	**17**	**3,472**	**3**	**3,101,340**	**3**	**34,771**	**1**
United States	304	9,632,030	1,744,000	1	94.2	2	3,051	4	3,034,070	4	14,752	5
China	1,326	9,598,090	1,433,000	3	66.6	6	2,830	6	2,054,056	5	2,223	46
Russian Federation	142	17,098,240	1,218,000	4	34.1	10	4,508	2	8,085,986	1	17,217	4
Mexico	106	1,964,380	250,000	11	68.7	5	457	25	637,172	13	8,493	14
Australia	21	7,741,220	494,000	6	87.7	3	492	21	1,632,912	6	24,167	3
South Africa	49	1,219,090	148,000	19	20.7	18	50	95	92,030	59	3,400	40

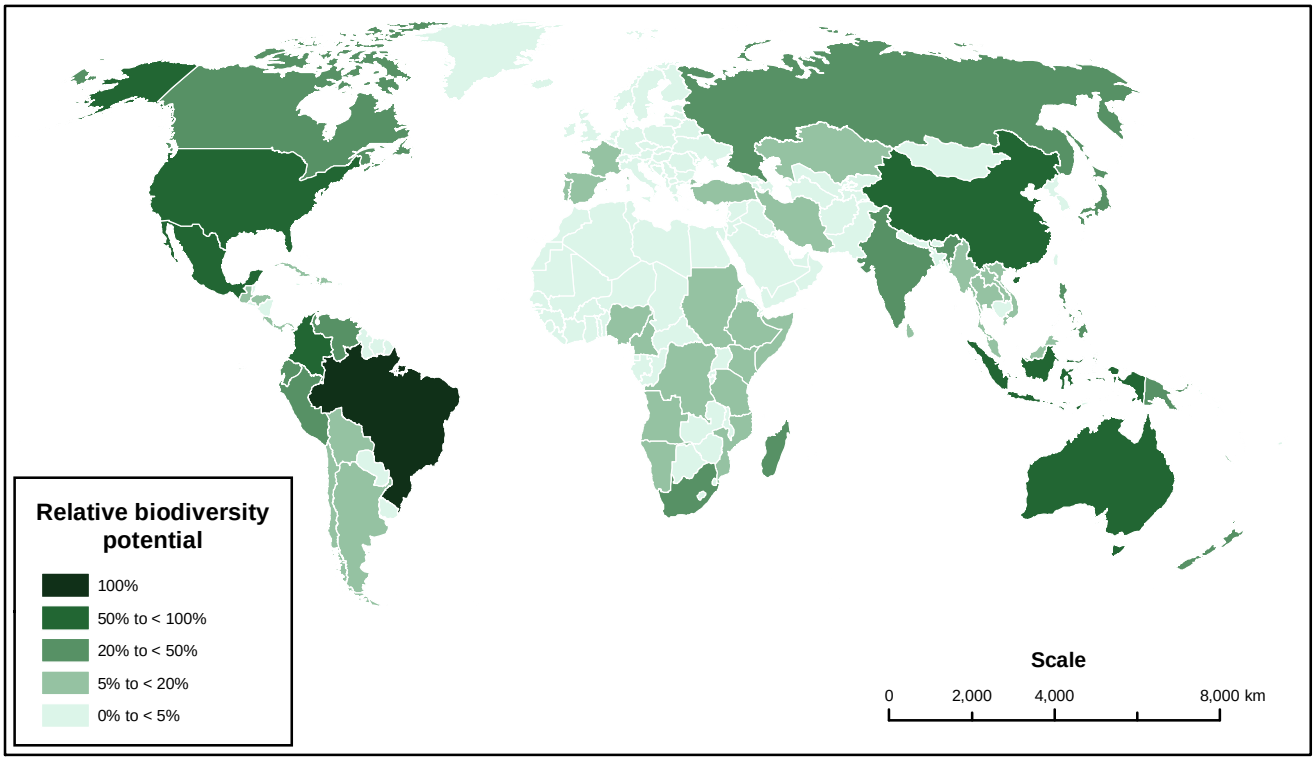
1. Population data are for 2008.
2. Arable land is land fit for cultivation of crops that are replanted after each harvest like wheat, maize, and rice. Arable land data are for 2005.
3. The Global Environmental Facility (GEF) is an international partnership that includes 10 agencies: the UN Development Programme, the UN Environment Programme, the World Bank, the UN Food and Agriculture Organization, the UN Industrial Development Organization, the African Development Bank, the Asian Development Bank, the European Bank of Reconstruction and Development, the Inter-American Development Bank, and the International Fund for Agricultural Development. (*www.thegef.org*) GEF biodiversity index is a composite index of relative biodiversity potential for each country based on the species represented in each country, their threat status, and the diversity of habitat types in each country. The index has been normalized so that values run from 0 (no biodiversity potential) to 100 (maximum biodiversity potential). GEF biodiversity data are for 2008.
4. Renewable water resource data are annual volumes listed in the United Nations AQUASTAT database for the period 2003 to 2007, with the exception of Canada, which is a long term average for 1971 to 2004. The estimate of world total renewable freshwater does not include the Antarctic or Greenland and a number of other small islands.
5. Value of natural capital is for the year 2000 and includes energy resources (oil, natural gas, hard coal, and lignite), mineral resources (bauxite, copper, gold, iron, lead, nickel, phosphate, silver, tin, and zinc), timber resources, non-timber forest resources, cropland, pastureland, and protected areas (recreational value, tourism and other existence values).

Source(s): Food and Agriculture Organization of the United Nations, n.d. (no date), *AQUASTAT Database Query*, *www.fao.org/nr/water/aquastat/data/query/index.html* (accessed April 27, 2010). Statistics Canada, Environment Accounts and Statistics Division, 2010, special tabulation. The World Bank, 2010, *World Development Report 2010*, Development and Climate Change, *http://siteresources.worldbank.org/INTWDR2010/Resources/5287678-1226014527953/WDR10-Full-Text.pdf* (accessed January 12, 2011). The World Bank, 2011, *Indicators - Data*, *http://data.worldbank.org/indicator* (accessed January 12, 2011).

Forests provide a wide variety of ecosystem services. Thirty-one percent of the earth's land area is covered by forest. The Russian Federation has the largest area of forest with 20% of the world's stock. Canada has approximately 8% of the world's forest land.

Table 3.1 also provides World Bank estimates of the value of natural wealth per capita for a selection of countries for the year 2000. According to these estimates, Canadians had the highest per capita natural wealth of any country in the world with U.S. $34,771 per person in 2000.

Map 3.1
Biodiversity potential, 2008



Note(s): GEF benefits index for biodiversity is a composite index of relative biodiversity potential for each country based on the species represented in each country, their threat status, and the diversity of habitat types in each country. The index has been normalized so that values run from 0 (no biodiversity potential) to 100 (maximum biodiversity potential).

Source(s): The World Bank, 2011, *Indicators - Data*, http://data.worldbank.org/indicator (accessed January 12, 2011).

Section 4

Natural wealth

In 2009, Canada's natural wealth—the dollar value of selected[1] natural resource stocks and land—stood at $2,998 billion (Chart 4.1 and Table 4.1).[2] From 2005 to 2009, natural wealth per capita averaged about $89,000; over the same period produced wealth[3] stood at about $121,000 per capita.[4]

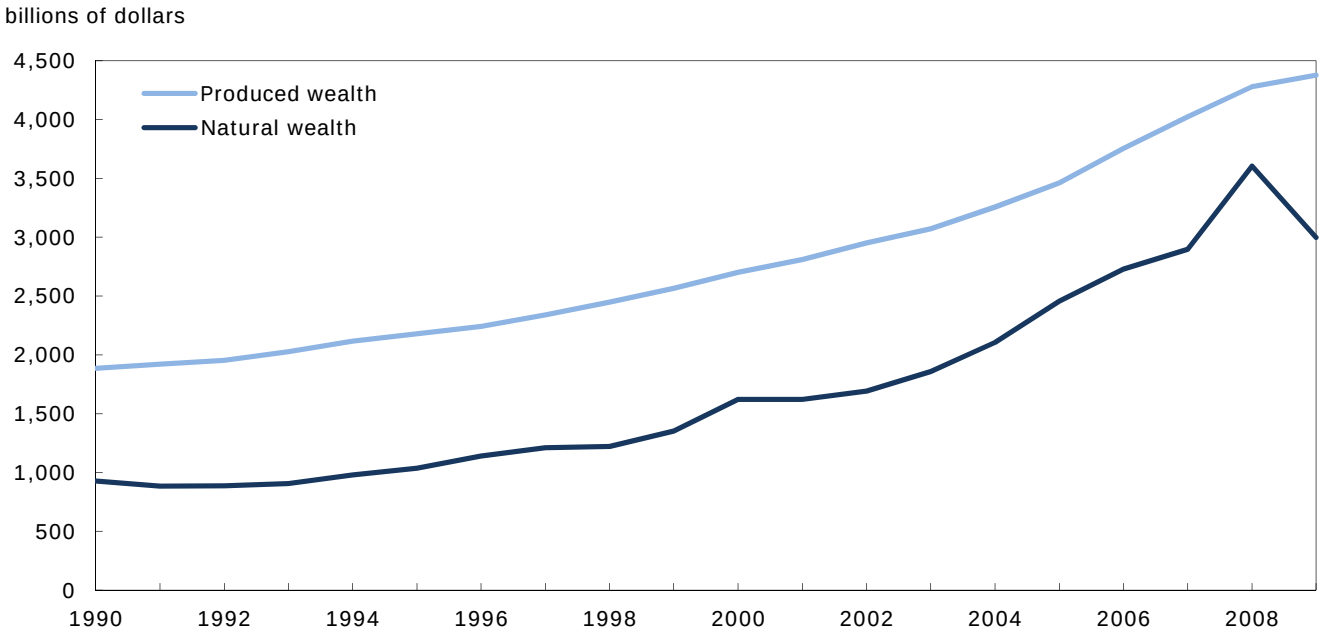
1. Energy resources (natural gas, crude oil, crude bitumen and coal), mineral resources (gold, nickel, copper, zinc, lead, iron, molybdenum, uranium, potash and diamonds) and timber. Other natural resource stocks, including water and fish, are not currently valued due to data limitations.
2. All natural wealth values are in current prices as opposed to constant prices.
3. Produced wealth includes residential and non-residential structures, machinery and equipment, consumer durables and inventories.
4. Statistics Canada, CANSIM tables 378-0005 and 051-0001 (accessed May 27, 2011).
5. Statistics Canada, CANSIM tables 378-0005 and 051-0001 (accessed May 27, 2011).

4.1 Natural wealth trends

Natural wealth fluctuates more than produced wealth over time. This is due to a variety of factors, primarily the volatility of natural resource prices on world markets. Most natural resource prices are driven by global demand and supply. As well, physical reserves of resources may change when prices change. For example, when the price of a resource increases, this often encourages greater exploration efforts which, in turn, can lead to more discoveries and ultimately an increase in reserves.

In 1990, natural wealth stood at $927 billion, or $33,000 per capita.[5] For the next two decades, the average annual growth rate of natural wealth was 6%, similar to that for produced wealth (5%) (Chart 4.1 and Table 4.1).

Chart 4.1
Produced wealth and natural wealth



Source(s): Statistics Canada, CANSIM table 378-0005 (accessed May 27, 2011).

4.2 Selected natural resource trends

Between 1990 and 2009, the value of selected natural resources declined several times: first, in the early 1990s as a result of a recession in North America; second, in 1998 in the wake of the East Asian financial crisis;[6] third, in the early 2000s during the economic slowdown that followed the events of September 11, 2001;[7] and most recently, in 2009 in the face of the global economic downturn.

In all other periods, the value of selected natural resource assets was buoyed by either increased reserves and/or increased prices fuelled by growing world demand. Notably, resource wealth exhibited sustained growth from 2003 to 2008 propelled by record growth in prices for energy and minerals. Increased demand from burgeoning economies such as China[8] played a large part in this price rise.

Since 2000, energy resources have contributed the most to the overall value of natural wealth, but they have also been subject to the most volatility (Chart 4.2).

Until 2004, timber resource wealth grew steadily—on average 4% per year. However, in recent years its value has been declining as the forest sector has faced a range of challenges, such as the downturn in the U.S. housing sector since 2006.[9]

Mineral resource wealth remained relatively constant from 1990 until 2002. From 2003 to 2008, the value of mineral assets grew significantly as a result of increased world prices of minerals resources. These higher prices have led to increased exploration and development and the discovery of new deposits.[10]

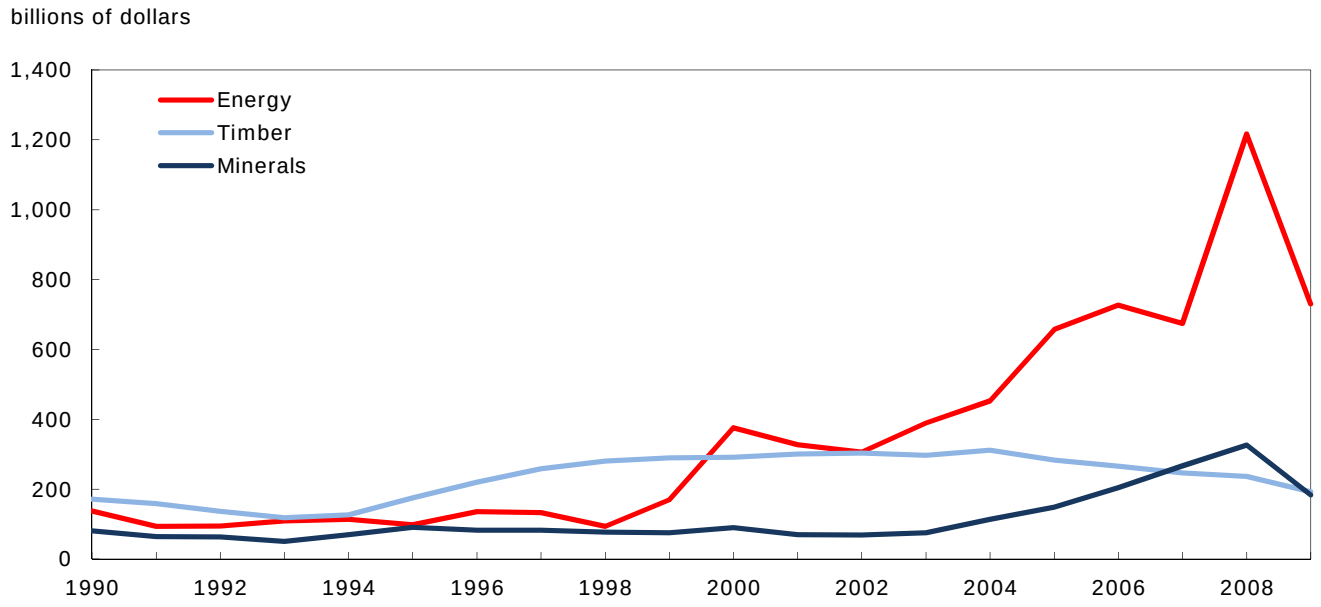
Table 4.1
Produced wealth and natural wealth

	Produced wealth	Natural wealth
	billions of dollars	
1975	523	274
1976	581	327
1977	644	361
1978	721	418
1979	823	541
1980	933	679
1981	1,055	687
1982	1,134	689
1983	1,185	749
1984	1,252	766
1985	1,335	749
1986	1,435	666
1987	1,546	741
1988	1,673	810
1989	1,801	899
1990	1,887	927
1991	1,922	885
1992	1,954	888
1993	2,027	907
1994	2,116	979
1995	2,179	1,038
1996	2,242	1,139
1997	2,340	1,212
1998	2,448	1,223
1999	2,566	1,352
2000	2,701	1,621
2001	2,811	1,623
2002	2,952	1,692
2003	3,072	1,858
2004	3,257	2,106
2005	3,460	2,456
2006	3,754	2,729
2007	4,024	2,897
2008	4,281	3,605
2009	4,378	2,998

Source(s): Statistics Canada, CANSIM table 378-0005 (accessed May 27, 2011).

6. International Monetary Fund, 1998, "Global Repercussions of the Asian Crisis and Other Issues in the Current Conjuncture," *World Economic Outlook*, *www.imf.org/external/pubs/ft/weo/weo0598/pdf/0598ch2.pdf* (accessed March 22, 2010).
7. International Monetary Fund, 2001, "The Global economy after September 11," *World Economic Outlook*, *www.imf.org/external/pubs/ft/weo/2001/03/index.htm* (accessed March 22, 2010).
8. Statistics Canada, 2007, *International Merchandise Trade Annual Review, 2006*, Catalogue no. 65-208-X.
9. Cross, P., 2009, "The impact of recessions in the United States on Canada," *Canadian Economic Observer*, Statistics Canada Catalogue no. 11-010-X, Vol 22, no 3.
10. Reed, A., 2007, "Canadian Reserves of Selected Major Metals, and Recent Production Decisions," *Canadian Minerals Yearbook, 2006*, Natural Resources Canada Catalogue no. M38-5/55E-PDF, *www.nrcan-rncan.gc.ca/mms-smm/busi-indu/cmy-amc/2006cmy-eng.htm* (accessed December 10, 2009).

Chart 4.2
Wealth from energy, timber and minerals



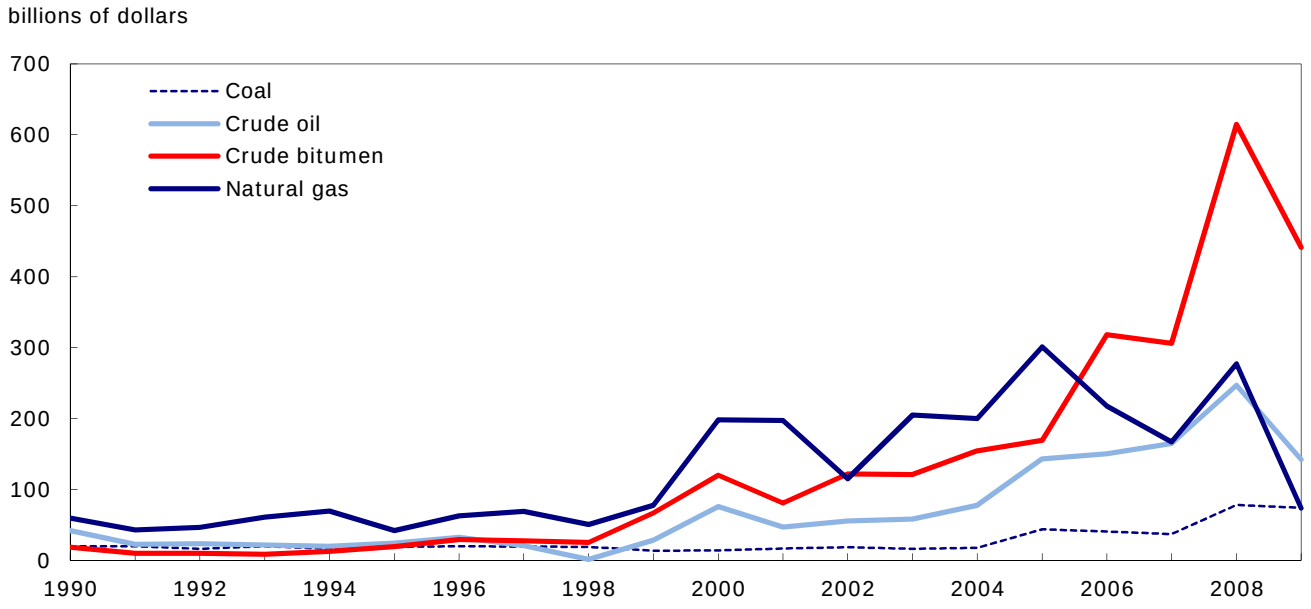
Source(s): Statistics Canada, CANSIM table 378-0005 (accessed May 27, 2011).

Until 2005, natural gas had the highest value among energy resources, which also include coal, crude oil, and crude bitumen.[11] However, since 2006, the wealth from oil sands has exceeded that from other energy resources, mainly on account of increased reserves (Chart 4.3).[12]

Canada's oil sands in Northern Alberta contain vast quantities of crude bitumen; they are one of the largest hydrocarbon deposits in the world. In 1990, the value of crude bitumen from oil sands represented $19 billion or 13% of energy resource wealth. In 2009, the value of crude bitumen reserves was $441 billion—more than the combined value of coal, crude oil and natural gas. In 1990, the oil sands reserves under active development stood at around 500 million m^3; by 2008 the reserves had increased to 4,300 m^3—an eight-fold increase (Chart 4.4). This large jump in reserves can be explained by improvements in crude bitumen extraction technology, combined with an increase in the global demand for crude oil. As technology improves and prices rise, oil sands deposits that were uneconomic become economically extractable.

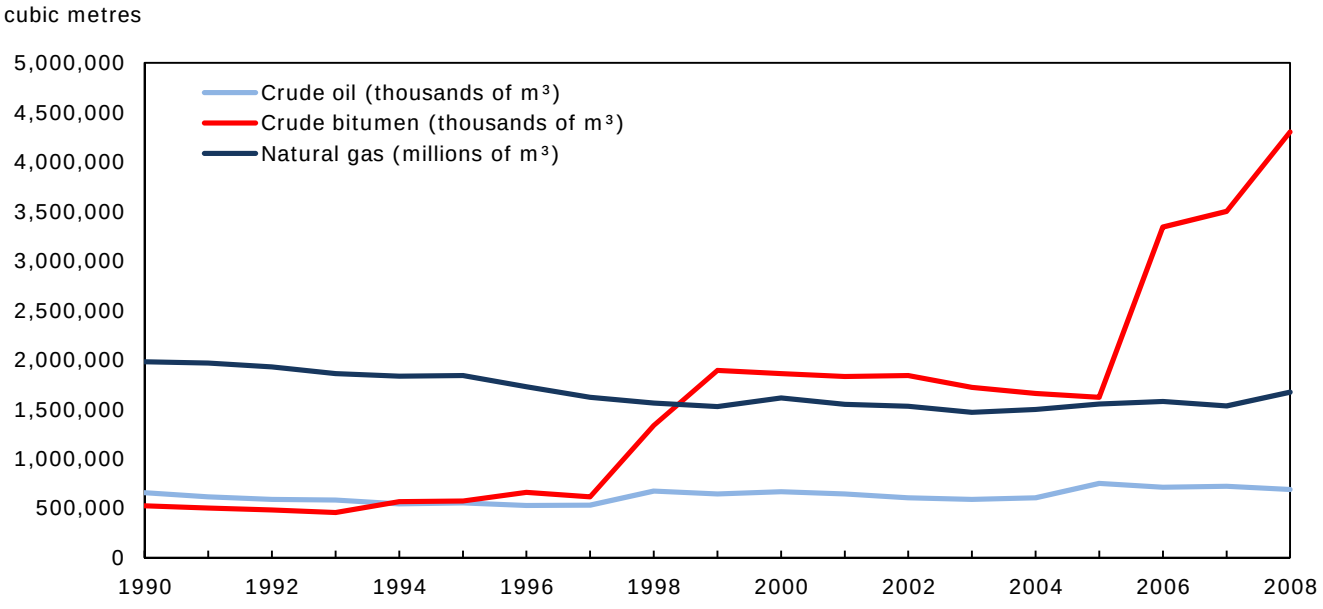
11. Crude bitumen is the hydrocarbon component of oil sands.
12. In 2006, estimates of oil sands reserves under active development doubled as compared to 2005. See Alberta Energy and Utilities Board, 2007, *Alberta's Energy Reserves 2006 and Supply/Demand Outlook 2007-2016,* Report no. ST 98-2007, table 2.1, *www.ercb.ca/docs/products/STs/st98-2007.pdf* (accessed September 14, 2009).

Chart 4.3
Value of energy resource stocks



Source(s): Statistics Canada, Environment Accounts and Statistics Division.

Chart 4.4
Stocks of selected energy assets



Source(s): Statistics Canada, CANSIM Tables 153-0012, 153-0013 and 153-0014 (accessed February 11, 2011).

Section 5

Water resources

Canada's abundant water resources have shaped our economic activities in many ways. Our rivers and lakes have provided access to the country's interior, enabling its early exploration and the development of a rich fur trade. Today, the Great Lakes continue to provide a high-capacity shipping route for the extraction of natural resources (such as wheat, iron, coal). Also of note is the fact that the majority of the electricity produced in Canada comes from hydro electric stations.

The measurement of water in the environment is challenging. Given the size of the country and its geography, an estimate of the total quantity of water accumulated in lakes, rivers, aquifers and other stocks is impractical and not particularly meaningful. This is all the more true since water is always on the move. The measurement of water is therefore undertaken differently from other natural resources, focussing on flows rather than stocks.

The measurement of water flows is meaningful and useful, as they represent the water that replenishes the stocks of water contained in our lakes, rivers and aquifers. Year-to-year fluctuations in flows reflect natural variability stemming from a variety of climatic and geographic variables, including precipitation, temperature, soil moisture, land cover and land use. Human-induced variability due to withdrawal and consumption also affect water flows.

The flow estimates presented here are referred to as the "water yield for Canada."

The average annual water yield for Canada between 1971 and 2004 was 3,472 km^3 (Table 5.1). To put this in perspective, this amounts to almost as much water as there is in Lake Huron (3,540 km^3) and is enough to cover the full extent of Canada's landmass to a depth of 350 mm of water. This abundance, however, is distributed unequally across the country (Table 5.1). Generally, drainage regions[1] on the Pacific coast, northern Quebec and the Atlantic coast have the highest average water yields. Drainage regions in the Prairies and north of the Prairies produce the least water. Furthermore, areas of abundant water do not correspond with the highly populated regions of the country—98% of Canadians live in the southern part[2] of the country, but this area yields only 38% of our water renewals on average.

Average water yield represents the amount of water that is expected to be renewed each year based on long-term trends.[3] There are, of course, significant variations in the amount of water that is actually renewed each year (Chart 5.1). A trend analysis is therefore a useful tool to understand water yield over time.

Annual water yield from 1971 to 2004 in southern Canada was estimated by interpolating unregulated streamflow observations.[4] National estimates cannot be derived because of insufficient data in the North.

Analysis of the water yield trend cycle[5] shows that water yield in the southern portion of Canada decreased on average by 3.5 km^3 per year from 1971 to 2004, which is equivalent to an overall loss of 8.5% of the water yield over this time period. This average annual decrease of 3.5 km^3 is almost as much as the 3.8 km^3 of water that is supplied to the residential population of Canada in a year.[6]

1. Drainage regions are the spatial units used to estimate water yield for Canada. For more detail please see Statistics Canada, 2010, *Human Activity and Environment 2010: Freshwater in Canada*, Catalogue no. 16-201-X201000011295, Section 2.
2. Niven C., and H. Puderer, 2000, "Delineation of Canada's North: An Examination of the North-South Relationship in Canada," *Geography Working Paper Series*, Statistics Canada Catalogue no. 92F0138M.
3. It should be noted that the length of the time series presented here (1971 to 2004) remains short by hydrological standards.
4. Bemrose, R., P. Meszaros, B. Quenneville, M. Henry, L. Kemp and F. Soulard, 2010, "Using a Trend-Cycle Approach to Estimate Changes in Southern Canada's Freshwater Yield, from 1971 to 2004," *Environment Accounts and Statistics Analytical and Technical Paper Series*, Statistics Canada Catalogue no. 16-001-M2010014.
5. The linear trend fitted to the smoothed trend in the annual water yield data.
6. Statistics Canada, 2010, *Human Activity and the Environment 2010: Freshwater supply and demand in Canada*, Catalogue no. 16-201-X201000011295, Table *3.1*.

Table 5.1
Average annual water yield by drainage region, 1971 to 2004

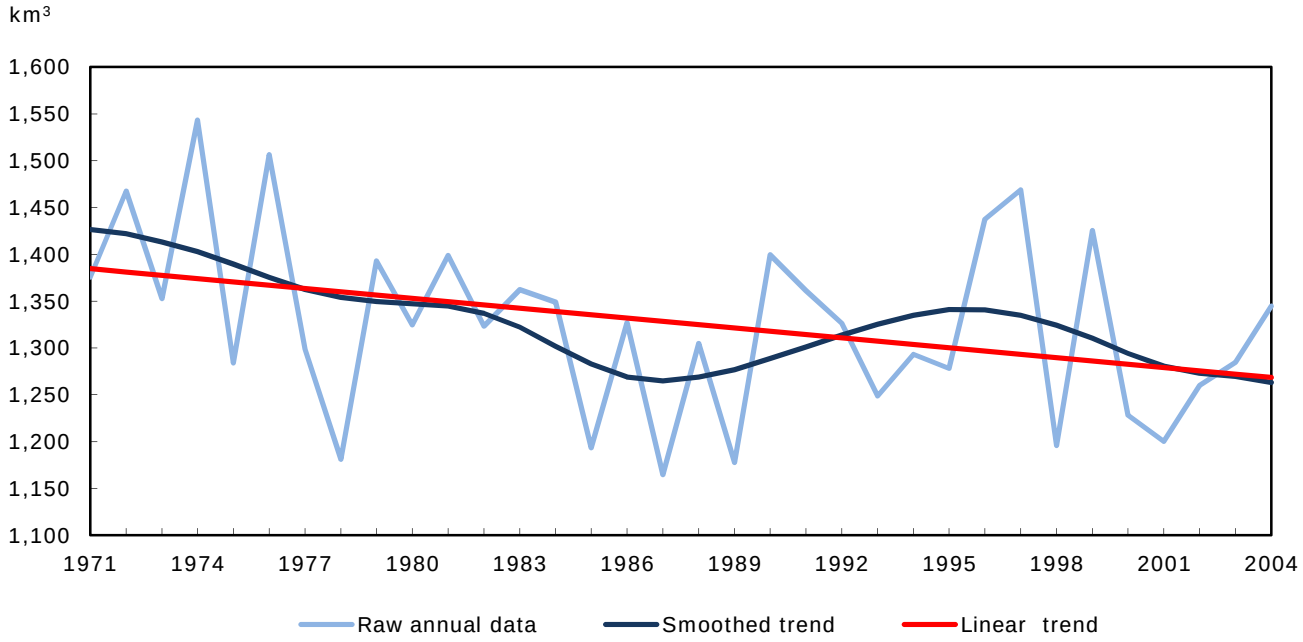
	Drainage region code	Water yield	
		Volume [1]	Volume per unit area
	code	km^3	m^3 per m^2
Canada		**3,472.3**	**0.348**
Pacific Coastal	1	513.7	1.536
Fraser–Lower Mainland	2	128.6	0.552
Okanagan–Similkameen	3	4.2	0.270
Columbia	4	67.7	0.776
Yukon	5	106.0	0.318
Peace–Athabasca	6	99.9	0.206
Lower Mackenzie	7	246.3	0.185
Arctic Coast–Islands	8	231.3	0.131
Missouri	9	0.5	0.019
North Saskatchewan	10	10.2	0.068
South Saskatchewan	11	9.6	0.054
Assiniboine–Red	12	6.9	0.036
Winnipeg	13	25.4	0.236
Lower Saskatchewan–Nelson	14	47.6	0.132
Churchill	15	49.4	0.158
Keewatin–Southern Baffin Island	16	192.0	0.204
Northern Ontario	17	199.2	0.288
Northern Quebec	18	516.3	0.549
Great Lakes	19	133.1	0.419
Ottawa	20	62.6	0.428
St. Lawrence	21	71.3	0.600
North Shore–Gaspé	22	292.2	0.792
Saint John–St. Croix	23	29.2	0.697
Maritime Coastal	24	103.6	0.849
Newfoundland–Labrador	25	325.4	0.856

1. The water yield estimates are 34-year annual averages (1971 to 2004), with the exception of those estimates for drainage regions 5, 7, 16, 17, 18 and the Labrador portion of 25 which are based on 20 years of data (1975 to 1996); and drainage region 8 which is based on a 23-year annual average (1972-1994) for the Arctic Archipelago (Spence and Burke 2008), and on a 20-year annual average (1975 to 1996) for the remaining area.

Note(s): Data were derived from discharge values contained in Environment Canada, 2010, Water Survey of Canada, Archived Hydrometric Data (HYDAT) (*www.wsc.ec.gc.ca/hydat/H2O/index_e.cfm?cname=main_e.cfm*).

Source(s): Spence C., and A. Burke, 2008, "Estimates of Canadian Arctic Archipelago Runoff from Observed Hydrometric Data," *Journal of Hydrology*, Vol. 362, pages 247 to 259. Statistics Canada, Environment Accounts and Statistics Division, 2010, special tabulation.

Chart 5.1
Trends in water yield for Southern Canada



Note(s): The North-line is a statistical area classification of the North based on 16 social, biotic, economic and climatic variables that delineates the North from the South in Canada.

Source(s): McNiven C., and H. Puderer, 2000, "Delineation of Canada's North: An Examination of the North-South Relationship in Canada," Geography working Paper, Statistics Canada Catalogue no. 92F0138M2000003. Statistics Canada, Environment Accounts and Statistics Division, 2010, special tabulation.

Section 6

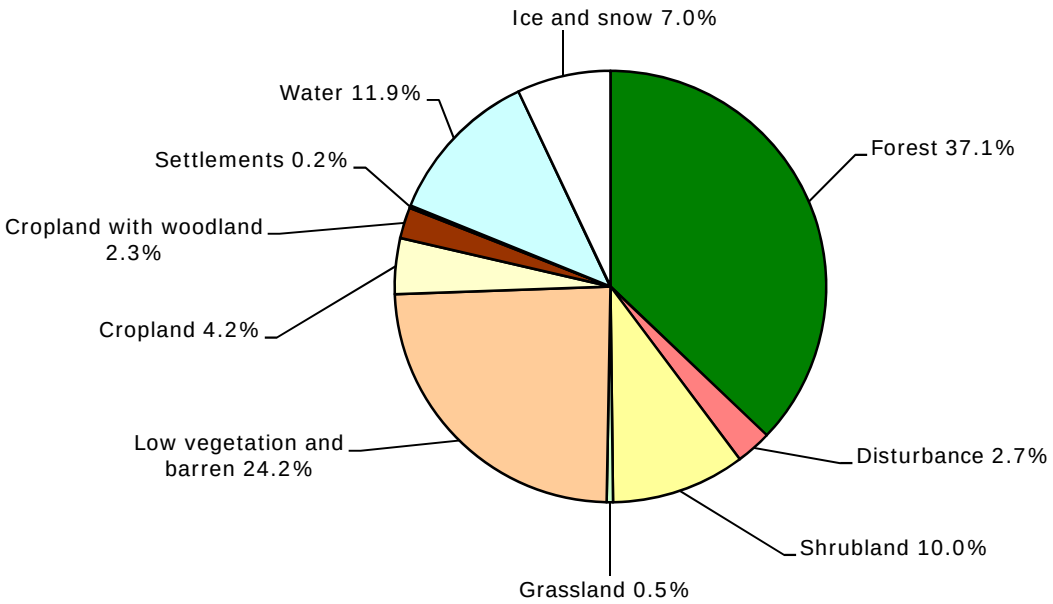
Land resources

6.1 Land cover and terrestrial ecosystems

Canada is the second largest country in the world with a total area of 9,976,183 km^2 (Table 3.1). It is largely covered by forest (37%), tundra[1] (24%) and fresh water (12%). The remainder is covered by land of various types (Chart 6.1). Canada's land base and the ecosystems that it supports provide many ecological goods and services (Table 2.1). These range from land for communities and businesses to build upon to flood prevention and water purification. Map 6.1 outlines Canada's 15 terrestrial ecozones and depicts the range of land-cover types found within each ecozone. The bulk of Canada's grassland and cropland is located in the Prairie ecozone, while the Boreal and Taiga shields contain 49% of the country's forested area (Table 6.1).

1. Land covered with low vegetation and barren land.

Chart 6.1
Canada's land cover, 2006



1. 'Disturbance' refers to forest disturbance, which can be caused by changes in forest structure or composition resulting from natural events such as fire, flood or wind; mortality caused by insect or disease outbreaks; or human-caused events such as forest harvesting.

Note(s): Figures may not add up to totals due to rounding.

Source(s): Agriculture and Agri-Food Canada and Environment Canada, 2005, *A National Ecological Framework for Canada*, *http://sis.agr.gc.ca/cansis/nsdb/ecostrat/gis_data.html* (accessed January 13, 2009). Latifovic, Rasim and Darren Pouliot, 2005, "Multi-temporal land cover mapping for Canada: Methodology and Products," *Canadian Journal of Remote Sensing*, Vol. 31, no. 5, pages 347 to 363. Statistics Canada, Environment Accounts and Statistics Division, 2010, special tabulation.

Table 6.1
Land cover by ecozone, 2006

	Forest	Disturbance[1]	Shrubland	Grassland	Low vegetation and barren	Cropland	Cropland with woodland	Settlements	Water	Ice and snow	Total[2]
	thousands of square kilometres										
Total	**3,702**	**267**	**1,001**	**48**	**2,411**	**418**	**233**	**16**	**1,184**	**698**	**9,976**
Arctic Cordillera	0	0	0	0	57	0	0	0	11	177	246
Northern Arctic	2	0	9	0	937	0	0	0	158	416	1,521
Southern Arctic	52	1	38	0	596	0	0	0	151	13	852
Taiga Plains	373	29	122	0	43	0	1	0	88	0	657
Taiga Shield	498	73	123	0	428	0	0	0	271	0	1,393
Boreal Shield	1,328	86	182	0	33	2	8	2	277	0	1,918
Atlantic Maritime	166	1	3	0	0	8	12	1	10	0	201
Mixed Wood Plains	27	1	3	0	0	18	54	7	60	0	170
Boreal Plains	405	24	84	0	2	91	62	1	72	0	740
Prairies	4	0	4	46	0	296	90	3	23	0	466
Taiga Cordillera	24	9	82	0	140	0	0	0	3	10	267
Boreal Cordillera	191	18	135	0	92	0	0	0	11	24	471
Pacific Maritime	89	3	47	0	14	1	0	2	14	39	209
Montane Cordillera	305	11	75	2	55	2	5	1	15	19	490
Hudson Plains	238	12	95	0	14	0	0	0	16	0	376

1. 'Disturbance' refers to forest disturbance, which can be caused by changes in forest structure or composition resulting from natural events such as fire, flood or wind; mortality caused by insect or disease outbreaks; or human-caused events such as forest harvesting.
2. These figures were estimated using Agriculture and Agri-Food Canada's National Ecological Framework 1:1,000,000 base.

Note(s): Figures may not add up to totals due to rounding.

Source(s): Agriculture and Agri-Food Canada and Environment Canada, 2005, *A National Ecological Framework for Canada*, *http://sis.agr.gc.ca/cansis/nsdb/ecostrat/gis_data.html* (accessed January 13, 2009). Latifovic, Rasim and Darren Pouliot, 2005, "Multi-temporal land cover mapping for Canada: Methodology and Products," *Canadian Journal of Remote Sensing*, Vol. 31, no. 5, pages 347 to 363. Statistics Canada, Environment Accounts and Statistics Division, 2010, special tabulation.

Map 6.1
Land cover, 2006

Source(s): Agriculture and Agri-Food Canada and Environment Canada, 2005, A National Ecological Framework for Canada, http://sis.agr.gc.ca/cansis/nsdb/ecostrat/gis_data.html (accessed January 13, 2009). Latifovic, Rasim and Darren Pouliot, 2005, "Multi-temporal land cover mapping for Canada: Methodology and Products," Canadian Journal of Remote Sensing, vol. 31, no. 5, pages 347 to 363. Statistics Canada, Environment Accounts and Statistics Division, 2010, special tabulation.

6.2 Settlements

Settlements can be defined as tracts of land where humans have altered the physical environment by constructing residential, commercial and institutional buildings and the associated infrastructure of roads and public spaces. Settlements include cities, towns, villages and other dense concentrations of human population.[2]

In 2006, Canada had a total settled area of just over 16,020 km^2 (Table 6.2). The largest settlements were located in Ontario, Quebec, British Columbia and Alberta, accounting for 84% of the settled area in Canada.

As Canada's population grows, so does the size of its settled areas. Between 2001 and 2006, settled areas grew in size by 14.1%. The demand for new land for buildings, transportation and other uses is highest adjacent to densely populated areas such as the Quebec City–Windsor corridor, Vancouver and the Calgary-Edmonton corridor. Between 2001 and 2006, Alberta led all provinces in terms of settlement growth, with an increase of over 24%.

6.3 Land and the economy

The agriculture and forestry industries are the two largest land-based primary economic activities in Canada. Both contribute significantly to the economy and create jobs not only in the primary sector, but also in the secondary and tertiary sectors. In 2009, employment in the agriculture and food products industries was more than 552,300 persons, while the forest products industries employed 134,000. In 1961, the agriculture and food products industries generated 8.3% of GDP; by 2007 this share of GDP had declined to just under 3% (Table 6.3).

In 1961, forest products industries contributed 4.8% to GDP (Table 6.4). By 2007, the industry's share of GDP had declined to 1.7%.

2. Hofmann, N., A. Elgarawany, H. Larocque, G. Filoso and T. Dennis, "A new research project on Canadian settlements: initial geographic results," *EnviroStats*, Statistics Canada Catalogue no. 16-002-X201000111134, Vol. 4, no. 1.

Table 6.2
Settlement area by province, 2001 and 2006

	Total 2001	Total 2006	Change 2001 to 2006	Change 2001 to 2006
	square kilometres			percentage
Canada	**14,040**	**16,020**	**1,980**	**14.1**
Newfoundland and Labrador	279	311	33	11.7
Prince Edward Island	54	67	12	22.5
Nova Scotia	444	516	72	16.2
New Brunswick	364	425	62	17.0
Quebec	2,831	3,190	359	12.7
Ontario	4,901	5,556	655	13.4
Manitoba	577	643	65	11.3
Saskatchewan	534	605	71	13.3
Alberta	1,789	2,220	430	24.0
British Columbia	2,223	2,437	214	9.6
Yukon Territory	23	26	3	14.2
Northwest Territories	20	22	3	15.0
Nunavut	2	2	1	30.2

Note(s): Figures may not add up to totals due to rounding.
Source(s): Statistics Canada, Environment Accounts and Statistics Division, 2010, special tabulation.

Table 6.3
Gross domestic product of agriculture and food industries

	Total gross domestic product	Agriculture and food industries				
		Crop and animal production	Food manufacturing [1]	Beverage and tobacco product manufacturing	Total	Share of total gross domestic product
	millions of current dollars					percent
1961	38,301	1,743	1,002	431	3,176	8.29
1971	90,792	2,913	1,901	871	5,685	6.26
1981	338,521	10,668	5,628	2,209	18,505	5.47
1991	636,082	11,981	11,600	4,091	27,672	4.35
2001	1,032,172	15,186	16,434	5,472	37,092	3.59
2002	1,068,765	14,630	16,345	5,878	36,853	3.45
2003	1,128,796	15,349	17,297	6,258	38,904	3.45
2004	1,201,306	17,101	17,718	6,688	41,507	3.46
2005	1,280,550	14,629	18,512	6,773	39,914	3.12
2006	1,354,353	13,904	19,291	7,089	40,284	2.97
2007	1,430,770	15,802	20,014	6,500	42,316	2.96

1. Food manufacturing excludes seafood product preparation and packaging.
Source(s): Statistics Canada, CANSIM tables 379-0023 and 379-0024 (accessed March 14, 2011).

Table 6.4
Gross domestic product of forestry and forest products industries

	Total gross domestic product	Forest products industries				
		Forestry and logging	Wood product manufacturing	Paper manufacturing	Total	Share of total gross domestic product
	millions of current dollars					percent
1961	38,301	500	390	939	1,829	4.78
1971	90,792	841	854	1,527	3,222	3.55
1981	338,521	2,366	2,642	5,716	10,724	3.17
1991	636,082	3,017	3,674	6,551	13,242	2.08
2001	1,032,172	5,226	11,300	13,554	30,080	2.91
2002	1,068,765	5,893	12,079	11,865	29,837	2.79
2003	1,128,796	5,429	11,599	10,706	27,734	2.46
2004	1,201,306	6,047	14,140	11,034	31,221	2.60
2005	1,280,550	6,055	12,774	11,110	29,939	2.34
2006	1,354,353	5,780	11,104	10,632	27,516	2.03
2007	1,430,770	5,387	9,457	9,850	24,694	1.73

Source(s): Statistics Canada, CANSIM tables 379-0023 and 379-0024 (accessed March 14, 2011).

Section 7

Energy use and greenhouse gas emissions

Economic activities use energy, resulting in the emission of greenhouse gases (GHGs). Analyzing data on material and energy flows makes it possible to describe the environmental impacts of many different economic activities. Questions such as the following can be addressed: what is the energy intensity of industrial production over time? And what proportion of Canadian greenhouse gas emissions comes from the production of different goods and services?

7.1 Household greenhouse gas emissions and energy use

A significant portion of the Canadian economy is devoted to the production of goods and services for households. Household environmental impacts can thus be very significant, both directly when using the goods and services they buy and in terms of the indirect impacts they create as industries generate wastes and use resources to meet households' demand for consumption.

In 2007, direct greenhouse gas emissions from the combustion of fuels for heating and transportation purposes represented about 115 megatonnes, or 27% of the total emissions attributable to households (Table 7.1). Indirect household emissions in 2007 amounted to 317 megatonnes, or 73% of the total emissions attributable to households (Table 7.1). Electricity purchases, food and non-alcoholic beverage purchases, restaurant and accommodations services and fuel and lubricant purchases were responsible for over half of the indirect household emissions produced in Canada (Table 7.2).

Table 7.1
Direct and indirect household greenhouse gas emissions

	Direct	Indirect	Total [1]	Emissions per unit of expenditure
	megatonnes			1990=100
1990	95	280	375	100.0
1991	92	278	371	100.3
1992	95	297	392	104.5
1993	99	287	386	101.2
1994	102	287	389	98.9
1995	101	286	387	96.4
1996	106	288	394	95.6
1997	104	299	403	93.6
1998	100	310	410	92.7
1999	103	309	412	89.6
2000	105	306	411	86.0
2001	103	307	410	83.9
2002	108	316	424	83.7
2003	111	322	432	82.9
2004	110	313	424	78.6
2005	111	305	415	74.4
2006	109	303	412	70.7
2007	115	317	432	71.0

1. Total emissions are the sum of direct plus indirect emissions.

Note(s): Figures may not add up to total due to rounding. Direct emissions include all greenhouse gas emissions due to energy use in the home and for private motor vehicles. Indirect emissions are those business-sector emissions due to the production of the goods and services purchased by households. An estimate of the emissions from foreign companies due to the production of the imported goods purchased by Canadian households is included.

Source(s): Statistics Canada, Cansim table 153-0046 (accessed March 28, 2011).

Table 7.2
Largest components of indirect household greenhouse gas emissions, 2007

	Emissions [1]	Contribution to total household indirect emissions	Personal expenditure [2]	Percent contribution to total spending	Emissions intensity [3]
	kilotonnes	percent	million of dollars	percent	kilotonnes per million of dollars
Electricity purchases	40,850	19	15,240	2	2.680
Food and non-alcoholic beverage purchases	39,345	18	75,238	9	0.523
Restaurants and accommodation services	15,451	7	56,603	7	0.273
Motor fuels and lubricant purchases	15,411	7	32,034	4	0.481

1. Domestic industrial emissions associated with producing goods and services to meet household demand.
2. Household spending on consumer goods and services, plus the operating expenses of private non-profit organizations serving households.
3. Domestic industrial emissions per unit of total personal expenditure.

Source(s): Statistics Canada, CANSIM table 380-0009 (accessed March 28, 2011) and Environment Accounts and Statistics Division, Material and Energy Flow Accounts, 2011, special tabulation.

Table 7.3
Direct and indirect household energy use

	Direct	Indirect	Total [1]	Use per unit of expenditure
	petajoules			1990=100
1990	1,976	3,552	5,528	100.0
1991	1,939	3,538	5,477	100.7
1992	1,993	3,697	5,690	103.0
1993	2,061	3,635	5,696	101.3
1994	2,120	3,606	5,726	98.8
1995	2,091	3,593	5,684	96.1
1996	2,190	3,671	5,861	96.6
1997	2,149	3,829	5,979	94.2
1998	2,067	4,052	6,119	93.8
1999	2,134	4,094	6,228	92.0
2000	2,188	4,071	6,258	88.9
2001	2,168	4,083	6,251	86.8
2002	2,256	4,217	6,473	86.8
2003	2,328	4,287	6,615	86.1
2004	2,329	4,126	6,456	81.3
2005	2,342	4,028	6,370	77.4
2006	2,289	4,018	6,307	73.6
2007	2,425	4,314	6,739	75.2

1. Total use is the sum of direct plus indirect use.

Note(s): Figures may not add up to total due to rounding. Direct use includes all energy used in the home and for private transportation. Indirect use measures the energy required by businesses to produce goods and services purchased by households. An estimate of the energy used by foreign companies in the production of imported goods purchased by Canadian households is included.

Source(s): Statistics Canada, Cansim table 153-0046 (accessed March 28, 2011).

Over time, the emissions intensity of household consumption has declined. In 2007 each dollar of household expenditure resulted in 29% fewer greenhouse gas emissions than in 1990 (Table 7.1). From a household energy consumption perspective, 25% less energy was used per dollar spent in 2007 than in 1990. (Table 7.3)

One reason for this decline in emissions intensity is the shift towards cleaner burning fuels like natural gas in both households and industry—this shift helps explain why the energy intensity of household consumption has not declined to the same extent as the emissions intensity. The breakdown of total household GHG emissions is shown in table 7.4.

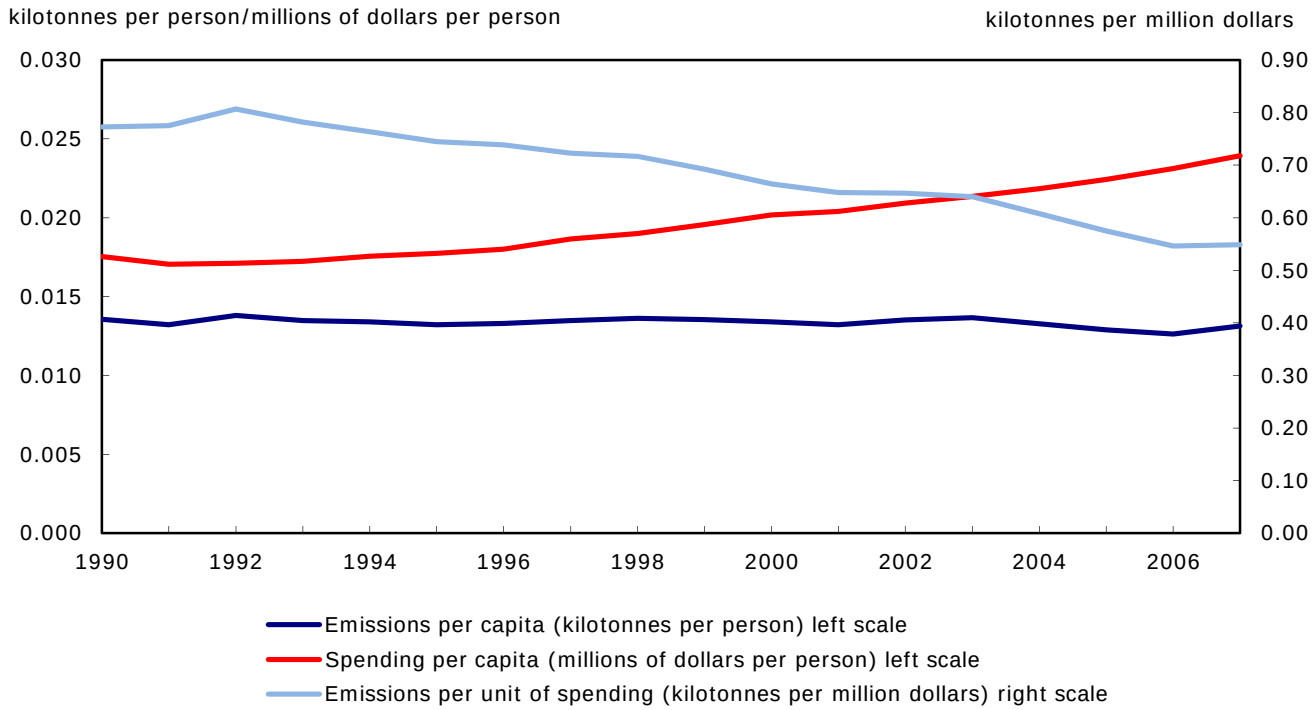
The declining intensities of both emissions per dollar and energy use per dollar have been matched by an increase in household spending. This has led to a fairly stable level of emissions per capita over time (Chart 7.1).

Table 7.4
Breakdown of total greenhouse gas emissions attributable to households, 1990 and 2007

	1990		2007	
	Emissions	Share of emissions	Emissions	Share of emissions
	kilotonnes	percentage	kilotonnes	percentage
Indirect emissions				
Goods	137,094	47.9	138,049	48.3
Services	54,010	18.9	75,723	23.0
Sub total, indirect emissions	**191,104**	**66.8**	**213,772**	**65.0**
Direct emissions				
Heating, lighting and appliances	40,457	14.1	40,753	12.4
Motor fuels and lubricants	54,410	19.0	74,541	22.7
Sub total, direct emissions	**94,867**	**33.2**	**115,295**	**35.0**
Total domestic grennhouse gas emissions emissions attributable to households	**285,971**	**100.0**	**329,067**	**100.0**

Source(s): Statistics Canada, Environment Accounts and Statistics Division, Material and Energy Flow Accounts, 2011, special tabulation.

Chart 7.1
Greenhouse gas emissions intensities per capita and per unit of spending



Note(s): These intensity measures include an estimate of the greenhouse gas emissions from foreign companies due to the production of imported goods purchased by Canadian households. This is done to ensure consistency with total household spending that is used in the calculation.
Source(s): CANSIM tables 153-0046, 380-0017 and 051-0001 (accessed March 28, 2011).

7.2 Industrial greenhouse gas emissions and energy use

Industries can be examined in much the same way as households. Table A (see Appendix A) shows a summary of greenhouse gas emissions and energy use associated with each detailed industrial sector for 1990 and 2007. Comparing the industries over time points to industries where emissions and energy use are changing. The general pattern shows that service industries require less energy and produce fewer emissions per dollar of output. Broad declines in energy use or emissions per dollar of output across many industries are apparent. Some industries that are heavily reliant on energy to yield their output do show increases in their emissions and energy use intensities over time (for example, air transportation).

Table 7.5 shows the distribution of industrial emissions by final demand category. It explains what category of consumers created the demand that triggered the emissions produced by industries. Most of the increase in industrial GHG emissions between 1990 and 2007 can be attributed to the production of goods and services for export. Forty-five percent of the industrial GHG emissions generated in Canada in 2007 were created to produce exports.

Table 7.5
Industrial greenhouse gas emissions by category of final demand, 1990 and 2007

	1990		2007	
	Emissions	Share of emissions	Emissions	Share of emissions
	megatonnes	percent	megatonnes	percent
Total final demand	**478.2**	**..**	**609.7**	..
Personal expenditure	191.1	40	213.8	35
Machinery and equipment	11.0	2	12.8	2
Construction	43.6	9	55.6	9
Inventories	13.9	3	8.9	1
Government expenditure	42.5	9	47.3	8
Exports	176.1	37	271.3	45

Source(s): Statistics Canada, Environment Accounts and Statistics Division, Material and Energy Flow Accounts, 2011, special tabulation

Section 8

Environmental protection efforts

8.1 Protecting ecosystems

In 2011, 9.8% of Canada's land and freshwater areas were protected (Table 8.1). The share of area protected varied from 2.7% in Prince Edward Island to 14.4% in British Columbia.

The distribution of protected land relative to Canada's 15 broad terrestrial ecozones is presented in Chart 8.1.

In northern ecozones, where population densities are lower and where economic activities are isolated, percentages of protected area tend to be higher. The Arctic Cordillera had the highest proportion of protected land in 2009, at 24% and had only 0.6 persons per 100 km^2. Canada's most densely populated ecozone, the Mixed Wood Plains (15,522 people per 100 km^2), had the lowest proportion of land protected at just under 2% (Chart 8.1).

Globally, Canada ranked 111th out of 201 countries reporting proportions of their land territory protected in 2008.Venezuela had proportionately more protected land area than any other country in the world, reporting 71.3% of its area protected.[1] Of the countries depicted in Table 8.2, Brazil protected the greatest proportion of its area at 29.6%, while the United States followed closely at 27.1%.

1. The World Bank, 2011, *Indicators - Data*, *http://data.worldbank.org/indicator* (accessed January 12, 2011)

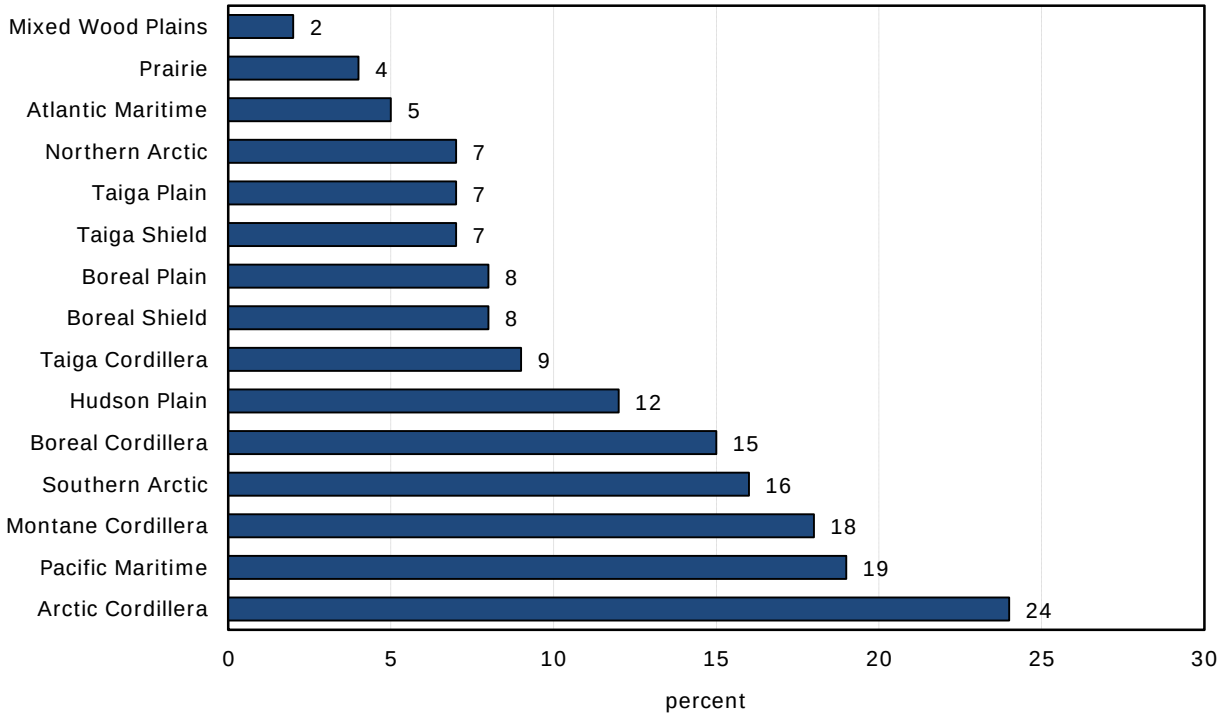
Table 8.1
Terrestrial and marine protected areas by province and territory, 2011

	Protected areas [1]	Area protected		Total area of land and freshwater	Percentage of land and freshwater protected
		Marine [2]	Terrestrial		
	number	square kilometres			percent
Canada	**5,384**	**49,265**	**981,511**	**9,976,182**	**9.8**
Newfoundland and Labrador	65	230	18,535	406,135	4.6
Prince Edward Island	119	16	156	5,955	2.6
Nova Scotia	73	22	4,598	55,386	8.3
New Brunswick	74	63	2,233	73,024	3.1
Quebec	2,399	5,039	131,035	1,510,840	8.7
Ontario	666	5	106,456	1,077,368	9.9
Manitoba	305	885	63,951	649,741	9.8
Saskatchewan	323	0	50,399	652,429	7.7
Alberta	263	0	82,130	663,242	12.4
British Columbia	1,011	6,345	135,989	947,009	14.4
Yukon	22	78	57,295	483,779	11.8
Northwest Territories	33	3,002	120,415	1,352,234	8.9
Nunavut	29	24,992	208,588	2,099,041	9.9

1. Includes protected areas administered federally, provincially and territorially, as well as Aboriginal or privately held conservation lands that are recognized by protected area agencies as being part of their network.
2. Some marine protected areas managed by Fisheries and Oceans Canada are not included in this provincial breakdown, but are included in the Canada total.

Source(s): Canadian Council on Ecological Areas, 2011, *CARTS Reports*, *www.ccea.org/en_cartsreports.html* (accessed May 10, 2011). Statistics Canada, Environmental Accounts and Statistics Division, 2011, special tabulation.

Chart 8.1
Protected land by ecozone, 2009



Note(s): The Montane Cordillera ecozone estimates are not adjusted to account for the Western Interior Basin.
Source(s): Environment Canada, 2010, Canadian Environmental Sustainability Indicators, Protected areas data, *http://www.ec.gc.ca/indicateurs-indicators/default.asp?lang=enamp;n=2F9B17BE-1* (accessed February 12, 2011).

Table 8.2
Terrestrial protected areas for selected countries, 2008

	Land area	Protected land area	
	km²	percentage of land area	global rank
Brazil	8,514,880	29.64	20
India	3,287,260	4.77	145
France	549,190	15.37	74
Canada	**9,976,182**	**8.23**	**111**
United States	9,632,030	27.07	26
China	9,598,090	15.13	75
Russian Federation	17,098,240	9.03	105
Mexico	1,964,380	7.97	114
Australia	7,741,220	12.80	85
South Africa	1,219,090	6.05	133

Note(s): Figures in this table are for 2008 so that international comparisons can be made. Terrestrial protected areas are those officially documented by national authorities.
Source(s): United Nations Environmental Program and the World Conservation Monitoring Centre, as compiled by the World Resources Institute, based on data from national authorities, national legislation and international agreements. The World Bank, 2011, *Indicators - Data*, *http://data.worldbank.org/indicator* (accessed January 12, 2011).

8.2 Managing solid wastes

Solid wastes are produced by nearly every kind of business or household activity, from large scale manufacturing processes to simple day-to-day living. Waste can either be disposed—buried in landfills or incinerated or recycled or composted. Recycling can reduce the demand for energy and new resources by re-using materials that have already been brought into the economy (for example, aluminum, glass, plastics and food).

In 2008, Canadians sent 777 kg of waste per capita for disposal on average, representing a rise of 1.1% over 2002. Another 254 kg of waste per capita were diverted from landfill or incineration, representing a 20.1 % increase in per capita diversion rates over 2002 (Table 8.3).

In 2008, Nova Scotia had the lowest per capita disposal at 378 kg, followed by British Columbia (641 kg) and New Brunswick (642 kg). Alberta had the highest quantity of waste disposed per person (1,122 kg).

Nova Scotia also had the highest waste diversion rate in 2008, with 45.0% of waste diverted from landfill or incineration. New Brunswick and British Columbia followed with 35.8% and 34.9% of waste diverted respectively.

Waste diversion and recycling activities have been on the rise in Canada. Nationally, diversion rates rose from 21.6% in 2002 to 24.7% in 2008 (Table 8.3). A wide variety of materials were diverted from landfills and incinerators in 2008 (Chart 8.2). In total, approximately 8.5 million tonnes of materials were diverted, with organic materials representing 28.8% of the total, followed by cardboard (16.5%), newsprint (13.4%) and mixed paper (11.0%).

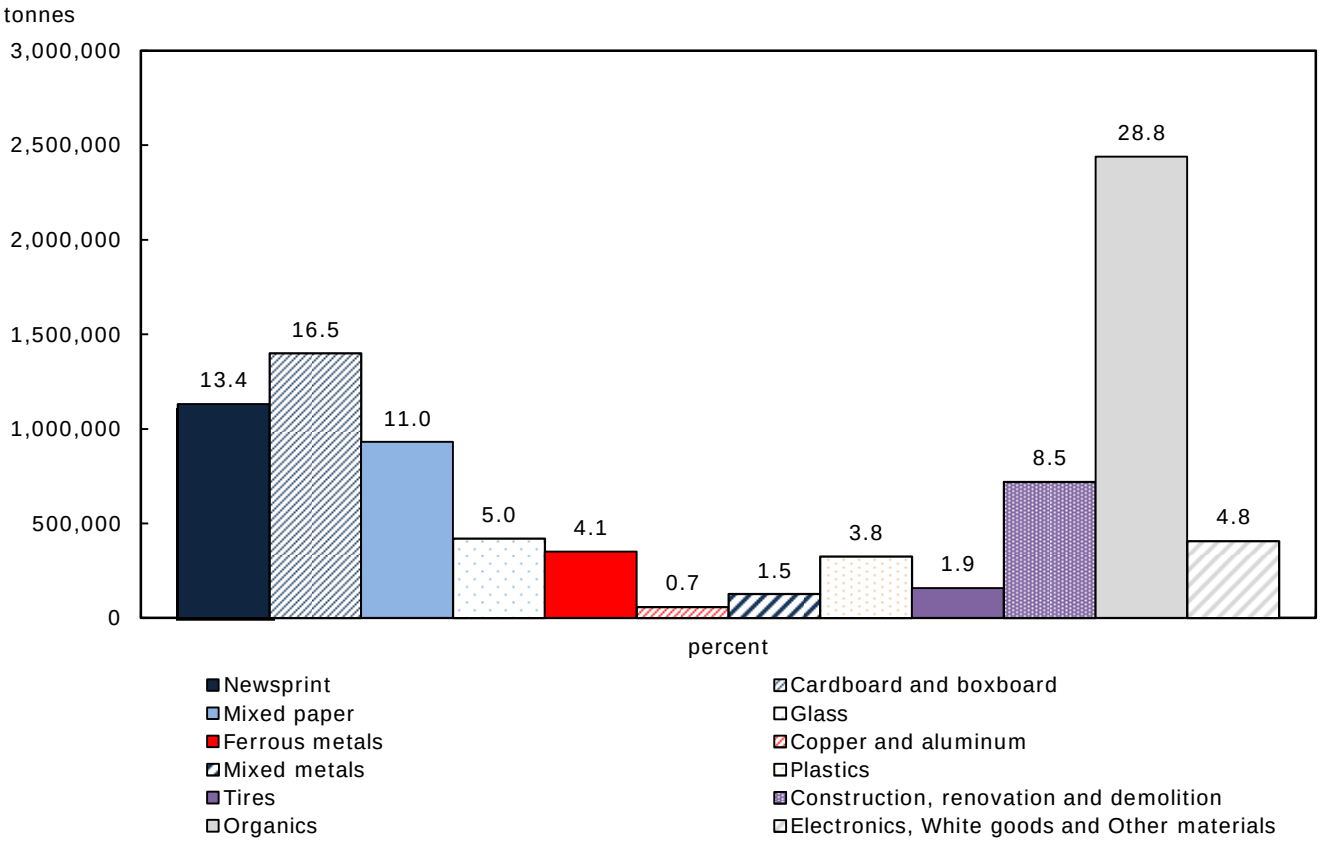
Table 8.3
Disposal and diversion of waste, by province and territory

	Waste disposed per capita [1]		Change 2002 to 2008	Diverted materials per capita [2]		Change 2002 to 2008	Diversion rate	
	2002 [r]	2008		2002 [r]	2008		2002 [r]	2008
	kilograms per capita		percent	kilograms per capita		percent		
Canada	**768.1** [r]	**776.5**	**1.1**	**211.8**	**254.3**	**20.1**	**21.6**	**24.7**
Newfoundland and Labrador	724.9	811.1	11.9	58.5	x	x	7.5	x
Prince Edward Island	x	x	x	x	x	x	x	x
Nova Scotia	416.2	378.2	-9.2	205.4	309.5	50.7	33.0	45.0
New Brunswick	552.0	641.9	16.3	174.5	358.1	105.3	24.0	35.8
Quebec [3]	785.7 [r]	794.5	1.1	234.3	317.8	35.7	23.0	28.6
Ontario	797.8	744.8	-6.6	187.4	217.4	16.0	19.0	22.6
Manitoba	775.2	801.5	3.4	186.6	141.3	-24.3	19.4	15.0
Saskatchewan	797.7	890.7	11.7	116.7	147.6	26.5	12.8	14.2
Alberta	923.9	1,122.0	21.4	220.7	202.9	-8.1	19.3	15.3
British Columbia	655.9	641.3	-2.2	297.3	343.3	15.5	31.2	34.9
Yukon Territory, Northwest Territories and Nunavut	x	x	x	x	x	x	x	x

1. Total amount of non-hazardous waste disposed of in public and private waste disposal facilities includes waste that is exported out of the source province or out of the country for disposal. This does not include wastes disposed in hazardous waste disposal facilities or wastes managed by the waste generator on site.
2. This information covers only those companies and local waste management organizations that reported non-hazardous recyclable material preparation activities and refers only to that material entering the waste stream and does not cover any waste that may be managed on-site by a company or household. Additionally, these data do not include those materials transported by the generator directly to secondary processors, such as, pulp and paper mills while bypassing entirely any firm or local government involved in waste management activities.
3. Waste diversion data are derived from a survey administered by RECYC-QUÉBEC.

Note(s): Figures may not add up to totals due to rounding.
Source(s): Statistics Canada, CANSIM tables 051-0001, 153-0041 and 153-0043 (accessed February 9, 2011) and *Waste Management Industry Survey: Business and Government Sectors, 2008*, Catalogue no.16F0023X.

Chart 8.2
Materials prepared for recycling, 2008



Note(s): This information covers only those companies and local waste management organizations that reported non-hazardous recyclable material preparation activities and refers only to that material entering the waste stream and does not cover any waste that may be managed on-site by a company or household. Additionally, these data do not include those materials transported by the generator directly to secondary processors, such as, pulp and paper mills while bypassing entirely any firm or local government involved in waste management activities.
Source(s): Statistics Canada, CANSIM table 153-0043 (accessed February 13, 2011).

8.3 Spending to control industrial impacts

Businesses spent $9.1 billion in 2008 to protect the environment, up 5.3% from 2006 (Table 8.4). The Oil and Gas Extraction industry spent close to $2.9 billion, or 31.7%, of the total expenditure, followed by the Electric Power Generation and Transmission industry ($1.3 billion or 14.2%) and the Primary Metals industry ($1.2 billion or 12.9%).

Looking at the same data by province shows that the bulk of environmental protection expenditures occurred in Alberta (34.3% of total), most of it in the Oil and Gas Extraction industry. Ontario and Quebec followed with 23.8% and 15.9% of total expenditures respectively, mainly in the Electric Power Generation, Transmission and Distribution; Primary Metals; and Other Manufacturing industries.

Capital investments by industry in pollution prevention, abatement and control[2] totalled $2.6 billion in 2008, or 69% of total capital expenditures on environmental protection. The majority of these capital investments were targeted at reducing air pollutants. Almost $1.4 billion was invested in abatement and control of air pollution, while expenditures on air

2. Pollution prevention is the minimization or elimination of pollution and waste before they are created. Pollution abatement and control is the treatment of pollution and waste after they are created.

pollution prevention totalled $422.2 million (Tables 8.5 and 8.6).

The largest investments for air pollution abatement and control were made by the Oil and Gas Extraction industry ($711.4 million) followed by the Primary Metals Manufacturing industry ($272.9 million).

Among industry groups, the Electric Power Generation, Transmission and Distribution industry reported the highest capital expenditures targeted at pollution prevention ($276.3 million), with just over half of this directed towards the on-site containment of solid and liquid waste.

Table 8.4
Operating and capital expenditures on environmental protection, by industry, province or territory, 2008

	Operating	Capital	Total	Share of total
	millions of dollars			percent
Total, all industries	**5,241**	**3,829**	**9,070**	**100.0**
Logging	30	F	30	0.3
Oil and gas extraction	1,236	1,640	2,876	31.7
Mining	402	352	754	8.3
Electric power generation, transmission and distribution	647	641	1,288	14.2
Natural gas distribution	21	53	73	0.8
Food	357	92	450	5.0
Beverage and tobacco products	19	14	33	0.4
Wood products	93	18	111	1.2
Paper manufacturing	440	60	500	5.5
Petroleum and coal products	339	206	545	6.0
Chemicals	287	116	402	4.4
Non-metallic mineral products	83	93	176	1.9
Primary metals	797	375	1,172	12.9
Fabricated metal products	133	30	162	1.8
Transportation equipment	119	43	162	1.8
Other manufacturing	240	85	325	3.6
Canada	**5,241**	**3,829**	**9,070**	**100.0**
Atlantic provinces [1]	453	155	608	6.7
Quebec	1,003	439	1,442	15.9
Ontario	1,581	580	2,160	23.8
Manitoba	83	364	448	4.9
Saskatchewan	232	348	579	6.4
Alberta	1,430	1,677	3,108	34.3
British Columbia and the territories [2]	460	266	726	8.0

1. Includes Newfoundland and Labrador, Prince Edward Island, Nova Scotia and New Brunswick.
2. Includes British Columbia, Yukon, Northwest Territories and Nunavut.

Note(s): Figures may not add up to totals due to rounding.

Source(s): Statistics Canada, Environment Accounts and Statistics Division, CANSIM tables 153-0054 and 153-0055 (accessed February 9, 2011) and *Environmental Protection Expenditures in the Business Sector, 2008*, Catalogue no. 16F0006X.

Table 8.5
Distribution of capital expenditures on pollution prevention by medium and industry, province or territory, 2008

	Air	Surface water	On-site contained solid and liquid waste	Noise, radiation and vibration	Other	Total
	millions of dollars					
Total, all industries	**422.2**	**178.8**	**232.8**	**F**	**100.6**	**959.1**
Logging	F	F	F	F	F	F
Oil and gas extraction	F	F	19.4	F	0.9	118.1
Mining	18.9	83.6	30.7	x	x	134.2
Electric power generation, transmission and distribution	81.3	21.3	142.3	F	F	276.3
Natural gas distribution	x	0.1	1.1	0.0	0.0	x
Food	10.8	8.3	F	F	16.2	42.3
Beverage and tobacco products	1.4	1.4	0.0	F	1.5	x
Wood products	3.1	0.6	1.6	0.0	1.6	6.8
Paper manufacturing	20.9	x	2.9	x	3.9	30.5
Petroleum and coal products	26.8	x	4.6	x	x	42.5
Chemicals	23.9	4.0	8.3	F	F	47.4
Non-metallic mineral products	30.9	2.7	x	F	4.2	38.2
Primary metals	60.5	5.7	5.4	x	x	72.6
Fabricated metal products	7.5	1.7	2.0	0.2	2.9	14.3
Transportation equipment	x	F	x	0.0	4.6	14.6
Other manufacturing	F	F	F	0.2	12.0	F
Canada	**422.2**	**178.8**	**232.8**	**F**	**100.6**	**959.1**
Atlantic provinces [1]	41.2	x	x	0.0	2.5	66.5
Quebec	98.1	16.1	19.6	1.1	20.0	155.0
Ontario	132.9	36.6	29.7	0.6	63.0	262.7
Manitoba	x	6.5	x	0.0	2.7	x
Saskatchewan	x	x	25.7	F	0.4	93.2
Alberta	100.5	F	x	F	x	183.8
British Columbia and the territories [2]	22.6	F	x	F	F	x

1. Includes Newfoundland and Labrador, Prince Edward Island, Nova Scotia and New Brunswick.
2. Includes British Columbia, Yukon, Northwest Territories and Nunavut.

Note(s): Figures may not add up to totals due to rounding.

Source(s): Statistics Canada, Environment Accounts and Statistics Division, CANSIM tables 153-0054 and 153-0055 (accessed February 9, 2011).

Table 8.6
Distribution of capital expenditures on pollution abatement and control (end-of-pipe) by medium and industry, province or territory, 2008

	Air	Surface water	On-site contained solid and liquid waste	Noise, radiation and vibration	Total
	millions of dollars				
Total, all industries	**1,361.0**	**114.7**	**190.2**	**16.2**	**1,682.2**
Logging	F	F	0.0	F	F
Oil and gas extraction	711.4	18.3	58.5	1.7	790.0
Mining	F	x	67.5	F	119.1
Electric power generation, transmission and distribution	149.7	20.9	x	F	197.6
Natural gas distribution	x	0.0	0.0	0.0	x
Food	9.9	3.6	F	F	19.2
Beverage and tobacco products	0.7	x	x	x	x
Wood products	3.0	F	0.2	0.0	3.4
Paper manufacturing	8.0	4.4	x	x	13.0
Petroleum and coal products	96.9	x	x	F	122.9
Chemicals	11.7	4.6	10.1	1.4	27.8
Non-metallic mineral products	37.9	0.5	F	0.7	39.2
Primary metals	272.9	8.3	x	F	290.5
Fabricated metal products	F	0.1	0.1	F	F
Transportation equipment	15.3	x	x	x	26.3
Other manufacturing	16.8	F	F	x	19.5
Canada	**1,361.0**	**114.7**	**190.2**	**16.2**	**1,682.2**
Atlantic provinces [1]	49.9	x	x	0.0	65.7
Quebec	F	14.8	x	F	F
Ontario	162.5	35.0	22.0	6.9	226.3
Manitoba	F	7.5	F	F	x
Saskatchewan	55.5	x	41.7	x	116.3
Alberta	764.8	21.1	69.4	2.1	857.3
British Columbia and the territories [2]	47.4	x	x	0.3	62.3

1. Includes Newfoundland and Labrador, Prince Edward Island, Nova Scotia and New Brunswick.
2. Includes British Columbia, Yukon, Northwest Territories and Nunavut.

Note(s): Figures may not add up to totals due to rounding.
Source(s): Statistics Canada, Environment Accounts and Statistics Division, CANSIM tables 153-0054 and 153-0055 (accessed February 9, 2011).

8.4 Households actions to protect the environment

Winters in Canada are generally long and cold, with the heating season lasting up to nine or ten months in some parts of the country. Lowering indoor air temperatures at certain times of the day is one way households reduce their energy consumption and heating expenses. More than nine out of ten (91%) Canadian households reported having a thermostat in their dwelling in 2009 (Table 8.7). Forty-nine percent of these households had programmable thermostats. Regardless of the type of thermostat, 61% of households with thermostats lowered the temperature while they slept during the winter. Households in Prince Edward Island were most likely to turn the temperature down (66%), while those in Manitoba and New Brunswick were the least likely (58%).

Lowering the temperature at night was much more prevalent in households with a programmable thermostat that had been programmed (74%) than in households with a non-programmable thermostat or a programmable thermostat that was not programmed (53%).

Among those households that had programmed their programmable thermostats, those in Saskatchewan were most likely to have programmed them to lower the temperature when the household was asleep (82%), while those in Nova Scotia were the least likely (57%) to have done so. For non-programmable thermostats and programmable thermostats that were not programmed, households in Nova Scotia were most likely to have lowered the temperature when asleep (64%) while those in Ontario were least likely (46%) to have done so.

Table 8.7
Thermostat use by households during the winter, by province, 2009

	Households reporting at least one thermostat	Winter temperature lowered when asleep [1]	Main thermostat, programmable [1]	Programmable thermostat		Not programmed or non-programmable
				Programmed thermostat [2]	Winter temperature lowered when asleep [3]	Winter temperature lowered when asleep [4]
	percent					
Canada	**91**	**61**	**49**	**84**	**74**	**53**
Newfoundland and Labrador	92	60	20	74	75	59
Prince Edward Island	97	66	25	86	76	63
Nova Scotia	96	63	25	77	57	64
New Brunswick	95	58	28	72	60	57
Quebec	92	62	46	81	76	54
Ontario	88	59	61	87	70	46
Manitoba	92	58	45	75	81	47
Saskatchewan	96	65	49	83	82	53
Alberta	97	63	47	85	79	52
British Columbia	92	64	38	86	78	58

1. As a percentage of all households that had a thermostat.
2. As a percentage of all households that had a programmable thermostat.
3. As a percentage of all households that had a programmable thermostat that was programmed.
4. As a percentage of all households that had an unprogrammed or non-programmable thermostat.

Source(s): Statistics Canada, Environment Accounts and Statistics Division, CANSIM table 153-0060.

Table 8.8
Indoor water conservation practices, by province, 2009

	Had a low-volume toilet [1]	Had a low-flow shower head [1]	Municipal water supply		Non-municipal water supply	
			Had a low-volume toilet [2]	Had a low-flow shower head [2]	Had a low-volume toilet [3]	Had a low-flow shower head [3]
	percent					
Canada	**42**	**63**	**42**	**62**	**48**	**65**
Newfoundland and Labrador	30	59	30	56	F	79
Prince Edward Island	31	60	29	59	35	62
Nova Scotia	39	66	37	61	43	75
New Brunswick	38	67	36	66	40	69
Quebec	34	64	33	65	45	61
Ontario	48	65	48	65	54	67
Manitoba	39	49	39	48	44	61
Saskatchewan	42	51	42	51	43 E	48
Alberta	46	58	46	59	46	57
British Columbia	40	60	39	59	54	67

1. As a percentage of all households.
2. As a percentage of households that had a municipal water supply.
3. As a percentage of households that had a non-municipal water supply.

Source(s): Statistics Canada, Environment Accounts and Statistics Division, Households and the Environment Survey, 2009 (survey no. 3881).

Another way households protect the environment is by employing water conservation practices around the home. Low-flow shower heads use up to 70% less water than standard shower heads and can save approximately 15% on the cost of heating water. In 2009, 63% of Canadian households reported they had a low-flow shower head. Households in New Brunswick (67%) were most likely to have had a low-flow shower head while those in Manitoba (49%) were least likely to have had one (Table 8.8).

The volume of water a toilet uses per flush can be reduced either through design, as in a low-volume toilet, or by adding a brick or weighted plastic bottle to reduce the amount of water in the toilet tank. New low-volume toilets typically use less than 6 litres of

water per flush, compared to older toilets that can use more than twice that amount.

Forty-two percent of Canadian households reported that they had a low-volume toilet in 2009 (Table 8.8). Provincially, 48% of households in Ontario reported having one of these toilets, while those in Newfoundland and Labrador and Prince Edward Island reported the fewest low-volume toilets (30% and 31% respectively).

Appendix A

Energy and greenhouse gas emissions

Table A
Energy use and greenhouse gas emissions (carbon dioxide equivalents) and intensities by industry

Industrial sector		Greenhouse gas emissions [1]					Energy use [2]				
		1990		2007			1990		2007		
		kilotonnes	current dollar intensity	kilotonnes	current dollar intensity	constant dollar intensity (1990=100)	terajoules	current dollar intensity	terajoules	current dollar intensity	constant dollar intensity (1990=100)
Crop and animal production	1	58,446	3.94	70,607	2.71	89.7	174,297	18.70	178,070	12.02	93.8
Forestry and logging	2	3,044	0.97	3,273	0.61	97.5	32,545	11.80	31,262	7.28	95.1
Fishing, hunting and trapping	3	653	0.88	823	0.72	143.2	9,087	11.81	11,252	10.00	145.8
Support activities for agriculture and forestry	4	374	0.84	1,121	0.75	157.7	5,534	11.78	15,398	10.27	151.7
Oil and gas extraction	5	66,495	3.36	111,141	1.09	86.3	616,262	32.49	1,104,925	11.35	90.8
Coal mining	6	3,164	2.24	1,613	0.93	74.1	20,379	18.18	14,233	9.49	93.1
Metal ore mining	7	4,230	0.97	3,320	0.33	74.0	104,172	17.78	67,994	5.67	68.8
Non-metallic mineral mining and quarrying	8	1,981	1.27	2,467	0.56	71.9	45,216	22.87	53,210	10.01	68.5
Support activities for mining and oil and gas extraction	9	1,516	1.00	3,842	0.48	80.9	25,329	14.87	64,041	7.45	81.5
Electric power generation, transmission and distribution	10	92,629	4.87	119,264	3.15	95.9	1,198,437	62.63	1,666,582	43.64	103.1
Natural gas distribution, water and other systems	11	3,941	1.82	4,750	0.98	78.1	24,176	12.34	21,114	5.66	69.1
Residential building construction	12	1,187	0.70	2,185	0.40	89.2	17,536	8.94	30,724	5.26	91.3
Non-residential building construction	13	1,040	0.61	1,454	0.35	91.2	15,248	7.87	20,604	4.66	92.4
Transportation engineering construction	14	2,780	1.46	4,377	0.72	84.8	37,671	18.63	58,346	9.09	83.5
Oil and gas engineering construction	15	561	0.74	2,279	0.36	80.2	7,699	11.59	30,706	5.54	77.8
Electric power engineering construction	16	390	0.52	178	0.21	65.2	5,479	6.97	2,489	3.06	69.4
Communication engineering construction	17	66	0.49	33	0.31	99.9	956	7.58	482	4.83	98.2
Other engineering construction	18	135	0.62	101	0.28	72.0	2,289	8.17	1,817	3.84	73.2
Repair construction	19	1,093	0.61	1,437	0.31	83.2	15,105	8.06	19,869	4.26	84.4
Other activities of the construction industry	20	257	0.65	530	0.46	111.8	4,115	9.53	9,127	7.36	115.6
Animal food manufacturing	21	347	1.79	265	1.06	80.4	8,162	15.57	7,438	8.52	78.5
Sugar and confectionery product manufacturing	22	329	0.70	301	0.44	92.0	6,829	9.74	7,078	6.05	89.8
Fruit and vegetable preserving and specialty food manufacturing	23	481	1.15	682	0.73	88.4	10,245	13.12	15,470	7.92	85.4
Dairy product manufacturing	24	647	2.30	411	1.53	88.8	14,364	15.46	10,840	9.35	89.5
Meat product manufacturing	25	745	2.64	728	1.43	71.8	17,773	15.87	20,331	8.51	77.1
Seafood product preparation and packaging	26	143	0.85	102	0.59	108.2	3,854	10.45	3,316	7.78	117.1
Miscellaneous food manufacturing	27	1,518	1.18	1,393	0.80	94.0	34,827	12.04	37,618	7.66	92.1
Soft-drink and ice manufacturing	28	101	0.74	182	0.36	72.3	2,196	10.73	3,882	5.59	75.6
Breweries	29	363	0.57	212	0.22	61.8	7,999	8.95	4,845	3.55	62.3
Wineries	30	13	0.88	15	0.36	58.5	340	10.84	446	4.18	56.6
Distilleries	31	309	1.08	204	0.60	79.0	6,578	16.30	4,010	9.66	80.7
Tobacco manufacturing	32	54	0.98	19	0.27	41.8	1,487	8.35	558	3.15	60.1
Textile and textile product mills	33	937	1.53	331	0.56	55.8	22,362	16.12	10,277	8.76	80.5
Clothing manufacturing	34	238	0.79	63	0.30	56.3	6,761	9.15	1,954	4.68	75.3
Leather and allied product manufacturing	35	59	0.75	11	0.34	69.6	1,588	9.20	336	4.93	81.0
Wood product manufacturing	36	1,437	0.87	2,222	0.51	89.0	41,925	12.84	69,289	8.26	93.3
Pulp, paper and paperboard mills	37	14,114	1.83	6,095	0.98	74.4	393,175	36.08	284,746	23.22	79.7
Converted paper products manufacturing	38	505	1.18	638	0.54	66.6	11,656	20.46	18,844	11.26	73.3
Printing and related support activities	39	422	0.75	282	0.36	72.8	11,707	13.49	9,675	7.32	73.5
Petroleum and coal products manufacturing	40	21,769	4.05	26,385	1.37	86.6	352,874	47.81	409,291	16.76	88.5
Basic chemical manufacturing	41	10,307	2.84	11,171	1.68	113.0	159,876	39.17	133,746	20.10	96.3
Resin, synthetic rubber, and artificial and synthetic fibres and filaments manufacturing	42	11,782	4.59	2,656	1.35	45.8	25,185	26.11	31,319	16.37	103.8

See notes at the end of the table.

Table A – continued

Energy use and greenhouse gas emissions (carbon dioxide equivalents) and intensities by industry

	Industrial sector	Greenhouse gas emissions [1]					Energy use [2]				
		1990		2007			1990		2007		
		kilotonnes	current dollar intensity	kilotonnes	current dollar intensity	constant dollar intensity (1990=100)	terajoules	current dollar intensity	terajoules	current dollar intensity	constant dollar intensity (1990=100)
Pesticides, fertilizer and other agricultural chemical manufacturing	43	7,675	7.49	9,809	3.26	81.9	36,846	45.75	54,634	22.20	90.0
Pharmaceutical and medicine manufacturing	44	308	0.47	187	0.26	85.3	4,245	6.07	5,862	3.86	96.2
Miscellaneous chemical product manufacturing	45	915	1.12	385	0.65	98.2	18,099	14.34	10,182	8.79	101.3
Plastics product manufacturing	46	643	1.67	667	0.61	56.7	20,401	16.45	29,170	8.87	84.2
Rubber product manufacturing	47	390	1.01	331	0.58	92.6	9,922	14.46	10,341	8.97	95.1
Cement and concrete product manufacturing	48	10,014	3.58	12,461	1.97	79.3	73,249	30.98	77,376	15.14	71.3
Miscellaneous non-metallic mineral product manufacturing	49	4,913	2.34	4,871	1.31	77.8	55,288	28.03	58,766	16.67	81.7
Primary metal manufacturing	50	22,191	2.11	24,316	0.90	72.7	464,216	38.20	521,215	16.79	74.1
Fabricated metal product manufacturing	51	1,798	1.01	1,779	0.45	71.4	42,711	17.79	47,041	8.05	71.7
Machinery manufacturing	52	923	0.70	856	0.33	77.4	23,055	12.00	22,760	5.79	76.9
Computer and peripheral equipment manufacturing	53	22	0.39	11	0.20	66.1	1,006	6.28	368	3.22	48.6
Electronic product manufacturing	54	258	0.39	116	0.22	85.3	8,155	6.27	6,226	3.72	83.9
Household appliance manufacturing	55	134	0.83	39	0.44	82.4	3,271	13.44	1,091	7.25	80.3
Electrical equipment and component manufacturing	56	558	0.92	192	0.41	72.6	13,346	14.69	6,128	7.19	78.5
Motor vehicle manufacturing	57	950	0.85	863	0.42	77.5	21,849	13.66	21,445	7.10	79.6
Motor vehicle body and trailer manufacturing	58	90	0.82	124	0.41	82.2	2,104	13.42	3,235	7.22	86.1
Motor vehicle parts manufacturing	59	838	0.96	547	0.44	73.6	23,305	16.27	20,367	7.85	74.9
Aerospace product and parts manufacturing	60	426	0.56	211	0.20	58.1	9,001	9.48	7,409	3.61	59.1
Railroad rolling stock manufacturing	61	128	0.69	40	0.54	135.9	3,107	12.09	1,147	9.80	140.1
Ship and boat building	62	85	0.64	35	0.38	96.4	2,064	9.88	1,324	6.40	99.5
Other transportation equipment manufacturing	63	5	0.53	20	0.33	99.7	144	8.47	406	5.40	98.7
Furniture and related product manufacturing	64	457	0.68	357	0.32	73.9	11,908	10.50	12,256	5.58	79.7
Miscellaneous manufacturing	65	296	0.86	274	0.37	67.7	7,328	13.15	7,298	6.06	71.2
Wholesale trade	66	7,052	0.43	13,281	0.29	102.6	120,219	6.46	238,656	4.44	102.2
Retail trade	67	7,406	0.45	8,392	0.23	78.5	183,871	7.76	208,657	4.00	75.7
Air transportation	68	12,256	2.27	15,689	1.45	117.7	171,758	30.81	227,013	20.38	119.4
Rail transportation	69	7,384	1.85	6,676	0.91	68.7	96,122	24.13	85,032	11.75	67.2
Water transportation	70	3,677	2.56	4,844	1.82	123.8	48,760	33.77	65,968	24.58	125.6
Truck transportation	71	14,925	1.75	29,068	1.11	92.6	210,792	24.07	403,636	15.26	90.7
Transit and ground passenger transportation	72	3,881	1.50	3,334	0.74	84.3	60,499	21.89	57,159	11.56	88.4
Pipeline transportation	73	11,320	4.12	14,699	2.15	68.3	141,063	51.48	186,964	27.59	70.0
Scenic and sightseeing transportation and support activities for transport	74	990	0.71	1,568	0.36	80.8	16,835	10.48	30,607	5.63	83.4
Postal service and couriers and messengers	75	735	0.48	1,345	0.38	133.0	12,159	7.00	22,001	5.57	130.2
Warehousing and storage	76	237	0.54	257	0.21	58.7	4,465	8.31	4,533	3.31	57.4
Motion picture and sound recording industries	77	419	0.68	516	0.35	80.1	9,223	11.42	11,461	5.78	75.3
Radio and television broadcasting	78	50	0.30	54	0.22	116.8	1,009	4.77	1,636	3.59	116.3
Pay TV, specialty TV and program distribution and telecommunications	79	774	0.20	623	0.12	91.9	15,870	3.20	13,862	2.03	88.1
Publishing industries, information services and data processing service	80	110	0.38	115	0.18	69.6	3,316	6.80	4,840	3.11	64.4
Monetary authorities and depository credit intermediation	81	901	0.20	2,411	0.13	98.8	21,564	3.40	58,709	2.31	100.0
Insurance carriers	82	214	0.24	170	0.12	81.1	5,553	3.85	2,970	1.88	77.4
Lessors of real estate	83	7,543	0.56	12,647	0.38	98.9	188,172	10.11	304,691	7.14	97.0
Owner-occupied dwellings	84	-	0.04	-	0.03	113.3	-	0.57	-	0.40	112.9
Rental and leasing services and lessors of non-financial intangible associations	85	1,984	0.62	1,594	0.25	62.2	30,304	9.03	26,883	3.88	64.0
Other finance, insurance and real estate and management of companies	86	2,549	0.47	3,653	0.21	72.4	54,909	7.44	82,759	3.39	72.7

See notes at the end of the table.

Table A – continued

Energy use and greenhouse gas emissions (carbon dioxide equivalents) and intensities by industry

	Industrial sector	Greenhouse gas emissions [1]					Energy use [2]				
		1990		2007			1990		2007		
		kilotonnes	current dollar intensity	kilotonnes	current dollar intensity	constant dollar intensity (1990=100)	terajoules	current dollar intensity	terajoules	current dollar intensity	constant dollar intensity (1990=100)
Advertising and related services	87	130	0.33	134	0.16	74.4	2,444	5.21	2,768	2.58	71.3
Architectural, engineering, legal and accounting services	88	348	0.19	840	0.14	118.7	8,166	3.06	19,439	2.22	119.6
Other professional, scientific and technical services	89	382	0.24	882	0.15	101.4	8,631	3.82	18,825	2.45	95.7
Administrative and support services	90	509	0.21	1,597	0.16	127.2	11,236	3.36	29,914	2.51	118.4
Waste management and remediation services	91	1,836	1.87	1,716	0.46	39.5	28,140	26.85	24,461	6.57	38.1
Educational services (except universities)	92	142	0.70	408	0.23	52.2	3,577	12.18	8,893	4.07	51.0
Health care services (except hospitals) and social assistance	93	1,075	0.27	2,311	0.19	113.0	28,692	4.41	60,653	3.30	118.7
Arts, entertainment and recreation	94	234	0.44	381	0.23	81.8	11,792	7.34	16,616	3.86	82.4
Accommodation and food services	95	2,337	0.68	2,062	0.39	83.1	65,859	7.87	67,215	4.60	87.1
Repair and maintenance	96	986	0.41	1,838	0.29	114.6	20,877	6.78	40,877	5.01	113.8
Grant-making, civic, and professional and similar organizations	97	70	0.38	11	0.14	62.9	1,464	5.79	2,034	2.71	73.1
Personal and laundry services and private households	98	659	0.35	574	0.19	87.3	14,188	5.44	14,913	3.28	93.1
Operating supplies	99	77	0.80	11	0.48	95.9	-	11.44	-	7.40	100.5
Office supplies	100	-	0.67	-	0.34	77.9	-	11.31	-	6.33	78.0
Cafeteria supplies	101	-	1.87	-	1.05	76.3	-	14.06	-	8.15	84.4
Laboratory supplies	102	-	0.77	-	0.54	116.4	-	10.90	-	7.55	113.2
Travel and entertainment	103	3,774	1.45	6,281	0.90	108.0	54,434	19.39	93,029	12.49	110.8
Advertising and promotion	104	-	0.39	-	0.21	81.9	-	6.61	-	3.62	78.6
Transportation margins	105	-	1.75	-	1.04	86.4	-	23.61	-	13.96	85.0
Religious organizations	106	591	0.56	1,456	0.49	137.0	17,564	10.61	34,677	9.47	134.1
Non-profit welfare organization	107	75	0.36	260	0.18	79.4	3,043	6.59	8,625	3.48	81.4
Non-profit sports and recreation clubs	108	85	0.73	378	0.49	102.6	3,276	11.47	10,309	9.09	120.2
Other non-profit institutions serving households	109	301	0.50	681	0.23	70.6	14,624	9.19	27,272	4.54	75.6
Non-profit education services	110	175	0.46	345	0.28	94.9	4,842	8.31	9,379	5.41	98.2
Hospitals	111	896	0.26	1,701	0.18	108.7	26,888	3.91	58,338	3.20	126.0
Government residential care facilities	112	96	0.27	141	0.12	70.3	2,944	3.32	3,641	1.74	82.0
Universities	113	1,002	0.37	1,855	0.25	109.2	23,945	6.19	47,317	4.47	111.5
Government education services	114	3,358	0.31	4,537	0.19	97.4	87,264	5.56	110,499	3.56	97.2
Other municipal government services	116	2,500	0.47	5,992	0.35	114.8	85,235	8.60	162,935	6.38	110.6
Other provincial and territorial government services	117	2,419	0.35	1,419	0.18	84.9	63,136	5.70	33,908	3.07	84.1
Other federal government services and defence services	118	5,098	0.44	3,251	0.20	73.7	89,643	6.68	58,357	3.18	73.5
Total, all sectors	**.**	**478,181**	**.**	**609,655**	**.**	**.**	**6,436,281**	**.**	**8,416,529**	**.**	**.**

1. Emissions intensity is shown in tonnes per thousand dollars of production
2. Energy intensity is shown in gigajoules per thousand dollars of production.

Note(s): Industry aggregation is at the L-level of the input-output accounts of Statistics Canada. Emission sources included in these estimates: combustion of fossil fuels; non-combustion uses of fossil fuels; industrial processes; agricultural soils; livestock manure and enteric fermentation. Intensity of production is measured as direct plus indirect greenhouse gas emissions or energy use per thousand dollars of production (in current and in chained 2002 dollars). Direct emissions and energy use are associated with the industry's own production; indirect emissions and energy use those associated with the production of the goods and services that are used by the industry.

Source(s): Statistics Canada, CANSIM tables 153-0031 to 153-0034.