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EnviroStats

Winter 2007 Vol. 1, no. 3

In this issue:

Latest indicators

Population 2005 to 2006 Percentage change	1.0%
Gross domestic product July 2007 to August 2007 Percentage change	0.2%
Greenhouse gas emissions 2004 to 2005 Percentage change	-0.1%
Particulate matter ($PM_{2.5}$) 2000 to 2005	No significant trend
Ground-level ozone 1990 to 2005 Median percent change per year	0.8%

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EnviroStats

Winter 2007 Vol. 1, no.3

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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
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

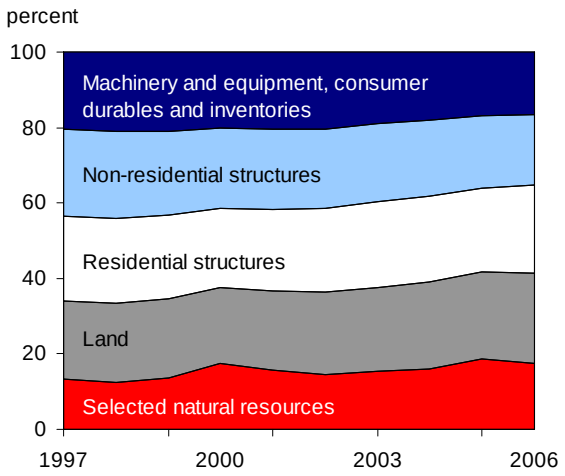
Canada's natural resource wealth at a glance

Kazi Islam, Environment Accounts and Statistics Division

Natural resources contribute significantly to Canada's total wealth. The value of this contribution fluctuates with prices, stocks and extraction costs. Fuelled by rising resource prices, Canada's natural resource wealth grew, on average, 10% per year during the last decade. This growth rate would have been higher if extraction costs had not risen significantly during this period. In 2006, natural resource wealth—the dollar value of selected natural resource reserves—stood above $1 trillion or more than $30,000 per capita.[1] The physical sources of this wealth, natural resource reserves, were relatively stable during this period.

Over the last decade, natural resource wealth accounted for between 12% and 19% of Canada's total wealth (Chart 1). Natural resources not only generate wealth but also contribute raw materials to create other types of wealth such as buildings, bridges, machinery and equipment. Timber and iron are used extensively in constructing houses and bridges. Machinery and equipment are made from a variety of metals such as iron, copper and zinc. As well, these resources are components of consumer durables such as cars and computers.

Chart 1
Relative share of various types of wealth, 1997 to 2006



Source: Statistics Canada, n.d. (no date), CANSIM table 378-0005.

Natural resource wealth plays an important role in generating income. Businesses invest capital and employ people to produce, process, market, transport and export resources. By doing so, they earn profits and pay taxes and royalties to the provincial and federal governments. These investments, exports, profits and taxes (including royalties) are significant components of Gross Domestic Product (GDP) or current income. As well, resource wealth will generate a stream of future income. This article provides key information and trends related to Canada's resource wealth over the last decade.

Energy, minerals and timber are accounted for

Statistics Canada's current wealth estimates are based on those resources for which all the necessary data for valuation are available. The resources fall into three categories: energy, mineral and timber resources.

Energy resources include natural gas, crude oil, crude bitumen (oil sands) and coal. Mineral resources include gold-silver, nickel-copper, copper-zinc, lead-zinc, iron, molybdenum, uranium, potash and diamonds.[2] Timber reserves include timber stocks that are physically accessible and available for harvesting.

Other renewable resources, such as fish and fresh water, are not included at this point due to a lack of the necessary data and methods to assign a value to these resources. Total natural resource wealth would be even higher if these resources were included.

1. Statistics Canada, n.d. (no date), CANSIM tables 378-0005 and 051-0001.

2. Some mines such as nickel-copper are polymetallic mines—more than one metal is mined from the same site.

Note to readers

Resource wealth mainly depends on the sales revenue from extracted resources, extraction costs and the remaining reserves. For mineral and energy resources, reserves are defined as the amount of proven and probable stocks that are profitable to extract using available technology.

The amount of the stock that is extractable with available technology and that is profitable to extract, is considered the economically recoverable reserve. Thus, reserve estimates can change due to several factors including the change in resource price, extraction costs, as well as new discoveries and depletion of stocks.

To calculate natural resource wealth, first resource rent—sales revenue minus extraction costs—is determined. Suppose last year's reserve of a mineral resource was 15 units and 5 units were extracted. Then the remaining reserve would be 10 units. If sales revenue from the extracted 5 units was $50, and the total extraction costs were $30, then the resource rent would be $20.

Assuming that all these factors stayed the same, the remaining reserves would generate $20 worth of rent in each of the following two years. However, $20 at the end of year one and two is worth less than it is now. Assuming a 5% annual interest rate, also known as the discount rate, estimated wealth of the remaining reserve would be:

$$Wealth = \frac{20}{(1+.05)^1} + \frac{20}{(1+.05)^2} = \$37.19$$

For timber resources, only the stocks that are physically accessible and available for harvesting are included as part of natural resource wealth estimation. Because timber is a renewable resource, its wealth calculation is based on the assumption that the stream of rent will be available for an infinite period.

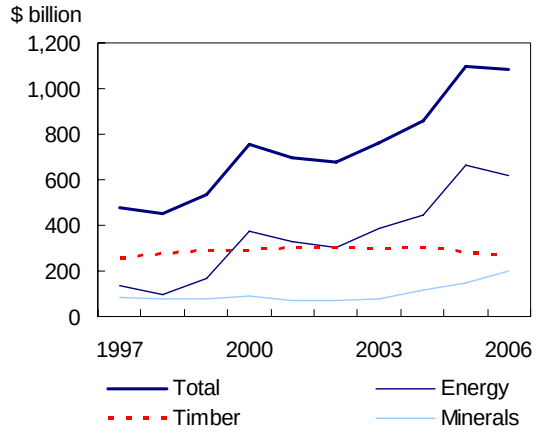
Total resource wealth shaped by energy resources

In 1997, the value of Canada's natural resource wealth approached $500 billion. Within a decade, the value of natural resource wealth exceeded $1 trillion. On average, natural resource wealth grew by 10% per year, from 1997 to 2006 (Chart 2).

Energy resource wealth, which surpassed the value of timber wealth in 2000, was the chief factor in the increase in total resource wealth.

In 2006, energy resources accounted for 57% of total resource wealth, followed by timber (24%) and mineral resources (19%). For much of the decade, natural resource wealth increased rapidly, with resource prices playing a substantial role in the expansion of the wealth.

Chart 2
Natural resource wealth, 1997 to 2006



Source: Statistics Canada, n.d. (no date), CANSIM table 378-0005.

Supply and demand are the key to prices

Unless set by regulatory agencies or organizations, the price of any good or resource is typically determined by supply and demand. The supply of natural resources is usually fixed in the short-term. In the long-term, however, the supply is affected by a number of factors including changes in resource prices, advancement of extraction technologies as well as discoveries of new deposits and depletion of resources.

On the other hand, demand for most natural resources is variable in both the short and long run, being affected by fluctuations in domestic and global economic factors. When resource demand rises in the short term, constraints on short-term supply can mean sharp increases in prices. This effect can be seen in the price index of natural resources (Chart 3), which has been volatile over the past decade, mainly due to fluctuating demand.

On average, the all-items natural resource price index grew more than 9% per year from 1997 to 2006. Declines in resource prices[3] in 1998 and 2002 were related to the 1997/98 East Asian

3. International Monetary Fund, 2007, *Indices of Commodity Prices*, Washington, D.C. www.imf.org/external/np/res/commod/table1a.pdf (accessed October 1, 2007).

What you should know about charts 3, 4 and 5

The resource price index shown in Chart 3 is much like the consumers price index (CPI). It provides a measure of the overall price change for the bundle of resources considered in this analysis. Since the prices for these natural resources vary independently and are based on very different units of measure (cubic meters for oil, kilograms for gold), to get an overall measure of price change for the bundle a weighted average of their respective price changes is constructed. Various weighted averages are possible but for this study the Chain Fisher Index formula is used for the indexes in Charts 3, 4 and 5.

The resource price indexes in Chart 3 weight the price changes for the various resources by their share in the total value of resource production. Chart 4 presents the natural resource reserve index, which weights the changes in physical volumes of various reserves using their share in the total value of natural resource wealth. The extraction cost indexes in Chart 5 average the changes in extraction costs of the various resources by weighting them according to their share in total extraction cost for these resources.

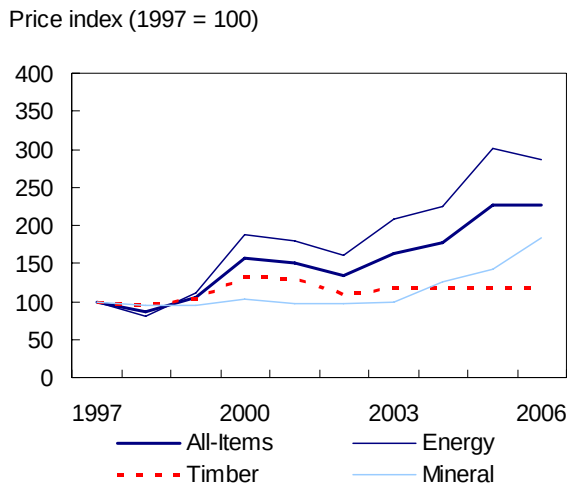
financial crisis, and the terrorist attack of September 11, 2001, which triggered slowdowns in the global economy. [4, 5]

Between 2002 and 2006, the price index of natural resources increased rapidly. In recent years, the real GDP of India and China, the world's two most populated countries, grew more than 8% a year.[6] These countries are both large importers of natural resources. In particular, China's demand for industrial raw materials has pushed up world energy and metal prices.[7]

Volatility in the energy resource price index was the main factor for the volatility in the all-items resource price index (Chart 3). During the last decade, the energy resource price index grew on average by 12% per year, followed by minerals (7%) and timber (2%).

4. International Monetary Fund, 1998, "Global repercussions of the Asian Crisis and other issues in the current conjuncture," *World Economic Outlook*, Washington, D.C. www.imf.org/external/pubs/ft/weo/weo0598/pdf/0598ch2.pdf (accessed October 1, 2007).
5. International Monetary Fund, 2001, "The Global economy after September 11," *World Economic Outlook*, Washington, D.C. www.imf.org/external/pubs/ft/weo/2001/03/index.htm (accessed October 4, 2007).
6. International Monetary Fund, 2007, *International Financial Statistics*, Washington D.C. www.internationalmonetaryfund.org/external/data.htm#data (accessed October 1, 2007).
7. Statistics Canada, 2007, *International Merchandise Trade Annual Review, 2006*, Catalogue no. 65-208-X, Ottawa.

Chart 3
Natural resource price index, 1997 to 2006



Source: Statistics Canada, Environment Accounts and Statistics Division.

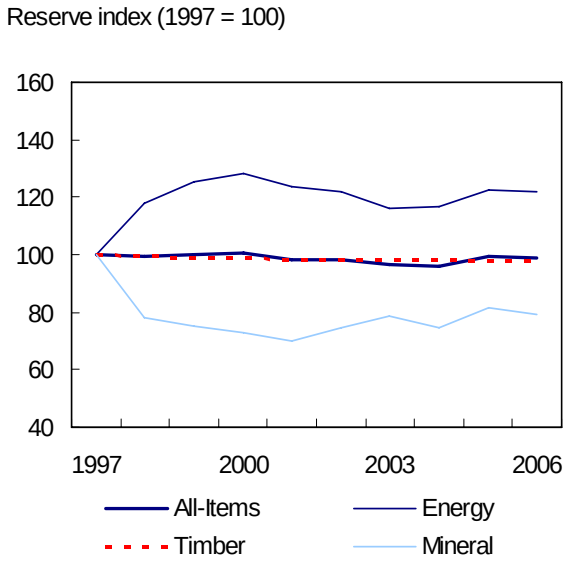
Natural resource reserves were relatively stable

Overall, the all-items natural resource reserve index remained relatively stable from 1997 to 2006 (Chart 4). This means that changes in the size of Canada's natural resource reserves had nearly no effect on the growth in natural resource wealth in Canada from 1997 to 2006. Although the all-items reserve index had gradually declined in the early 2000s, the index rebounded in 2005. Reserve size can change for several reasons including changes in resource prices, changes in extraction costs, advancement in extraction technologies, discoveries of new deposits and depletion of resources.

When prices increase, businesses not only boost production to earn profits but also invest more in exploration and drilling activities. This may result in the discovery of new deposits. Also, with increased prices, previously known but unprofitable resources may become profitable to extract, which in turn increases the size of the economically recoverable reserve.

For example, production of offshore oil and gas and diamonds, which were discovered in the late 1970s and early 1990s respectively, only began in the late 1990s as extraction became economically

Chart 4
Natural resource reserve index, 1997 to 2006



Source: Statistics Canada, Environment Accounts and Statistics Division.

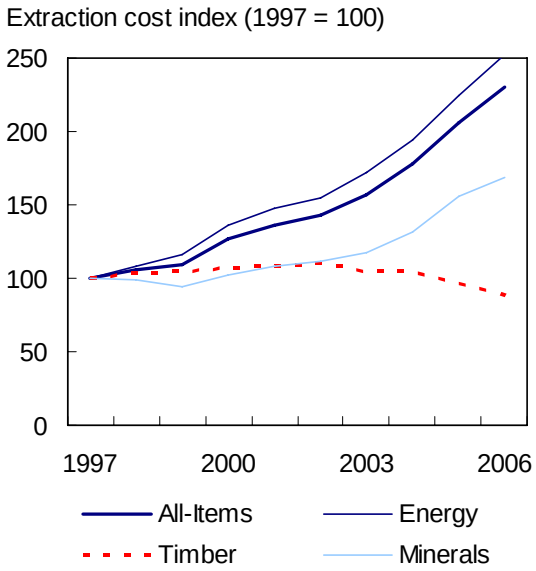
and technologically feasible.[8,9] These resources helped in maintaining the level of the all-items reserve index.

Although the all-items reserve index was relatively stable, the reserves of energy and mineral resources were quite volatile. The gain in energy reserve index was partly offset by the decline in the mineral reserve index. In 1998, the addition of offshore oil and gas, and a significant increase in crude bitumen (oil sands) reserves raised the energy-reserve index to 118. On the other hand, the mineral reserve index dropped to 78 partly due to a substantial drop in iron ore reserves. The timber reserve index declined slightly over the years, and stood at 97 at the end of the period.

Extraction costs increased rapidly

From 1997 to 2006, the all-items extraction cost index grew, on average, by 10% per year (Chart 5).[10] This increase was mainly due to the increase in labour and capital costs in recent years.

Chart 5
Extraction cost index, 1997 to 2006



Source: Statistics Canada, Environment Accounts and Statistics Division.

Businesses may need to employ more people and invest a substantial amount of money on advanced technologies to extract resources that are located in relatively remote locations and are expensive to extract. The cost of maintaining this additional investment, also called fixed costs, remains the same even when the production drops.

Overall, extraction costs grew more quickly between 2003 and 2006 than during the previous six years, averaging more than 13% per year. Canada's tight labour market is partly responsible

8. In 1979, the Hibernia oil field—located 315 kilometres east-southeast of St. John's, Newfoundland and Labrador—was discovered, and in November 1997 the project came on stream and became the first offshore oil extraction site in Canada. More information on Hibernia is available on the Government of Newfoundland and Labrador website, www.economics.gov.nl.ca/bulletins/oil.asp (accessed September 20, 2007).
9. Canada's first diamond mine, the Ekati diamond mine—located about 300 kilometres northeast of Yellowknife, Northwest Territories—came on stream in October 1997. More information about the Ekati diamond mine is available on the Government of the Northwest Territories website, www.iti.gov.nt.ca/diamond/production.htm (accessed September 15, 2007).
10. Extraction costs for energy and mineral resources consist of wages and salaries, the cost of deploying machinery and equipment for exploration, drilling and extracting resources, and the cost of fuel, electricity and raw materials. For timber, harvesting costs include wages and salaries, capital costs as well as stumpage fees and forest management costs.

for this increased cost. In 2006 the overall unemployment rate was 6.3%, the lowest level in over three decades, while the unemployment rate in resource-rich Alberta was 3.4%.[11]

From 2003 to 2006, employment in mining and oil and gas extraction industries grew on average by 10.5% per year, while weekly employee earnings grew by 4.4% per year.[12] This growth in employment and earnings has pushed up the total labour costs. In recent years, both the energy and mineral extraction cost indexes grew rapidly, while the timber harvesting cost index declined.

Conclusion

Canada is rich in natural resources. This wealth is an important source of current as well as future incomes. By generating wealth, natural resource reserves play a significant role in sustaining present as well as future economic activities. Natural resource wealth depends on a number of factors including the size of physical resource reserves as well as resource prices. Fuelled by increases in resource prices, natural resource wealth grew, on average, by 10% per year during the last decade. In 2005, Canada's natural resource wealth crossed the trillion dollar mark.

11. Statistics Canada, 2007, "The Labour Force Survey," *The Daily*, www.statcan.ca/Daily/English/070105/d070105a.htm (accessed September 20, 2007).
12. Statistics Canada, n.d (no date), CANSIM tables 282-0008 and 281-0026.

Trip chaining while driving—comparing men's and women's behaviour

Gord Baldwin and Sean Fagan, Transportation Division

Trip chaining is the practice of stopping at intermediate points during a journey. Leaving home in one's car and stopping for a coffee, dropping children off at school, picking up dry-cleaning, all on the trip to work would be an example of trip chaining. It is encouraged as a good driving behaviour from an energy consumption perspective.[1] It can also complicate the life of engineers planning commuter travel patterns.

Do men and women have different trip chaining behaviour?

While men predominated in terms of the number of trips and the distance driven in light vehicles in Canada in 2005, there were also differences between men's and women's trip chaining behaviours.

The longer the trip chain, that is the greater number of trip stages involved in a complete tour, the greater the likelihood that the driver was female.

During the morning commute, a higher percentage of women drive to schools and daycares and to retail establishments as their next stop after leaving home.

During the evening commute, a higher percentage of men than women drive directly home. A higher percentage of women drive to shopping centres, banks and other places of personal business, as their next stop after leaving work.

Why does this matter? Understanding the differences can help when planning transit routes, when analyzing traffic patterns, when trying to plan traffic calming measures, when trying to plan retail locations or when trying to plan "no stopping" or "no parking" time periods. Designing a roadway system to facilitate flow from point A to B is more complex if a large sub-set of the users requires intermediate stops at points C, D and E.[2]

What you should know about this study

This paper uses data from the 2005 Canadian Vehicle Survey (CVS) to examine trip chaining behaviour from a gender perspective. This is a voluntary vehicle-based survey started in 1999, conducted by Statistics Canada with funding from Transport Canada and Natural Resources Canada. The CVS provides quarterly and annual estimates of road vehicle activity (vehicle-kilometres and passenger-kilometres) for vehicles registered in Canada. A quarterly sample of vehicles is drawn from vehicle registration lists provided by the provincial and territorial governments.

The provincial component of the survey consists of two steps. The first step is a computer assisted telephone interview (CATI) with the registered owner of each sampled vehicle. This interview is used to collect some general information on the usage of the vehicle as well as to ask the respondent to complete a trip log specific to his/her vehicle type. The trip log is then mailed out as a second step. If respondents cannot be contacted by phone, the trip log is mailed out with a short questionnaire to collect some of the information normally collected during the CATI. For 2005, a total sample of 21,915 vehicles was drawn for the ten provinces.

To qualify as a chained trip for this study the following conditions had to be met:

- Only trips made by light vehicle types were analyzed (i.e. those weighing less than 4,500 kg). This was done to exclude travel in heavier truck and transport type vehicles that tend to be used for work purposes.
- Trips were made on the same day.
- Trips were consecutive, made by the same driver as identified by age and gender.
- A chain of trips was excluded if even one was made as part of the driver's job (i.e. while they were at work).

A trip chain or tour would be completed once the driver returned home (if the driver ventured out again later on the same day, then this would begin a new trip chain). With the exception of requiring all trips in a chain to be completed within the same calendar day, there was no other time period requirement for the completion of a trip chain in this analysis.

Trip chaining

In the example given above of leaving home, stopping for a coffee, dropping children off at

1. For more information on transportation and energy consumption, please see the results of the *Households and the Environment Survey, 2006* and *Human Activity and the Environment, 2006*, Statistics Canada Catalogue no. 11-526-X and 16-201-X.

2. Planning models for the Montgomery County Planning Department, Maryland use trip purpose to account for chained trips. See David M. Levinson and Ajay Kumar, 1994, *Multi-modal trip distribution: structure and application*, p. 2, http://nexus.umn.edu/Papers/TripDistribution.pdf (accessed October 23, 2007).

school, picking up dry-cleaning, and finally driving to one's place of work, there are:

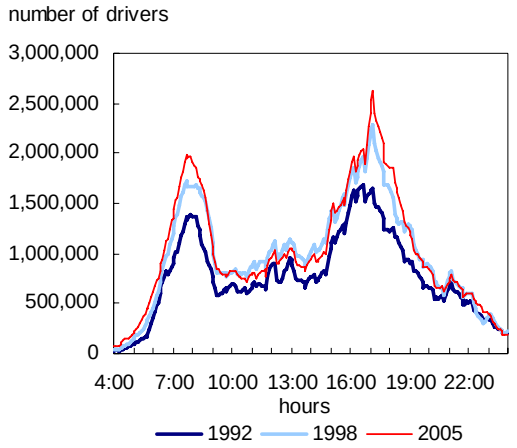
- Four trip stages (home to coffee shop, coffee shop to school, school to dry cleaners, dry cleaners to work);
- Three stops—coffee shop, school and dry cleaners;
- One trip chain or tour—home to work.[3]

The Canadian Vehicle Survey defines a trip as a driver's travel from one location to another. Respondents are asked to report a new and separate trip each time the driver gets in the vehicle and travels and each time any passenger (or group of passengers) gets in or out of the vehicle.

Commuting times

The morning commute is a shorter period of time than the evening commute. For this reason the study used a four hour period for the morning commute and a six hour period for the evening commute.

Chart 1
Variation in the estimated number of drivers on the roads, by time of the day, 1992, 1998 and 2005



Source: Turcotte, Martin, 2006, "The time it takes to get to work and back," *General Social Survey on Time Use: Cycle 19,* Statistics Canada Catalogue no. 89-622-X no.1, chart 4, Ottawa.

It is possible that some vehicle destinations may not be reflected in a trip chain. A driver can go somewhere without actually getting out of the car, for example, full service gas stations, fast food drive-thrus, or a drive in the country. Even though the driver travelled somewhere, it is not considered a finished trip until they leave the vehicle or a passenger gets in or out.

Trip chaining differences between men and women

While men predominated in the simplest of trips with one "stage" in the trip with 45% of their trips of this type as opposed to 39% for women, they showed the same propensity to make two stage trips (Table 1). For trips with three, four or five and more stages in the trip chain, women led men in every group.

Table 1
Trip chaining, by gender of driver, 2005

	Men	Women
	percent	
Number of trip stages in the trip chain		
1	45.5	39.4
2	39.9	40.1
3	8.3	11.4
4	3.6	5.5
5 or greater	2.7	3.6
Total	**100.0**	**100.0**

Note: The data in this table are based on 121 thousand reported trips.
Source: Statistics Canada, Canadian Vehicle Survey—Annual 2005, special tabulations.

If one examines trips by time of day, more differences become apparent. Comparing men and women for trips starting at home during the morning commute (from 6:00 am to 9:59 am) shows that a slightly higher percentage of men than women drove directly to work. A higher percentage of women drove to schools and daycares and retail establishments as their next stop after leaving home during morning rush hour (Table 2).

3. Nancy McGuckin and Elaine Murakami, 1999, *Examining Trip-Chaining Behavior—A Comparison of Travel by Men and Women*, Center for Transportation Analysis, p. 4, http://nhts.ornl.gov/npts/1995/Doc/Chain2.pdf (accessed January 17, 2007).

Table 2
Trips showing next stage destination for morning commute trips starting at home, 2005

	Trips, by next stage destination		Next stage destination, by gender		
	Men	Women	Men	Women	**Total**
	percent of trips		percent of destination		
Next stage destination					
Someone else's home	5.9	7.0	53.8	46.2	**100.0**
Driver's regular workplace	51.2	49.9	58.7	41.3	**100.0**
Another workplace	8.0	7.1	61.1	38.9	**100.0**
School/daycare	5.9	8.1	50.4	49.6	**100.0**
Shopping Centre, bank, other place of personal business	8.6	10.6	53.0	47.0	**100.0**
Medical/dental	3.4	3.6	56.3	43.7	**100.0**
Leisure, entertainment, recreational, restaurant	7.4	6.3	62.0	38.0	**100.0**
Gas station	2.8	2.0	65.3	34.7	**100.0**
Other	6.9	5.4	63.8	36.2	**100.0**
Total	**100.0**	**100.0**	58.1	41.9	**100.0**

Source: Statistics Canada, Canadian Vehicle Survey—Annual 2005, special tabulations.

Table 3
Trips showing next stage destination for trips starting at regular workplace during the evening commute, 2005

	Trips, by next stage destination		Next stage destination, by gender		
	Men	Women	Men	Women	**Total**
	percent of trips		percent of destination		
Next stage destination					
Home	79.8	71.5	60.1	39.9	**100.0**
Someone else's home	3.0	4.6	46.9	53.1	**100.0**
Another workplace	1.6	1.8	54.4	45.6	**100.0**
School/daycare	1.0	2.3	37.2	62.8	**100.0**
Shopping Centre, bank, other place of personal business	6.8	11.5	44.4	55.6	**100.0**
Medical/dental	0.7	0.6	62.5	37.5	**100.0**
Leisure, entertainment, recreational, restaurant	3.3	2.8	61.2	38.8	**100.0**
Gas station	2.2	3.0	50.2	49.8	**100.0**
Other	1.6	2.0	52.3	47.7	**100.0**
Total	**100.0**	**100.0**	57.5	42.5	**100.0**

Source: Statistics Canada, Canadian Vehicle Survey—Annual 2005, special tabulations.

Overall, men comprised the majority of drivers for trips leaving home during the morning commute regardless of the destination (58% men versus 42% women). Of those drivers headed directly to work, 59% were men as opposed to 41% for women. Men also led in those heading to another workplace (a possible indicator the driver was involved in car pooling) by 61% to 39% for women.

In trips where the first destination in the trip chain after leaving home was to a leisure, entertainment, recreational facility or restaurant, men led 62% to 38%. Some studies in the United States have attributed the growth in trip chaining for men to "stops to get a meal or a coffee on the way to work, called the Starbucks effect."[4]

Men do the majority of driving in Canada according to the Canadian Vehicle Survey. In 2005, men driving light vehicles accounted for 68% of the vehicle-kilometres driven and women drivers for only 32% of the vehicle-kilometres.[5]

4. Nancy McGuckin and Yukiko Nakamoto, 2005, "Differences in Trip Chaining by Men and Women", *Research on Women's Issues in Transportation—Volume 2: Technical Papers*, Transportation Research Board, p. 49, http://onlinepubs.trb.org/onlinepubs/conf/CP35v2.pdf (accessed October 15, 2007).
5. Statistics Canada, 2005, *Canadian Vehicle Survey: Annual 2005* (revised), Catalogue no. 53-223-X, table 6-2, p. 21.

During the evening commute (trips starting between 2:00 and 7:59 pm), different patterns are also noticeable for men and women drivers. A higher percentage of men than women drove directly home. A higher percentage of women drove to shopping centres, banks and other places of personal business, as their next stop after leaving work (Table 3).

Grouped by the next stage destination, men comprised 60% of those drivers headed directly home as opposed to only 40% for women. Men also led in those heading to another workplace (possibly for another job, possibly involved in car pooling) by 54% to 46%. Men predominated in driving to medical/dental establishments by 63% to 37%. They also led in heading for leisure, entertainment, recreational facilities and restaurants by 61% to 39%.

Women leaving work in the evening led in driving to schools or daycares by 63% to 37%. They also led 56% to 44% in driving to shopping centres, banks and other places of personal business. Driving to someone else's home was also dominated by women by 53% to 47% for men. This could possibly indicate car pooling or picking up children from care-giving services in a private home as opposed to a daycare. That women are more likely to drive to these destinations is especially noteworthy when compared to the morning commute when men led in every category. Also as indicated earlier, men reported driving two-thirds of the vehicle-kilometres in light vehicles in the Canadian Vehicle Survey.

Conclusion

Differences are apparent in the trip chaining behaviour of drivers in Canada. Understanding the differences can help when planning transit routes, when analyzing traffic patterns, when trying to plan traffic calming measures, when trying to plan retail locations or when trying to plan "no stopping" or "no parking" time periods. Planners should be aware of the travel requirements of large sub-sets of the travelling public when planning transportation routes and infrastructure.

Blowing up a storm: Snowblowers in Canada

Nancy Hofmann, Environment Accounts and Statistics Division

Most parts of Canada experience snow every winter. Clearing driveways and sidewalks is backbreaking work, but household snowblowers can make the job easier and faster. However, gas-powered snowblowers affect the environment since burning fossil fuels emits air pollutants. The amount of particulate matter emitted depends on the make, age and model—some new motors are more efficient.[1]

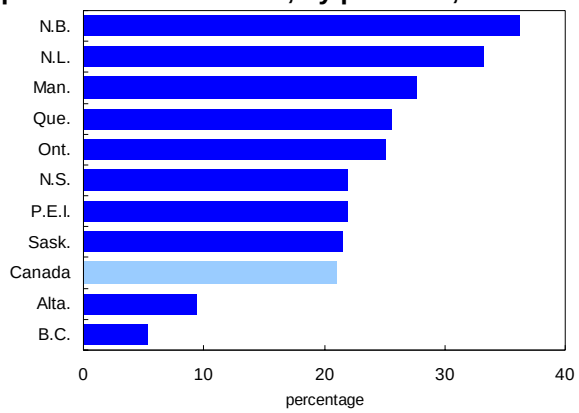
Canadians spend a considerable amount of money on their household snowblowers. In 2003, more than 200,000 households purchased a snowblower, with half spending over $800.[2]

Just over 20% of households[3] owned a gas-powered snowblower in 2006.[4] Snowblowers were most popular in New Brunswick, where they were owned by 36% of households (Chart 1). Only households in two provinces, Alberta and British Columbia, had fewer than the national average.

Snowblower ownership is affected by a variety of socio-economic, cultural and climatic influences. Average snowfall is one factor that could impact the rate of ownership (Chart 2). Cities in Eastern Canada appear to have higher snowblower ownership rates, as well as higher levels of snow accumulation. However, in the Central and Western provinces, there is often less snow, but still relatively high ownership rates.

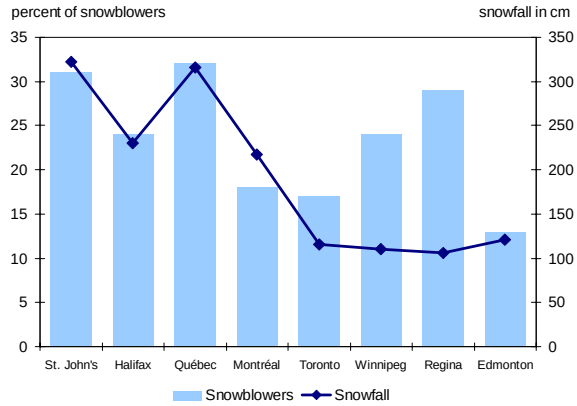
Other factors influencing snowblower ownership might include the length and size of driveways, household incomes and average temperatures. For instance, although Regina ranked fourth for the proportion of households with a snowblower, it had the lowest average snowfall (Chart 2). However, of those cities studied, Regina was the second coldest city, after Winnipeg. Perhaps snowblowers allow residents to avoid the cold.

Chart 1: Households that used gasoline-powered snowblowers, by province, 2006



Note: Data excludes apartment dwellers.
Source: Statistics Canada, 2007, *Households and the Environment, 2006,* Catalogue no. 11-526-X, Ottawa.

Chart 2: Households that owned gasoline-powered snowblowers and average snowfall, by city



Notes:
Data excludes apartment dwellers.
Snowfall data based on climate normals from 1971 to 2000 by the Canadian Meteorological Centre, Environment Canada.
Sources:
Statistics Canada, n.d. (no date), *Weather Conditions in Capitals and Major Cities,* www40.statcan.ca/l01/cst01/phys08a.htm (accessed October 16, 2007).
Statistics Canada, 2007, *Households and the Environment, 2006,* Catalogue no. 11-526-X, Ottawa.

1. Environment Canada, 2007, *Snowblower Emissions,* www.etc-cte.ec.gc.ca/databases_e.html (accessed October 16, 2007).
2. Statistics Canada, n.d. (no date), CANSIM Table 203-0005.
3. Data excludes apartment dwellers.
4. Statistics Canada, *Households and the Environment, 2006.*

Population change in Canada's drainage areas

Giuseppe Filoso and Doug Trant, Environment Accounts and Statistics Division

The size and distribution of Canada's population are changing continually. During the 25 year period from 1981 to 2006, Canada's population increased 30%, growing from 24.3 million to 31.6 million people.[1] Using detailed data from the Census, this population change can be calculated for each of Canada's drainage areas, effectively linking people to the fresh-water resource that supports them (Map 1).

The urbanized drainage areas that support Canada's three largest cities, Toronto, Montreal and Vancouver, saw population increases of 51%, 22% and 81% respectively, over this time period (Table 1). In absolute terms, populations increased by 2.31 million in the Lake Ontario and Niagara Peninsula drainage area (02H) surrounding Toronto, by 853 thousand in the Central St. Lawrence (02O) around Montreal and by 822 thousand in the Lower Fraser (08M), which includes Vancouver.

Over this same time period, some of Canada's more rural drainage areas experienced declines. Population dropped by 46 thousand or 21%, in the Northern Newfoundland drainage area (02Y), and by 15 thousand or 16% in the Lake Winnipegosis and Lake Manitoba drainage area (05L).

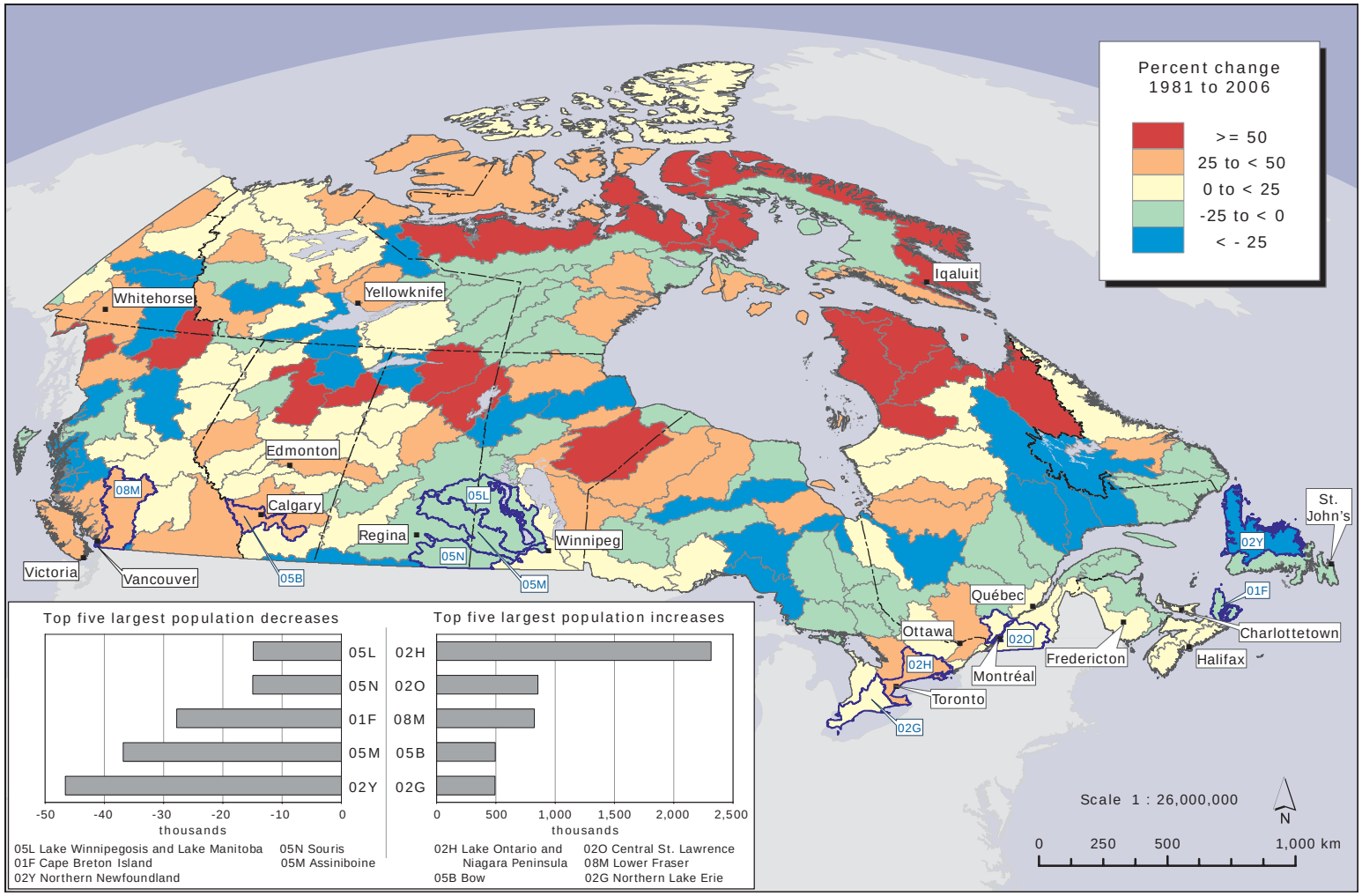
Table 1
Population change, top 10 sub-drainage areas, 1981 to 2006

Code	Sub-drainage area name	Major drainage area name	1981	2006	Percentage change
02H	Lake Ontario and Niagara Peninsula	St. Lawrence	4,549,385	6,861,310	51%
02O	Central St. Lawrence	St. Lawrence	3,895,360	4,748,230	22%
02G	Northern Lake Erie	St. Lawrence	1,649,120	2,142,595	30%
08M	Lower Fraser	Pacific	1,008,555	1,830,480	81%
02L	Lower Ottawa	St. Lawrence	857,915	1,268,965	48%
02P	Lower St. Lawrence	St. Lawrence	1,052,255	1,188,920	13%
05B	Bow	Nelson River	670,160	1,166,785	74%
05E	Central North Saskatchewan	Nelson River	576,450	811,145	41%
02E	Eastern Georgian Bay	St. Lawrence	410,135	761,645	86%
08H	Vancouver Island	Pacific	496,695	705,820	42%

Source: Statistics Canada, n.d. (no date), CANSIM table 153-0036.

1. Statistics Canada, n.d. (no date), CANSIM table 153-0036.

Map 1
Total population change, by sub-drainage area, 1981 to 2006



Sources: Statistics Canada, Environment Accounts and Statistics Division.
Statistics Canada, n.d. (no date), CANSIM table 153-0036.

Environment and sustainable development indicators

Table 1
Selected environmental statistics

	2001	2002	2003	2004	2005	2006
Population						
Population (number)[1]	31,021,251	31,372,587	31,676,077	31,989,454	32,299,496	32,623,490
Percentage change	1.1	1.1	1.0	1.0	1.0	1.0
Aged 65 and over (percent of total)	12.6	12.7	12.8	13.0	13.1	13.2
Urban (percent of total)	79.7	..	..	..	..	80.2
Density (per square kilometre)	3.4	3.5	3.5	3.5	3.6	3.6
Economy						
Gross Domestic Product (million chained 2002 dollars)	1,120,146	1,152,905	1,174,592	1,210,656	1,247,780	1,282,204
Percentage change	1.8	2.9	1.9	3.1	3.1	2.8
Per capita (chained 2002 dollars)	36,109	36,749	37,081	37,845	38,632	39,303
Consumer Price Index (2002 = 100)	97.8	100.0	102.8	104.7	107.0	109.1
Unemployment rate (percent)	7.2	7.7	7.6	7.2	6.8	6.3
Social						
Average household spending (current dollars)						
Water and sewage	195	190	209	209	217	..
Electricity	973	1,019	1,056	1,065	1,099	..
Food	6,415	6,692	6,787	6,910	7,135	..
Gasoline and other motor fuels	1,539	1,729	1,713	1,893	2,075	..
Personal expenditure on consumer goods and services (million chained 2002 dollars)	632,781	655,722	675,443	698,138	724,942	755,204
Residential waste						
Production per capita (kilograms)	..	390	..	418	..	..
Disposal (tonnes)	..	9,447,531	..	9,792,787	..	..
Disposal per capita (kilograms)	..	301	..	306	..	..
Diversion (tonnes)	..	2,789,669	..	3,582,301	..	..
Diversion per capita (kilograms)	..	89	..	112	..	..
Diversion rate (percent of waste production)	..	23	..	27	..	..
Distance driven by light vehicles[2] (million kilometres)	238,380	290,320	286,803	285,164	289,717	296,871
Asthma (percent of population age 12 and over)	..	..	8.4	..	8.3	..
Energy						
Primary energy availability (terajoules)	10,950,393	11,163,501	11,478,526	11,527,500	11,310,201	..
Primary and secondary energy (terajoules)						
Export	9,305,984	9,491,341	9,444,883	9,810,695	9,641,137	..
Residential consumption	1,239,970	1,286,677	1,338,166	1,313,015	1,296,130	..
Established reserve, closing stock[3]						
Crude bitumen (million cubic metres)	1,830	1,840	1,720	1,660	1,620	..
Crude oil (million cubic metres)	644.7	606.1	590.0	603.8	752.3	..
Natural gas (billion cubic metres)	1,590.8	1,569.7	1,504.1	1,532.2	1,621.2	..
Recoverable reserves, closing stock[3]						
Coal (million tonnes)	4,555.4	4,485.3	4,423.1	4,357.2	..	..
Uranium (tonnes)	452,000	439,000	429,000	444,000	..	..

Table 1 (continued)
Selected environmental statistics

	2001	2002	2003	2004	2005	2006
Total electricity generation (megawatt hours)	565,757,322	578,728,900	564,218,465	571,291,905	597,248,219	585,097,531
Hydro (percent of total)	58.0	59.8	59.0	58.7	60.0	60.0
Nuclear (percent of total)	12.8	12.3	12.5	14.9	14.5	15.8
Generation from fossil fuel and other fuel combustion (percent of total)	29.2	27.9	28.5	26.4	25.4	24.2
Research and development expenditures						
Private sector R&D in alternative energy (million constant 1997 dollars)	228	196	204	..	..	..
Environment and natural resources						
GHG emissions (megatonnes of carbon dioxide equivalent)	714	720	745	747	747	..
GHG emissions by final demand (megatonnes of carbon dioxide equivalent)						
Exports	278	264	..	..	..	..
Personal consumption	200	210	..	..	..	..
Annual temperature departures,[4] Canada (degrees Celsius)	1.7	0.6	1.1	0.1	1.7	2.4
Value of selected natural resources (million current dollars)						
Land	926,150	1,013,754	1,095,419	1,226,497	1,352,999	1,493,300
Timber	300,445	303,278	297,474	302,358	281,125[p]	263,192[p]
Subsoil resource stocks	396,760	375,276	465,083	558,023	817,416[p]	818,926[p]
Average farm pesticide expenditures (current dollars)	6,312	6,228	7,232	7,602	7,792	..
Air quality[5]						
Ozone (population weighted, parts per billion)	40	40	39	35	38	..
$PM_{2.5}$ (population weighted, micrograms per cubic metre)	9	10	9	9	9	..

1. Population data is based on the Estimates of Population program, except for data on urban population, which is based on the Census of Population.
2. Distance driven for vehicles weighing less than 4.5 tonnes, excluding the territories.
3. The size of the reserve at year-end.
4. Annual departures from the 1951-1980 temperature normals.
5. Ground level ozone and fine particulate matter ($PM_{2.5}$) are two key components of smog that have been linked to health impacts ranging from minor respiratory problems to hospitalizations and premature death. Exposure studies indicate that adverse health effects can occur even with low concentrations of these pollutants in the air. Annual data are revised, based on the latest release of the *Canadian Environmental Sustainability Indicators* report.

Sources: Statistics Canada, n.d. (no date), CANSIM tables 051-0001, 153-0037, 380-0017, 326-0021, 282-0002, 203-0003, 203-0002, 203-0007, 405-0063, 105-0400, 128-0002, 128-0009, 153-0012, 153-0013, 153-0014, 153-0017, 153-0018, 153-0019, 127-0001, 378-0005, and 002-0044.
Chiru, Radu, 2006, "Research and Development for New Energy Technologies in the Private Sector, *Analysis in Brief,* Statistics Canada Catalogue no. 11-621-M, Ottawa.
Environment Canada, 2007, *Canada's 2005 Greenhouse Gas Inventory: A Summary of Trends,* www.ec.gc.ca/pdb/ghg/inventory_e.cfm (accessed June 20, 2007).
Environment Canada, 2006, *Climate Trends and Variations Bulletin,* www.msc-smc.ec.gc.ca/ccrm/bulletin/annual06/national_e.cfm (accessed June 20, 2007).
Environment Canada, Statistics Canada and Health Canada, 2007, *Canadian Environmental Sustainability Indicators*, Statistics Canada Catalogue no. 16-251-X, Ottawa.
Statistics Canada, *Waste Management Industry Survey: Business and Government Sectors,* Catalogue no. 16F0023X, Ottawa.
Statistics Canada, Environment Accounts and Statistics Division, Material and Energy Flow Accounts.

Updates

New releases

Households and the Environment Survey: Public Use Microdata File (PUMF), 2006

The 2006 Households and the Environment: Public Use Microdata File is now available. The initial results from the Households and the Environment Survey, 2006 were released on July 11, 2007 (Catalogue no. 11-526-X). To order a copy of the 2006 Households and the Environment Survey: Public Use Microdata File, contact the information officer, (613-951-0297; environ@statcan.ca) Environment Accounts and Statistics Division.

Released December 10, 2007 (Statistics Canada Catalogue no. 16M0001X; $1,000)

Canadian Environmental Sustainability Indicators

This annual report provides a summary of the key findings from Canadian Environmental Sustainability Indicators. It presents a synopsis for each of the report's three environmental sustainability indicators: exposure to ground-level ozone and fine particulate matter, surface freshwater quality, and greenhouse gas emissions. The report provides answers to the following questions for each of the three indicators: What is the issue? What is happening? What does it mean? Why is it happening? The indicators are intended to assist those in government responsible for developing policy and measuring performance, while also helping Canadians who want to know more about the trends in their environment.

Released December 6, 2007 (Statistics Canada Catalogue no. 16-251-X)

Released December 6, 2007 (Statistics Canada Catalogue no. 16-253-X)

Released October 15, 2007 (Statistics Canada Catalogue no. 16-252-X)

Survey of Environmental Protection Expenditures in the Business sector, 2004

This publication presents estimates from the Survey of Environmental Protection Expenditures, 2004. The survey covers capital and operating expenditures made in 2004 by businesses, in order to anticipate or to respond to environmental regulations, conventions or voluntary agreements. In addition to statistics on environmental protection activities such as pollution prevention, end-of-pipe and environmental monitoring, statistics on the use of environmental technologies and their cost, as well as environmental management practices are presented.

Released November 27, 2007 (Statistics Canada Catalogue no. 16F0006X)

Environment Surveys of Establishments: The Canadian Experience

This paper explores the development of the environment survey program at Statistics Canada, the framework within which the surveys exist and what data gaps the surveys fill. The paper will focus on Statistics Canada's experiences and challenges related to the recent development of a new environment survey on industrial water use and the methodological redesign of an existing survey on environmental protection expenditures and technology use in industry. The lessons learned serve as an input for future work related to the collection of environmental statistics.

Released November 23, 2007 (Statistics Canada Catalogue no. 16-001-X)

Estimation of Water Use in Canadian Agriculture in 2001

The main objective of this study was to produce Canadian agricultural water use statistics for the reference year 2001, using several different methods. Water use was estimated for various farming activities including irrigation; spraying herbicides, insecticides and fungicides; frost protection, sanitation washing, and harvesting; on-farm processing; livestock watering, livestock sanitation and other miscellaneous uses.

Released November 13, 2007 (Statistics Canada Catalogue no. 21-601-X)

The new underground economy of subsoil resources

This article, published in the *Canadian Economic Observer,* looks in detail at how the commodity boom has affected primary industries over the last 5

years, notably the shift from forestry to energy and mining.

Released October 11, 2007 (Statistics Canada Catalogue no. 11-010-X)

Environment Industry: Business Sector 2002 (revised) and 2004

Information on revenues earned from sales of environmental goods and services is reported in the upcoming Environment Industry publication. Environmental goods and services are used to measure, prevent, limit or correct environmental damage to water, air and soil as well as problems related to waste, noise and ecosystems. They also include clean or resource-efficient technologies that decrease material inputs, reduce energy consumption, recover valuable by-products, reduce emissions and/or minimize waste disposal problems.

Released September 24, 2007 (Statistics Canada Catalogue no. 16F0008X)

Behaviour Study on the Water Quality Index of the Canadian Council of Ministers of the Environment

The objective of the present study is to understand and explain how the Canadian Council of Ministers of the Environment (CCME) Water Quality Index (WQI) behaves, and at the same time determine its limitations to make a better use of it in the future. In order to do so, four data sets were made available to us thanks to participation of the following provinces: Newfoundland, Ontario, British Columbia and Quebec.

Released September 19, 2007 (Statistics Canada Catalogue no. 16-001-X)

New developments

National Pollutant Release Inventory linkage project

Allison Bone

Tracking emissions that affect global warming as well as air and water quality is an issue of importance to both Environment Canada and Statistics Canada.

Environment Canada currently collects annual pollution emissions data for over 300 substances via the National Pollutant Release Inventory (NPRI) which is under the authority of the Canadian Environmental Protection Act, 1999 (CEPA, 1999). However, since the NPRI is not designed to provide comprehensive estimates, there is only partial knowledge of the emissions for most substances. More comprehensive emissions data that can be linked to economic data would make a valuable contribution to the Canadian System of Environment and Resource Accounts of Statistics Canada.

Both departments have begun a project to link data on economic production and pollutant emissions in order to address the need to analyse changes in emissions over time, and also to estimate emissions intensities of various economic sectors. This project will provide Canadians with more complete and consistent data on pollution releases that go beyond the current information available through the NPRI.

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