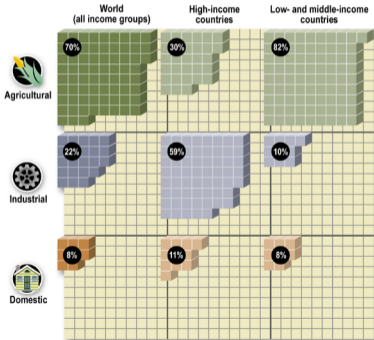


# Competing for a larger slice of the water pie

High-income countries devote the majority of their total water supply to industrial needs, while low- and middle-income countries use far more of their water for agriculture.

*Percentages indicate portion of total water consumption by use*



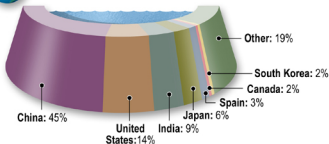
# Dam builders have been busy beavers

In 2000, there were over 45 000 large dams\* worldwide. Half of the world's existing large dams are built strictly for irrigation, while the remainder are built for hydro generation, water supply and flood control.



## Distribution of large dams worldwide

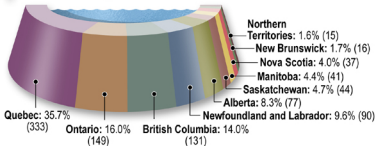
Shown as a percentage of total large dams worldwide



## Distribution of large dams in Canada

Shown as a percentage of total large dams in Canada.

Actual numbers appear in brackets.

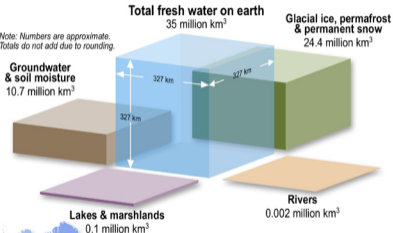


\* According to the International Commission on Large Dams, a large dam is one with a height of 15 m or more from the foundation, or a height of 5 to 15 m with a reservoir volume of more than 3 million cubic metres.

## Where on earth is all that fresh water?

There are about 35 million km<sup>3</sup> of fresh water on the earth. Here's where that water is found.

*Note: Numbers are approximate.  
Totals do not add due to rounding.*



### How much water is that?

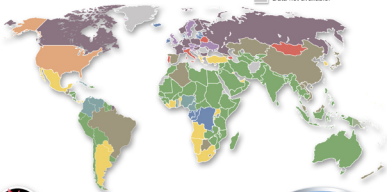
There is enough fresh water on the earth to cover Canada and the United States to a depth of about 1.8 kilometres.

# Freshwater withdrawals

Almost 70% of the world's freshwater withdrawals are used for agriculture. In many countries, that figure is even higher, while in Canada, agricultural use accounts for only 9% of freshwater withdrawals. Here's a look at global and Canadian freshwater withdrawals based on use.

## Map legend

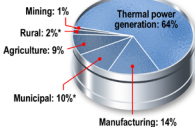
- |  |   |   |
|--|---|---|
| Industry widely dominant.                                      | Domestic use widely dominant.                                     | Agriculture widely dominant.                                  |
| Industry and agriculture equally dominant.                     | Domestic use and agriculture equally dominant.                    | Agriculture dominant with significant use by industry.        |
| Industry dominant with significant use by the domestic sector. | Agriculture dominant with significant use by the domestic sector. | Agriculture widely dominant with significant use by industry. |
|  |   | Data not available.   |



## How Canada uses its water

In Canada, almost two out of every three litres of water are withdrawn for thermal power generation. Here's how Canada's 44.7 billion cubic metres of annual freshwater withdrawals are put to use.

*\*Municipal and rural percentages include: residential, commercial/institutional and other non-industrial uses.*



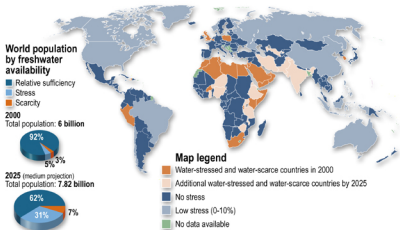
## Are all water withdrawals created equal?

Not at all. Agriculture is the least efficient user of water, returning only about 30% of water withdrawn back to the source. The manufacturing and mining sectors are much more efficient users of the water they withdraw because of recycling, sometimes reusing its water two or more times.



## Gazing into the (water-filled) crystal ball

Currently, 600 million people face water scarcity.\* Depending on future rates of population growth, between 2.7 and 3.2 billion people may be living in either water-scarce or water-stressed conditions by 2025. A glimmer of hope lies in the fact that the growth of world population is slowing significantly. The map below presents a look at the future based on medium-growth projections for population and freshwater availability.



\* Water stress begins when there is less than 1 700 m<sup>3</sup> of water per person per year for all major functions (domestic, industrial, agricultural, and natural ecosystems). It is considered scarce when there is less than 1 000 m<sup>3</sup> per person.

Note: the terms "stress" or "scarcity" do not take into account actual physical access to water sources, or the quality of the water, or the irregularity of availability due to droughts and storms, or seasonal change. Instead, the terms give an indication of the close relation between population dynamics and renewable freshwater availability.

# The appropriately named Great Lakes

The Great Lakes Basin is the world's largest freshwater lake system with approximately 18% of the world's surface water. The five lakes are vital to the economies of both Canada and the United States and the surrounding basin is home to about 1 in 3 Canadians and 1 in 10 Americans. As a result the basin is also home to serious environmental issues.

## Great, but not perfect

In 1987, an agreement between Canada and the United States identified several "Areas of Concern," environmentally degraded sites in the Great Lakes Basin. These areas were targeted for environmental repair and protection. The map below identifies current and delisted "Areas of Concern."

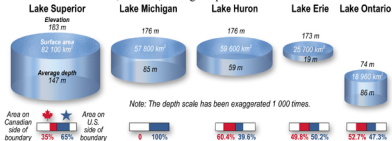
## Map legend

- Lake Superior drainage basin
- Lake Huron drainage basin
- Lake Ontario drainage basin
- Lake Michigan drainage basin
- Lake Erie drainage basin
- Canadian Area of Concern (AOC)
- United States AOC
- ◆ Binational Remedial Action Plans
- ▲ Areas in recovery
- ★ Delisted Area of Concern



## A look at the lakes

The chart below shows the five Great Lakes in relative proportion to each other in terms of surface area, volume, average depth and elevation.



## Powering the world with water

In 2000, one-third of the world's countries relied on hydropower for more than half their electricity supply and large dams generated 19% of electricity overall. About 70% of hydroelectric power generation potential has already been tapped in the developed world; only about 10% in the developing world.

### The world's largest hydroelectric plants

*Numbers indicate megawatts of installed generating capacity*

1. Three Gorges	China	18 200 MW
2. Itaipu	Brazil/Paraguay	12 600
3. Grand Coulee	United States	10 100
4. Guri	Venezuela	10 100
5. Tucuruí	Brazil	7 500
6. Sayano-Shushensk	Russia	6 400
7. Krasnoyarsk	Russia	6 100
8. Corpus-Posadas	Argentina/Paraguay	6 000
9. La Grande 2	Canada	5 300*
10. Churchill Falls	Canada	5 200

\* The combined output of all eight dams at James Bay is 15 237 MW



### How much electricity is that?

La Grande 2 on James Bay, Canada's largest hydroelectric plant, produces enough hydro to constantly light a 60-watt light bulb for more than 10 000 years.\*\*

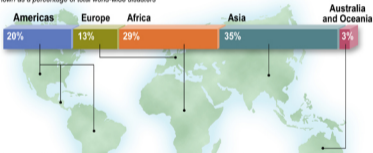
\*\* Assuming the plant is run at maximum capacity around the clock.

## Worldwide water-related natural disasters

More than 2 200 major and minor water-related natural disasters occurred in the world between 1990 and 2001. Asia and Africa were the most affected continents, with floods accounting for half of these disasters.

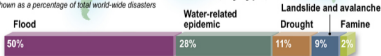
### Distribution of water-related natural disasters, 1990-2001

*Shown as a percentage of total world-wide disasters*



### World-wide water-related natural disasters, by type, 1990-1991

*Shown as a percentage of total world-wide disasters*



## That better be a **REALLY** juicy orange

Not only is water vital to life, it is critical to food production where huge volumes of it are needed. How huge? You could fill 28 standard-sized orange juice cartons with the same amount of water that is needed to grow just one medium-sized orange (130 grams) and to prepare it for market.

H<sub>2</sub>O



*\*1.89 litre cartons*

© Environment Canada, 2004

# Linking the Great Lakes to the world

The St. Lawrence Seaway, which opened the North American heartland to ocean-going ships, is one of three main transportation waterways in Canada. More than 200 million tonnes of cargo move through the Seaway annually.



## Why the need for locks?

Because the Great Lakes are higher than sea level, ships must be lifted using locks. Over the course of the seaway, ships are lifted more than 180 metres above sea level, almost twice the height of the Peace Tower.

## By the numbers: Painting a picture of the St. Lawrence Seaway

**1959** Year the St. Lawrence was officially opened to deep draft navigation.

**2038** Distance in nautical miles from the Atlantic Ocean to Duluth, Minnesota.

**19** Number of locks in the seaway system; 13 are Canadian, six are U.S.

**225.5** Length in meters of largest ships able to use locks in the seaway system.

**10** Number of provinces (two) and U.S. states directly served by the seaway.

**91 MILLION** Litres of water that fill each lock in just 7 to 10 minutes.

**6500** Approximate number of people relocated to allow for construction of the seaway.

**2 to 4 BILLION** Dollars; the estimated annual impact of the seaway on the Canadian economy.

## Giving new meaning to the term “liquid steel”

It takes about 215 000 litres of water to produce just one metric tonne of steel. That's enough water to supply the water needs of a Canadian family of four for about five months.\*



\* Based on 2001 statistics showing Canadian daily freshwater use per capita of 335 L.

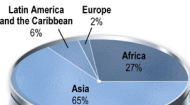
# Safe water and sanitation still a dream for many

About one in six people in the world are still without access to a safe water supply. More than twice that many remain without adequate sanitation.

## Distribution of world population without access to safe water supply

*Shown as a percentage of world population without safe water supply*

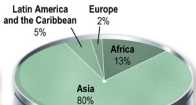
**Total unserved population: 1.1 billion**



## Distribution of world population without access to adequate sanitation

*Shown as a percentage of world population without adequate sanitation*

**Total unserved population: 2.4 billion**





# Water availability versus population

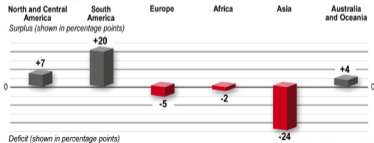
Although 60% of the world's population live in Asia, the continent has only 36% of the world's water resources. Here's how Asia compares to other regions.

## Water/Population distribution



## Water/Population balance

A region's water/population balance is determined by the difference between its proportion of the world's available water and its proportion of the world's population. A surplus indicates that its proportion of the world's available water is greater than its proportion of the world's population. A deficit indicates the reverse situation.



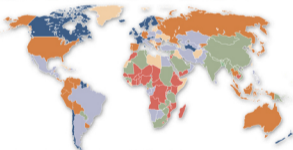
## A broader perspective on water

Canada ranks second best out of 147 countries on the Water Poverty Index. The study released in March 2003, uses five criteria – resources, access, capacity, use and environment – to assess each country. The index demonstrates the strong connection between “water poverty” and “income poverty” and will help the international community develop strategies that support sustainable water management practices. The map below plots the results of the Water Poverty Index rankings.

### Map legend

Degree of water poverty

Severe High Medium Medium low Low No data



### Top ten countries on index

In descending order

Finland

Canada

Iceland

Norway

Guyana

Suriname

Austria

Ireland

Sweden

Switzerland

### Bottom ten countries on index

In ascending order

Haiti

Niger

Ethiopia

Eritrea

Malawi

Djibouti

Chad

Benin

Rwanda

Burundi



### Is it all good news for Canada?

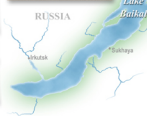
Although Canada scored well in four of the five categories used to determine the rankings, we ranked a lowly 129th in the “use” component because of wasteful or inefficient water use in industry and in the domestic sector. Per capita water consumption in Canada is the second highest in the world, exceeded only by the United States, which ranked 32nd overall on the Water Poverty Index.

# Lake Baikal: deepest lake on the planet

Lake Baikal in southern Russia is the world's deepest lake with a maximum depth of 1 637 metres. The lake also contains about one-fifth of the world's unfrozen fresh water, a volume equivalent to that of all five Great Lakes combined.

## How deep is that?

At its deepest point, Lake Baikal is deep enough to submerge Toronto's CN Tower, which stands 553.3 metres, almost three times over.



## The world's deepest lakes

1. Lake Baikal	Russia	1 637 m
2. Lake Tanganyika	Tanzania, Zaire and Zambia	1 435 m
3. Caspian Sea	Iran and Russia	946 m
4. Lake Nyasa	Mozambique, Tanzania and Malawi	706 m
5. Issyk Kul	Kyrgyzstan	700 m
6. Great Slave Lake	Canada	614 m

Note: Great Bear Lake in the Northwest Territories is the world's 10th deepest lake.



## Row, row, row, row, row, row your boat

The lake with the largest surface area in the world is the Caspian Sea in central Asia. Its surface area is about 436 000 km<sup>2</sup>.

### How large an area is that?

The Caspian Sea has over 5 times the surface area of Lake Superior, which ranks second in the world. Lake Superior drawn to scale below, has a surface area of about 82 300 km<sup>2</sup>.



# Canadian Shield no shield against acid rain

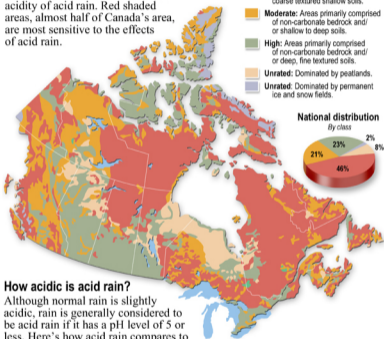
Just over 45% of the country's total surface area is highly sensitive to acid rain. Much of this area is in eastern Canada where the Canadian Shield has little ability to neutralize acidic pollutants.

## In the red

The map below shows the potential of soils and bedrock to reduce the acidity of acid rain. Red shaded areas, almost half of Canada's area, are most sensitive to the effects of acid rain.

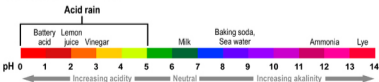
## Map legend

- Low:** Areas primarily comprised of non-carbonate bedrock and coarse textured shallow soils.
- Moderate:** Areas primarily comprised of non-carbonate bedrock and/or shallow to deep soils.
- High:** Areas primarily comprised of non-carbonate bedrock and/or deep, fine textured soils.
- Unrated:** Dominated by peatlands.
- Unrated:** Dominated by permanent ice and snow fields.



## How acidic is acid rain?

Although normal rain is slightly acidic, rain is generally considered to be acid rain if it has a pH level of 5 or less. Here's how acid rain compares to other common products.



Note: Because the pH scale is logarithmic, an increase in acidity of only one unit results in a ten-fold increase. For example, rain with a pH of 4 is 10 times more acidic than rain with a pH of 5 and 100 times more acidic than rain with a pH of 6.

# The Aral Sea: Going, going, almost gone

As recently as forty years ago, the Aral Sea in Central Asia was the fourth largest lake in the world. Diversions of its two main feeder rivers for agricultural irrigation have since reduced the lake to a salty shell of its former self.



## Why is this a big deal?

The loss of two-thirds of the Aral Sea's surface area has caused serious harm to the environment and to millions living in the surrounding former Soviet republics. Here's a look at the impact:



### Environment

Three million hectares of seabed have been exposed, resulting in extreme jumps in the salt content of the soil and desertification of surrounding areas. The disappearance of wildlife has followed the shrinking of the lake.



### Climate

The lake used to regulate climate in the region, buffering the cold Siberian winds and keeping summers cool. The region now faces shorter, hotter, rainless summers and longer, colder, snowless winters.



### Fishing

Some 60 000 fishing jobs have been wiped out by the lake's disappearance. Only four species of fish are now caught commercially, down from more than two dozen.



### Agriculture

Dust storms scour the dry lake bed and surrounding areas, blowing salt and pesticide residues over the region. Between the salination of farm fields and the shrinking of the growing season, once-thriving cotton farms are now un-farmable.



### Human health

Major health problems for area residents have followed the lakes desiccation. High levels of heavy metals, salts and other toxic substances have led to sharp increases in cancer, kidney, liver and lung diseases.



## World's freshwater supply just a drop in the bucket

Of all fresh water not locked up in ice caps or glaciers, some 20% is in areas too remote for humans to access and of the remaining 80%, about three-quarters comes at the wrong time and place – in monsoons and floods – and is not always captured for use by people. The remainder is less than 0.08 of 1% of the total water on the planet.

### How much water is that?

If all of the water on earth were stored in a standard 18-litre water cooler bottle, the available fresh water would fill only three teaspoons.

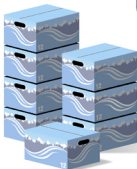


# Your very own body of water

The average human body is composed of about 55% water. The average adult male is about 60% water, the average adult female about 50% water.\*

## How much water is that?

An average adult male with a weight of 80 kg (about 176 lbs) and a water content of 60%, would contain 48 kg or 48 L of water, equal to eight cases of standard-size bottled water.\*\*



## Where is all of that water?

All parts of the body contain some water. Here are some of the more "watery" parts.



**Lungs: 90% water**



**Blood: 82%**



**Skin: 80%**



**Muscle: 75%**



**Brain: 70%**



**Bones: 22%**

\* Muscle contains more water than fat does. Males generally have higher muscle content than females.

\*\* 1 litre of water weighs 1 kilogram. A standard size container of bottled water is 500 mL.



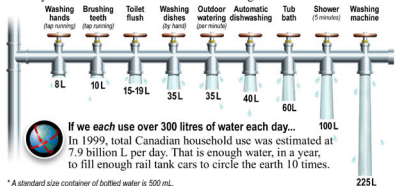
# Canada's watery lifestyle

In 2001, the average daily freshwater domestic use per capita was 335 litres, equal to more than 55 cases of standard-size bottled water.\* Here's how the average Canadian used that much water.



## How can we be using *that* much water?

Water goes down the drain faster than most of us realize. Here's how some of our daily activities contribute to our total water usage.



\* A standard size container of bottled water is 500 mL.

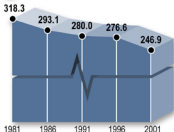
# Fewer Canadian farms, but more crop land

While the number of farms in Canada has declined steadily since 1981, the amount of farmland used for crops has climbed over the same period.



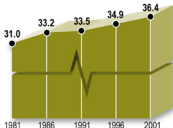
## Number of farms in Canada

Thousands of farms



## Hectares of cropland in Canada

Millions of hectares



## Why is this important to fresh water?

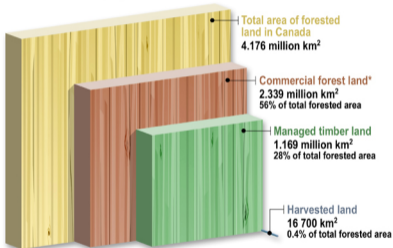


Canada's freshwater resources help drive the nation's economy in part by contributing directly to its agriculture. Irrigation is a vital part of crop production in certain areas of Canada.

## Canada's forest story

Although forests cover more than two-fifths of Canada's total land area, only a small sliver of that is harvested each year. The chart below shows how Canada's forest land is used.

*Slabs are shown in relative proportion to total area of forested land.*



\* Commercial forest land is capable of producing timber and non-timber products such as maple products and Christmas trees.



### What's so special about forests?

Forests play a key role in moderating climate, regulating water systems, preventing erosion, alleviating air pollution and providing wildlife habitat.

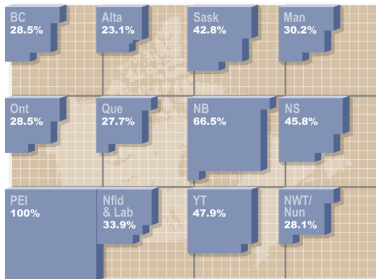
## What you see may not be what you get

Almost 9 million Canadians, or 30.3% of the population rely on groundwater for domestic use. About two-thirds of these users live in rural areas where wells are often less expensive and more reliable than obtaining water from nearby lakes, rivers and streams. The chart below shows the wide variations in provincial reliance on groundwater.

Canada  
30.3%

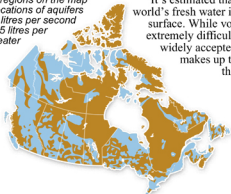
### Percentage of population that relies on groundwater

*Municipal, domestic and rural only. Figures shown are provincial averages and may vary regionally.*



### Canadian groundwater aquifer potential

*Blue shaded regions on the map identify the locations of aquifers that yield 0.4 litres per second or greater (0.5 litres per second or greater in British Columbia, Quebec and Labrador).*



### Just how much water is down there?

It's estimated that about 31% of the world's fresh water is below the earth's surface. While volume estimates are extremely difficult to determine, it is widely accepted that groundwater makes up the vast majority of the world's available fresh water.

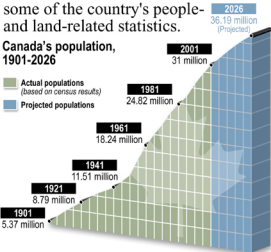
## Putting Canada in context

Canada's population has grown at a more or less steady rate since the second world war. Here's a look at some of the country's people- and land-related statistics.

### Canada's population, 1901-2026

Actual populations  
(based on census results)

Projected populations



## Canada's place in the world

Shown as percentage of world totals

Population (2003)



Total land area



Fresh water (by surface area)



Forest area



Arable land area



# Alberta tops in irrigating crops

There are about 10 000 km<sup>2</sup> of irrigated cropland in Canada, with Alberta alone accounting for 60%.

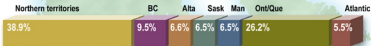
## Distribution of irrigated cropland in Canada

Shown as a percentage of total irrigated cropland in Canada



## Distribution of total land area in Canada

Shown as a percentage of total land area in Canada



## Distribution of total agricultural water withdrawals



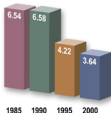
## Canada's recreational fish tale

The recreational fishing industry in Canada, which contributes billions of dollars each year to the economy, relies on healthy freshwater ecosystems. Studies done every five years by Fisheries and Oceans Canada show that while the number of anglers has dropped dramatically, fishing-related spending has remained relatively steady. Here's a look at recent statistics.



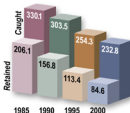
### Total number of anglers

Shown in millions of resident and non-resident anglers



### Total fish caught and retained

Shown in millions of fish



### Direct fishing-related expenditures\*

Shown in billions of dollars



\*Direct fishing-related expenditures include: food & lodging, transportation, fishing services and fishing supplies.

## Why are anglers releasing so many more fish?

In 1985, anglers released less than 38% of all fish they caught. By 2000, that number had climbed to 64%. In part, this is because many recreational anglers have adopted the "catch and release" approach to fishing. By using barbless hooks and carefully releasing fish, they help to ensure the continued sustainability of Canada's recreational fishing industry.

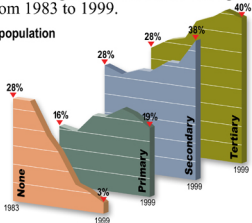


# Closing in on 100 percent wastewater treatment

In 1999, 97% of the municipal population\* in Canada received some form of sewage treatment. Secondary or tertiary treatment was provided to 78% of the municipal population. The chart below plots the trend in municipal sewage treatment from 1983 to 1999.

## Percentage of municipal population on sewage treatment

- None (least effective):** Sewage is released untreated.
- Primary:** Removal of debris and suspended solids by screening and settling.
- Secondary:** Use of biological processes to break down organic material and remove additional suspended solids.
- Tertiary (most effective):** Advanced treatment that uses additional filtering or chemical or biological processes to remove specific compounds or materials that remain after secondary treatment.



\* Refers only to municipal population that is served by a sewer system.



## Flowing in opposite directions

Approximately 60% of Canada's fresh water drains to the north, while 85% of the population live along the southern border with the United States.

### Canada's most populous cities

- More than 1 million people
- 500 000 - 999 999 people
- Fewer than 499 999 people

### Drainage areas

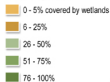
- Pacific Ocean
- Arctic Ocean
- Hudson Bay
- Gulf of Mexico
- Atlantic Ocean
- Internal drainage area
- Drainage flow (the wider the arrow, the greater the flow)



# Canada's wetland story

About 14% of Canada is covered by wetlands, the edges of lakes and rivers, swamps, inland marshes, sloughs, peatlands and the marine waters of estuaries and tidal ocean shoreline. These fragile freshwater habitats, vital to ecology and the Canadian economy, are under severe threat by drainage, land reclamation, pollution, overuse and human development.

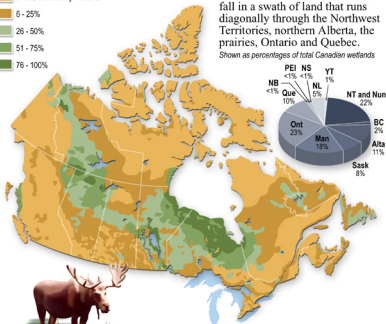
## Map legend



## A wetland corridor

About 90% of Canada's wetlands fall in a swath of land that runs diagonally through the Northwest Territories, northern Alberta, the prairies, Ontario and Quebec.

*Shown as percentages of total Canadian wetlands*



## How much wetland is out there?

There are about 1.48 million km<sup>2</sup> of wetlands in Canada, about 1/4 of the world's total and slightly larger than the combined areas of Alberta and Saskatchewan.

## Provincial/territorial wetland coverages

*Shown as percentage of total area of each province or territory*

