

Environmental Trends in British Columbia

2002



**HUMAN HEALTH
AND ENVIRONMENT**

WATER

**TOXIC
CONTAMINANTS**

CLIMATE CHANGE

STEWARDSHIP

BIODIVERSITY



**Ministry of Water, Land
and Air Protection**
State of Environment Reporting

ON THE COVER

The Pacific Giant Salamander (*Dicamptodon tenebrosus*) is a secretive amphibian that lives in clear, fast flowing and shaded streams of coastal coniferous forests in the Chilliwack River watershed and immediately adjacent areas. Most records are from relatively small streams, between 100 and 1050 m elevation in coast coniferous forests. Cover is very important for this species and mature or old-growth forests with plenty of shade and with considerable litter and debris, such as rotting logs on the forest floor, are preferred habitats. Habitat loss and alteration, due to logging, agriculture and town expansion, is likely the main cause of the salamander's declining numbers in British Columbia.

Little is known about the behaviour of this species because they are mostly active at night, preferring to hide in damp crevices during the day. Both the adults and juveniles are predatory. They feed on aquatic insects, such as mosquitoes and black flies, as well as worms, snails, small fish, tadpoles, and other organisms. The adults are able diggers and climbers and are capable of aggressively defending themselves if threatened.

The Pacific Giant Salamander has a restricted distribution range within British Columbia but outside of the province it occurs along the coast as far south as California. To maintain the genetic diversity of this species, it is important to ensure northern populations are maintained. The Pacific Giant Salamander has been placed on British Columbia's Red list, the category of greatest concern, and is reported on as part of the Species at Risk indicator (page 50).

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A technical compendium documenting methodologies and presenting the data behind each indicator is available on hardcopy upon request or is available on the Internet at <http://wlapwww.gov.bc.ca/soerpt>.

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Environmental Trends in British Columbia 2002

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Acknowledgements

Ministry of Water, Land and Air Protection Steering Committee:
Dr. Risa Smith, Christy Lightowlers, Angeline Tillmanns and Dr. Linda Gilkeson

Contributors:

Contributors are staff of the Ministry of Water, Land and Air Protection unless otherwise indicated.

Doug Adama ⁵	Orville Dyer ¹⁶	Maurice Lirette	Dr. Peter Ross ¹¹
Mark Anielski ¹⁷	John Elliot ³	Jessica MacDonald ⁵	Karen Rothe ¹⁶
Pia Archibald	Ann Eriksson ⁵	Mike MacFarlane	Donna Sanford
Matt Austin	Dr. John Errington ¹³	Thomas Maxwell	Dale Sebastian
Nick Baccante	Duncan Ferguson	Dr. Asit Mazumder ¹⁹	Cynthia Sinclair
Fran Backhouse ⁵	Dr. Glyn Fox	Eric McGreer	Tory Stevens
Randy Baker ¹	Jenny Fraser	Michele McLachlan	Roger Streets ⁹
Barry Bartlett ⁵	Dave Fraser	Vincent Mercier ⁹	Stephen Sutherland ⁶
Diane Beattie	Peter Friesen ¹⁶	Dave Minty ¹⁶	Natalie Suzuki
Warren Bell	Laura Friis	Kathleen Moore ³	Les Swain
Kim Bellefontaine ¹³	Marilyn Fuchs ¹⁰	Maureen Moore ¹⁶	Art Tautz
Don Bernard ⁹	Paul Giroux	Chris Morgan ¹⁶	Lee Thiessen
Doug Bertram	Brian Grant	Ken Morrison	Andy Thompson ⁷
Doug Biffard	Malcolm Gray ¹⁶	Ted Murray ¹⁶	Arlene Tompkins
Kul Bindra	Mike Hagen ⁹	Kari Nelson	Luke Trip ⁹
Barry Boettger ¹⁵	Tony Hamilton	Linda Nichol	Terje Vold ¹⁴
Dan Bolton	Andrew Harcombe ¹⁶	Bob Nicholson ¹⁶	Harry Vogt
Wayne Bond ⁹	Rick Hardy ¹⁶	Tom Niemann ¹⁶	Tony Wakelin
Ian Buck ⁵	Sarah Harrigan	David Niemi ⁹	Dr. John Ward
Dr. Alan Burger ⁵	Ian Hatter	Carol Ogborne ¹⁶	Mike Wei
Syd Cannings ¹⁶	Ed Hill ²	Kathryn Ostermann	Bill Weismiller ¹²
Greg Cheesman	Bill Hodge	Jeff Oulton ²	Susan Westmacott ¹⁶
Myke Chutter	Lynn Husted	Dr. Rick Page ⁵	Bill Westover
Mike Collet	Chris Jenkins	Eric Parkinson	Bob Williams
Ray Copes ¹⁵	Vic Jensen	Bob Paul	Rick Williams
Alan Coverly	Duane Jesson	Burke Phippen ⁵	Laurie Wilson ³
Rob Dalrymple	Doug Jury	Larry Pommen	Tonya Wilts ⁹
Tom Dann ⁹	Kristin Karr	Dr. Bill Price ¹³	Karen Wipond
Michael DeAbreu ⁹	Michael Keating ⁵	Juanita Ptolemy	Frank Wittheoft ¹⁶
Pat Dielman	Ann Kerr ⁹	James Quayle	Phil Wong ⁹
Patty Doherty ⁴	Al Kohut	Henry Quon ⁹	Beth Wright
Marta Donovan ¹⁶	Ted Lea	Leah Ramsay ¹⁶	Alan Young ⁸
George Douglas ¹⁶	Carl Lee	William Rees ¹⁸	Dr. Mark Zacharias ¹⁶
Ted Down	Ernest Leupin ⁵	Roger Reid	Ted Zimmerman
Wilf Dreher ¹⁶	Nancy Liesch ¹⁶	Nedjo Rogers ⁸	Pamela Zevit
Doug Duggan ⁹	Bob Lindsay	Beth Rogers ¹⁶	

1) Azimuth Consulting Group, 2) BC Hydro, 3) Canadian Wildlife Service, 4) Certified Organic Associations of BC, 5) Contractor, 6) Co-op student, 7) Department of Fisheries and Oceans, 8) Energy and Mines Council of BC, 9) Environment Canada, 10) Garry Oak Ecosystems Recovery Team, 11) Institute of Ocean Sciences, 12) Ministry of Agriculture, Food and Fisheries, 13) Ministry of Energy and Mines, 14) Ministry of Forests, 15) Ministry of Health Planning, 16) Ministry of Sustainable Resource Management, 17) Pembina Institute, 18) University of British Columbia, 19) University of Victoria

Highlights

British Columbia continues to make progress towards achieving both broad goals and specific targets in several areas. Environmental protection efforts have resulted in improvements in the amount of waste recycled, increases in protected land areas and a reduction in the impact of some industries on the environment and human health. During this time, the value of environmental protection industries to the provincial economy continued to increase, generating nearly \$1.8 billion in revenues in 1998.

A majority of British Columbia households are now served by curbside collection of recyclables; industry stewardship programs prevent waste oil, batteries and other hazardous household products from going into landfills. While the amount of solid waste generated per person has remained about the same for the last 10 years, the percentage recycled more than doubled since 1990. The total amount of waste sent to landfills has continued to decrease even though the province's population increased by nearly a third over the same period.

Progress continues to be made in removing sources of water contamination. As pulp mills changed bleaching processes and added treatment of effluent, there was a substantial drop in chlorine compounds and toxic by-products discharged into provincial waters. Since 1996, the number of British Columbians served by municipal wastewater systems that employ secondary and tertiary sewage treatment has doubled.

The use of environmentally friendly production practices continues to increase in agriculture. The number of certified organic producers and processors has nearly tripled since 1992 and a large area of farmland is currently managed using integrated pest management methods. Since 1991, pesticide use by landscape services in the Lower Mainland dropped by 40%, likely in part due to the adoption of integrated pest management practices.

Legislative initiatives and stewardship programs aimed at lessening the impact of human activity on the environment have had a positive effect. Their effects, however, are diminished by pressure from an expanding population. Increases in human activity, such as road development, water consumption and discharge of pollutants into the surrounding environment, continue to affect air and water quality and natural habitat in the province.

Most of the province's surface waters appear to be in good condition, however, monitoring for water quality declined in the late 1990's, with fewer water bodies monitored in 1999 than earlier in the decade. An increasing number of groundwater observation wells show declining water levels and over half of the province's most heavily used aquifers are now considered highly vulnerable to contamination.

The release of carbon dioxide and other gases that contribute to atmospheric warming has increased markedly in British Columbia. The largest source of gases comes from burning fossil fuels in vehicles. This is a result of increasing population and higher numbers of less fuel-efficient vehicles on the road. If the current trend continues, by 2010 the province may experience one of the largest increases in greenhouse gas emissions in the country. Presently, coastal British Columbia is warming at the same rate

as the global average over the past century, however, the central and southern interior regions have warmed by 1.1°C, which is twice the global average.

British Columbia has made a concerted effort to assess the status of its species and to preserve biodiversity by protecting ecosystems. The area of forests and certain ecosystems protected by legislation has doubled and the area of key estuaries managed for conservation tripled. The province has surpassed the goal recommended in the Brundtland Report (1988) of protecting 12% of the land base. Despite this progress, rapid expansion of human activities, especially in southern areas of the province, continues to alter habitat and increase the number of wildlife species "at risk". Although large, mainly northern, areas of the province remain essentially roadless, road development had increased substantially in the regions of the province that were re-surveyed in 1999. Habitat loss has affected wildlife species, such as Caribou and Columbian Sharp-Tailed Grouse, which no longer occupy significant portions of their historical ranges. In addition, a third of all known species of reptiles and freshwater fish and a quarter of the amphibians in British Columbia are currently threatened or endangered.

Efforts to protect terrestrial ecosystems have not been matched by protection of marine environments. Only a small percentage of marine ecosystems are protected and sewage discharges into coastal waters are an ongoing problem.

Freshwater habitats and the species that depend on them also continue to be at risk. Development in the Lower Fraser Valley has resulted in a marked drop in

the area of wetlands, while 15% of the original streams in the area no longer exist. All White Sturgeon populations in British Columbia are threatened and three populations are considered critically imperilled. Over half of the Steelhead Trout stocks are of conservation concern and there is a continuing effort to rebuild the populations of Kokanee in Kootenay Lake.

Environmental protection in British Columbia compares favourably with other jurisdictions. The province ties Alberta for the highest percentage of land base in protected areas in Canada and British Columbia currently has the third lowest per capita emission rate of greenhouse gases in Canada. Generally, British Columbians are exposed to lower levels of air pollution, mercury, heavy metals and other pollutants than residents in more heavily industrialized regions. British Columbia residents generally have access to high quality drinking water and use about the same amount of water per capita as the national average.

The Environmental Trends report shows areas where further work is needed to protect the provincial environment. It also highlights the connection between the provincial environment and the global environment. For example, average temperatures have increased in British Columbia as the effects of atmospheric warming from greenhouse gas emissions are felt internationally. As well, long-range atmospheric transport of persistent chemicals used in other parts of the world continues to bring contaminants into the provincial environment.



Introduction

The health of British Columbians and their economy are intimately linked to the health of their environment. People depend on natural capital, such as wood, fish, fruits and vegetables, and ecosystem services such as water purification, soil creation and biological diversity to help maintain a healthy, productive environment.

The government's environmental goals are:

- > Protect human health and safety by ensuring clean and safe water, land and air.
- > Maintain and restore the natural diversity of ecosystems, and fish and wildlife species and their habitat.

This report on the state of British Columbia's environment was prepared to inform people about how their choices affect the natural world.

Environmental Trends in British Columbia 2002 is published by the provincial government to make credible scientific information on key environmental issues and trends accessible to citizens. It is part of the government's commitment to accountability and transparency. This is not just a report on government performance; it also shows the results of decisions by industries, businesses and individuals. This environmental information can be used by British Columbian's to make choices that promote a healthy environment for themselves and future generations.

This report is based around a series of environmental indicators. Reports like this are emerging tools to encourage the incorporation

of environmental information into decision-making. They also provide an opportunity for the public and community organizations to access credible environmental information. By reporting on environmental indicators we are able to measure environmental performance and progress toward environmental targets. Monitoring these indicators can also alert decision makers and the public to emerging environmental issues. These indicators are being used by international organizations such as the Organization for Economic Co-operation and Development and World Wildlife Fund for Nature; by national organizations such as Environment

Canada and Statistics Canada; and by many provincial organizations such as the Ministry of Health.

British Columbia is a leader in developing and publishing environmental indicator reports that present highly technical information in a manner that is easily understood by the public. Experts in the field have reviewed each indicator. This report is based on the most recent data available at the end of 2001. Indicators based on annual monitoring programs present data from 2000 or 2001, however, dates vary for indicators based on studies that were conducted irregularly or at longer intervals.

A technical background document with the data and a description of the methodology for each indicator is available on the British Columbia State of Environment Reporting Internet Site: <http://wlapwww.gov.bc.ca/soerpt/index.html>



Environmental Trends in British Columbia 2002 is the province's third environmental indicators report. The 1998 report began with 12 indicators, a list expanded to 15 in 2000. This latest report has 16 key indicators, incorporating 64 separate measures that show the status and sometimes the trends in issues. The information has been grouped into six theme areas: Biodiversity, Water, Stewardship, Human Health and the Environment, Toxic Contaminants, and Climate Change. When read as a package they paint an overall picture of British Columbia's environment, showing important linkages, particularly between human activities and environmental changes.

Each edition of *Environmental Trends in British Columbia* offers the opportunity to review recent knowledge about the state of the province's environment, and through discussion to identify gaps where indicators are needed. This report has incorporated past criticisms and suggestions, and as a result is an improvement over earlier work. Some indicators, such as Species at Risk, Surface Water Quality, and Toxic Contaminants, have emerged as key indicators that the public and decision makers find useful, while other indicators are still being refined.

NEXT STEPS

This report allows tracking of progress towards environmental targets. Some have been achieved, such as 12% of the land base protected, a target suggested by the World Commission on the Environment and Development. Some have led to major improvements, such as the reduction of AOX

from pulp and paper mill effluent; and some have not yet been reached, such as reducing by half the amount of solid waste disposed of per person by the year 2000. In all cases, setting clear targets, monitoring and reporting can motivate action towards attaining a sustainable environment.

Through its Service Plan, the Ministry of Water, Land and Air Protection has a commitment to increase its focus on setting environmental standards and goals, and on monitoring and reporting. As they are developed, new targets and indicators will be tracked in future editions of *Environmental Trends in British Columbia*. To make decisions about environmental management, it is essential to maintain a system of reporting that is based on environmental monitoring, inventories and research. This is costly, but through public discussions and stewardship initiatives, strategic partnerships can be forged to share the costs and integrate information into a single reporting system.

Maintaining a clean, healthy and naturally diverse environment will require actions by all British Columbians. Government can set standards and develop guidelines, but the health of the environment also depends on individual British Columbians choosing to drive their cars less, buy less toxic products and generate less waste. Information in reports such as this one can help people make choices that reflect their values and aid in our goal towards a healthy, sustainable environment.



Summary of Indicators

AIR QUALITY

Measured as the percentage of communities exposed to health risks from fine particulates ($PM_{10} > 25 \mu\text{g}/\text{m}^3$) for more than 18 days (or 5%) of the time

OTHER HEALTH AND ENVIRONMENTAL INDICATORS

Measured as the mean mercury concentration for Bull Trout and Lake Trout; landscape pesticide use; ultraviolet radiation

SURFACE WATER QUALITY

Measured as ten-year trends of 53 water quality monitoring stations

GROUNDWATER

Measured as the percentage of observation wells that show declining water levels due primarily to human activities

SURFACE WATER USE

Measured as the percentage of licensed stream length that has water allocation restrictions by decade

TOXIC CONTAMINANTS

Measured as on-site toxic substance releases in British Columbia

PERSISTENT CHEMICALS IN WILDLIFE

Measured as the concentration of organochlorines (DDE and PCBs) in Great Blue Heron eggs

GREENHOUSE GAS EMISSIONS

Measured as per capita greenhouse gas emissions in British Columbia

CLIMATE CHANGE

Measured as the temperature change ($^{\circ}\text{C}$) over the past century

MITIGATING ENVIRONMENTAL IMPACTS

Measured as the percentage of the population served by secondary or tertiary wastewater treatment plants in British Columbia

LINKING ECONOMY AND ENVIRONMENT

Measured as conventional energy consumption and energy intensity

PROTECTED AREAS

Measured as the percentage of the land base having protected areas status

SPECIES AT RISK

Measured as the percentage of known species that are threatened or endangered or candidates for these designations

HABITAT

Measured as road density by watershed group

FISH

Measured as the conservation risk to steelhead stocks

WILDLIFE

Measured as the percentage of historical range that is either no longer occupied or has declining populations for three key species (Caribou, Columbian Sharp-tailed Grouse, and Grizzly Bear)

Healthy Ecosystems, Healthy People

One of the new themes presented in this edition of Environmental Trends is Human Health and the Environment. This theme focuses on impacts to human health that have been related to environmental causes. Human health is inextricably linked to the health of the environment, and this new section, together with the other themes, also provides information on the health of our ecosystems.

An ecosystem is a community of organisms and their physical environment interacting as an ecological unit. Although people are part of the ecosystem, we tend to take our connection to this life-support system for granted. We cannot afford to ignore the ecosystems that sustain us, because our health depends, directly and indirectly, on a healthy environment. We rely on ecosystems for a wide variety of services, including production of food and raw materials, regulation of atmospheric gases and climate, replenishment of water supplies, erosion control, detoxification and decomposition of wastes, nitrogen fixation, pollination, suppression of pests, provision of genetic resources and access to recreational and aesthetic opportunities.

Air pollution is one example of an environmental condition that has a direct impact on human health. Exposure to elevated concentrations of fine particulates and ground-level ozone can impair breathing, aggravate existing respiratory and cardiovascular disease, alter the body's defense systems and damage lung tissue, contributing to cancer and premature death. Children and the elderly with heart or lung disease are more at risk than healthy adults from air pollution. Air pollution can also harm the lungs of animals, damage plants and reduce crop yields.

Overexposure to ultraviolet (UV) radiation leads to direct human health impacts by damaging essential, immunity-mediating components of the skin known as Langerhans cells, and causing skin cancer and ocular cataracts. Overexposure to UV radiation disrupts

reproduction in single-celled organisms, including phytoplankton, which support the marine food web. It also damages pollen and the sensitive meristem cells where growth takes place in green, leafy plants. This means that the health of the world's human population may be indirectly affected by UV radiation on organisms that are the basis of fisheries and agriculture.

The degree to which human health problems may be related to exposure to environmental contaminants is difficult to determine because of the large number of variables inherent in this type of research. In some cases, however, a link has been established, especially for high risk groups, such as children, the elderly or those with certain medical conditions. For example, human health and environmental impacts of some chemicals used in pesticides are not well known, but there is enough evidence to raise concerns about exposure to pesticides, especially for children. The Quebec Focus Group on Pesticides has responded to these concerns by releasing a report recommending considerable reductions in pesticide use in urban areas. In the Lower Fraser Valley, awareness of the issue has led to landscapers decreasing their use of more toxic pesticides over the past ten years.

Many of the benefits of ecosystem services accrue to humans without ever passing through our monetary economy, so their true worth is almost never accounted for. One thorough economic assessment, conducted in 1996 at the National Center for Ecological Analysis and Synthesis (University of California, Santa Barbara), calculated that global ecosystems provide at least US\$33 trillion worth of services annually, with the majority of this value contributed by coastal marine ecosystems, forests and wetlands.

By including the new theme, Human Health and the Environment, Environmental Trends 2002 explicitly connects the health of British Columbians with the health of the ecosystems we live in.



Environmental Trends
in British Columbia 2002

Human Health and the Environment

WHAT IS THE PRESENT SITUATION?

Compared with more heavily populated and industrialised parts of the country and the world, British Columbians are exposed to low concentrations of environmental pollutants such as dissolved chemicals, heavy metals and air contaminants. The actual risk associated with chronic low-level exposure of pollutants is unknown.

WHAT CAN WE EXPECT IN THE FUTURE?

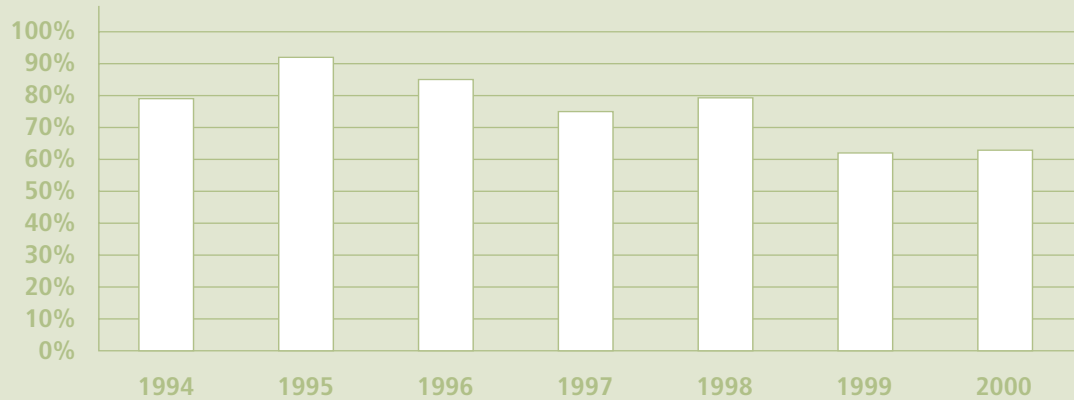
It is difficult to determine cause and effect relationships between pollutant emissions and human health impacts. The effects on human health depend on the concentration of the contaminant and how long or how often a person is exposed to it as well as the sensitivity of the individual. Currently, efforts to minimise health risk due to environmental factors are limited to areas where there is a high incidence of exposure, as is the case with air pollution. As more information becomes available on cause and effect relationships, British Columbians may respond by decreasing the amount of pollutants released into the environment that pose a risk to human health. European countries are currently leading the way by promoting zero emission technologies and industries that do not rely on the environment as a depository for potentially hazardous pollutants.

BRITISH COLUMBIA'S GOAL:

Protect human health and safety by ensuring clean and safe water, land and air.

Air Quality in British Columbia

PERCENTAGE OF MONITORED COMMUNITIES EXPOSED TO HUMAN HEALTH RISKS FROM FINE PARTICULATES ($PM_{10} > 25 \mu g/m^3$) FOR MORE THAN 18 DAYS (OR 5% OF THE TIME)¹



STATUS AND TRENDS IN FINE PARTICULATES (PM_{10}) IN BRITISH COLUMBIA

- > Fine particulate matter (PM) includes naturally occurring dust as well as soot, smoke, liquid droplets and other particles emitted by vehicles, factories, power plants, construction and other human activities.
- > PM is divided into classes according to particle size. PM_{10} , refers to particles 10 micrometres or less (about 1/8th the width of a hair).
- > In 2000, 25 out of 40 communities monitored exceeded the fine particulate (or PM_{10}) levels at which health risks are known to occur, on more than 18 days (or 5% of the time). Twenty-one of these communities exceeded this level on more than 36 days (or 10% of the time).
- > Air quality appears to be improving in several communities. For example, twelve communities have shown consistent improvements in the concentrations of PM_{10} over the past three years.
- > This indicator uses 25 micrograms per cubic metre as the concentration at which health risks begin to occur. Although this is an accepted standard, studies have not found a threshold below which there are no health effects. People with respiratory and cardiovascular ailments may be affected at concentrations below $25 \mu g/m^3$. Studies suggest that smaller particles ($PM_{2.5}$ or less) are the fraction that poses the greatest risk to health. In future, $PM_{2.5}$ will be used as the basis for reporting air quality.

WHY IS IT IMPORTANT?

- > Fine particulates can pose a serious threat to public health. Most at risk are individuals with chronic obstructive pulmonary or cardiovascular disease, asthmatics, the elderly and children.
- > Fine particulates are a major component of smog.

WHAT IS BEING DONE?

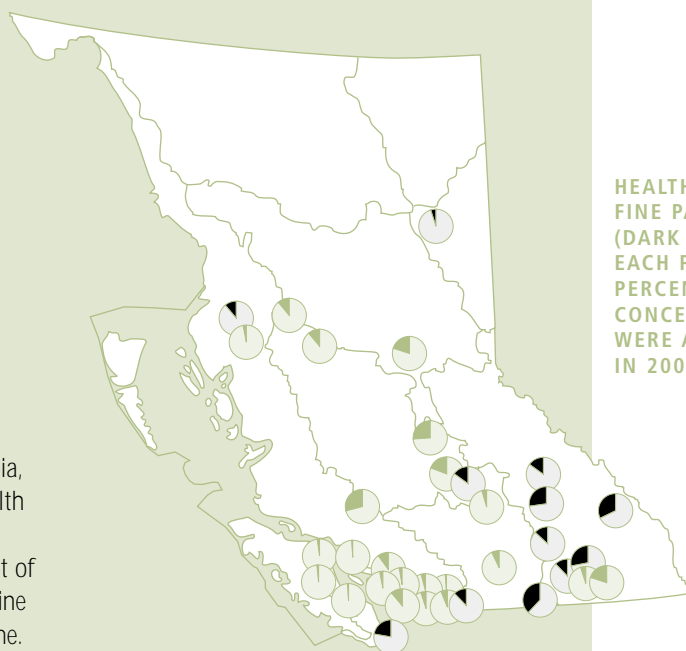
- > Initiatives designed to protect good air quality, and improve on poor air quality, include:
 - development of a framework for airshed planning that can be applied to threatened airsheds;
 - development of individual airshed management plans in Prince George, the Bulkley Valley, Greater Vancouver, Quesnel/Williams Lake, Golden and the Fraser Valley;
 - Air Care, an ongoing inspection program to reduce motor vehicle emissions in the Lower Fraser Valley, and a heavy vehicle testing program in the Lower Fraser Valley;
 - modernization of air monitoring programs;
 - continued phase-out of beehive burners; and
 - Smoke Control Regulations such as the regulation of large-scale open burning and higher standards for wood stoves.

RESEARCH HAS SHOWN THAT THE RISK OF PREMATURE MORTALITY AND HOSPITALIZATIONS FROM CARDIOVASCULAR AND RESPIRATORY CAUSES INCREASES WITH INCREASES IN DAILY EXPOSURE TO FINE PARTICULATES. THESE EFFECTS OCCUR AT CONCENTRATIONS FREQUENTLY FOUND IN A NUMBER OF BRITISH COLUMBIAN COMMUNITIES.

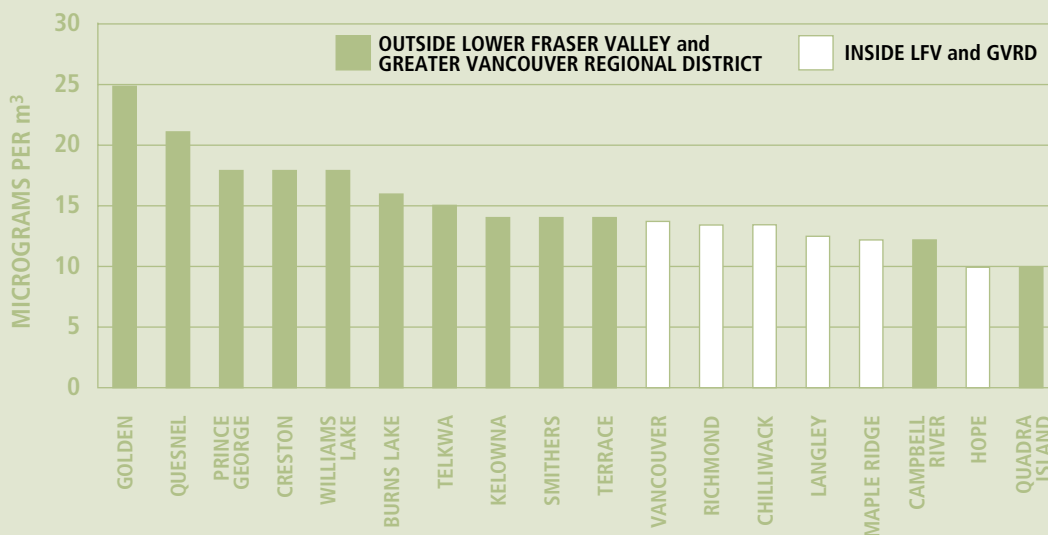
1] SOURCE: BC Ministry of Water, Land and Air Protection, 2001, Air Resources Branch. **NOTES:** This indicator depicts the percentage of communities where PM_{10} is greater than $25 \mu g/m^3$, the concentration above which there is statistical evidence that health risks begin to occur, for more than 5% of the time in each year. Data were taken from two types of stations – continuous and non-continuous. Non-continuous samplers take samples over a 24-hr period once every six days. Only stations with data for 75% of the hours over each quarter of the year were included. The total number of stations meeting these requirements were 1994, 19; 1995, 24; 1996, 27; 1997, 32; 1998, 32; 1999, 36; 2000, 38. Monitoring stations are often located in communities where air quality is of some concern, therefore the data do not necessarily reflect the average air quality. In cases where there was more than one monitor in a community, the monitor located in a residential area or city centre was chosen over monitors located adjacent to industrial facilities.

WHICH COMMUNITIES ARE MOST AT RISK FROM FINE PARTICULATES?

- > Recent scientific evidence indicates that negative health effects from PM₁₀ can occur when outdoor concentrations rise above 25 micrograms per cubic metre.
- > Concentrations of air pollutants, such as fine particulate matter, can vary greatly among communities that are fairly close together. Topography, air circulation patterns, settlement patterns and the location of industries all affect the concentrations of fine particulate matter in local airsheds.
- > Communities in the southwest of British Columbia, including Vancouver Island, were exposed to health risks from fine particulates from less than 1% to 11% of the time in 2000. Communities in the rest of the province were exposed to health risks from fine particulates from less than 1% to 40% of the time.
- > On average, PM₁₀ concentrations in 2000 were greater in communities in the interior than within the Lower Fraser Valley and Greater Vancouver Regional District.



HEALTH RISKS FROM FINE PARTICULATES²
(DARK PORTION OF EACH PIE SHOWS PERCENTAGE OF TIME CONCENTRATIONS WERE ABOVE 25µg/m³ IN 2000)



ANNUAL MEAN PM₁₀ CONCENTRATIONS FOR BRITISH COLUMBIAN COMMUNITIES WITH CONTINUOUS SAMPLING STATIONS - 2000^{2a}

2] SOURCE: BC Ministry of Water, Land and Air Protection, Air Resources Branch, 2001. Air Data and Monitoring System Database. NOTES: The dark portion of the pie graphs shows the percentage of time in 2000, at each sampling station, that PM₁₀ exceeded 25 micrograms/m³, i.e., levels above which health effects can occur. The green pies represent data taken from continuous samplers and the grey pies represent data taken from non-continuous samplers, (i.e., one sample every six days). The delineations on the map show the 10 ecoprovinces of British Columbia, based on Ecoregions of British Columbia, 1993.

2a] SOURCE: BC Ministry of Water, Land and Air Protection, Air Resources Branch, 2001.

**GROUND LEVEL OZONE
IN BRITISH COLUMBIA³**
[Annual 4th highest
8-hr daily maximum
ozone concentration
averaged for 1998-2000
(parts per billion)]



STATUS AND TRENDS IN GROUND LEVEL OZONE

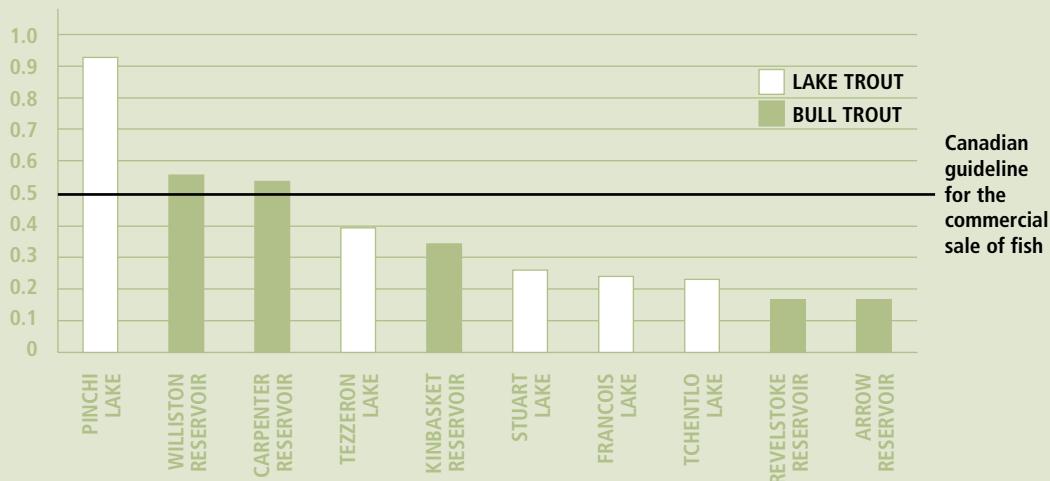
- > Ground level ozone is a secondary pollutant that forms when nitrogen oxides and volatile organic compounds react in the presence of sunlight.
- > Ground level ozone can damage lung tissue and cause irritation to mucus membranes in humans and animals, and can damage vegetation, reducing overall yields.
- > Ground level ozone is not a problem specific to the Lower Fraser Valley (LFV), but applies to any area where conditions for the production of ozone are favourable. In the LFV, the combustion of fossil fuels from vehicles, natural sources and solvent evaporation all contribute to the production of ground level ozone on sunny days.
- > Measured ground level ozone levels did not exceed the Canadian standard for air quality (65 ppb) in 1998-2000.
- > Scientists are uncertain why there are high levels of ozone in less populated areas. It may be due to a combination of natural, physical and chemical processes in the atmosphere, and the availability of precursor emissions.
- > The elderly, people with respiratory diseases, and children are most sensitive to ground level ozone. Health effects can begin to occur at levels lower than the national standard. Health effects can also be compounded by the presence of other pollutants.
- > Standards are designed to reach a balance between minimizing the effects of air pollutants on health and the feasibility and the costs of reducing polluting factors.

3] SOURCES: Environment Canada 2001. **NOTES:** Most jurisdictions have switched from a one-hour maximum to the 4th highest 8-hr daily maximum. The purpose of this change is to account for longer periods of exposure rather than single high events.



Other Health and Environment Indicators

MEAN MERCURY CONCENTRATION FOR BULL TROUT AND LAKE TROUT IN BRITISH COLUMBIA (parts per million wet weight)¹



STATUS OF MERCURY IN FRESHWATER FISH IN BRITISH COLUMBIA

- > Both Bull Trout and Lake Trout feed at the top of the aquatic food chain. This means that mercury becomes more concentrated in their tissues than in species found lower on the food chain.
- > In British Columbia, elevated levels of mercury in fish have resulted in three freshwater fish consumption advisories: Jack of Clubs Lake and Pinchi Lake (due to historic mining activities) and Williston Reservoir (due to mercury released during flooding when the reservoir was created). (Comparable data for Jack of Clubs Lake were unavailable and so are not included in the above indicator).
- > A fish consumption advisory is issued to minimize exposure to mercury by humans. Health risk is dependent upon the amount of fish eaten per meal, frequency of fish meals, mercury concentration of the fish eaten, and body weight and gender of the consumer.
- > The recommended guideline concentration for the commercial sale of fish in Canada is 0.5 parts per million. This does not apply to shark, swordfish, and fresh or frozen tuna that are considered delicacy items, not regularly consumed by the average individual.

WHY IS IT IMPORTANT?

- > Methyl mercury is the most toxic form of mercury and at high concentrations can affect nerve tissues of animals.
- > Methyl mercury accumulates in fish, birds and mammals (bioaccumulation) and is found in higher concentrations in species near the top of the food chain (biomagnification).
- > In addition to natural sources, human activities such as mining, and burning of fossil fuels and garbage contribute mercury to the environment. Also, mercury released from flooded soils and vegetation during reservoir creation, can cause mercury levels in fish to become elevated for about 20 to 30 years.

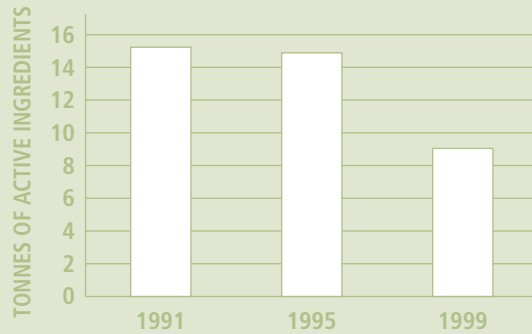
WHAT IS BEING DONE?

- > There have been significant reductions in mercury emissions in Canada, particularly in base metal mining. Mercury used in the manufacture of chlorine and pesticides has mostly been eliminated. Releases from paints and batteries have also declined.
- > The Canadian Council of Ministers of the Environment (CCME) has identified mercury as a priority issue. Canada-wide standards to regulate point-source mercury emissions are currently being developed.

IN BRITISH COLUMBIA, FRESHWATER FISH MERCURY CONCENTRATIONS ARE TYPICALLY LOWER THAN IN LAKES IN EASTERN CANADA OR THE UNITED STATES. DURING 2001, 2,242 LAKES IN 41 STATES HAD MERCURY ADVISORIES AND 13 STATES ISSUED STATEWIDE BANS ON FRESHWATER FISH CONSUMPTION.

¹ SOURCE: Source Baker, R.F., 2002. Fish mercury database – 2001 British Columbia. Prepared by Aqualibrium Environmental Consulting, Vancouver for BC Hydro, Burnaby BC. NOTES: These data represent the most recent data available for the waterbody. All data are for 2000 except for Kinbasket (1995) and Arrow Reservoirs and Revelstoke Reservoir (1995). Data are size-adjusted to a 550 mm long fish.

TOTAL PESTICIDE USE REPORTED BY LANDSCAPE SERVICES IN THE LOWER MAINLAND⁴



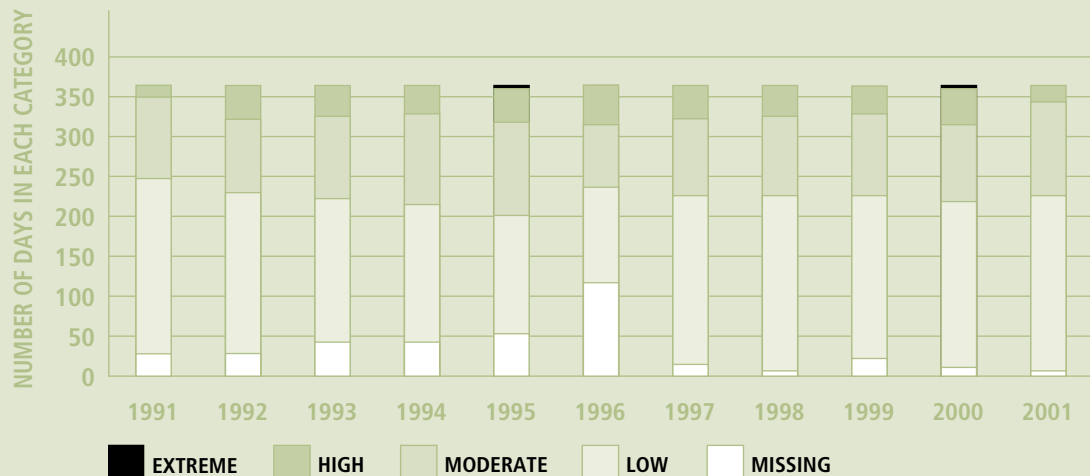
LANDSCAPE PESTICIDE USE – LOWER MAINLAND

- > In the Lower Mainland, the total weight of pesticide active ingredient used by landscape services decreased by 37% between 1991 and 1999.
- > Nine pesticides listed by Environment Canada as priority substances of concern in the Georgia

Basin were used by landscape services in 1991. The use of four of these substances, malathion, lindane and trifluralin (possible carcinogens) and endosulphan, decreased from 1991 to 1995 and no uses were reported in 1999.

- > The use of insecticidal soap, a low toxicity pesticide, by landscape services increased by 717 kg since 1991, likely as a replacement for other pesticides.
- > This decrease in pesticide use may in part be due to the efforts by the landscape industry to reduce pesticide use and promote adoption of Integrated Pest Management (IPM). IPM is based on preventing pest problems and applying treatment only when monitoring shows it is necessary.
- > In 1999, 64,100 hectares of farmland in British Columbia, were also managed using methods compatible with IPM.

UV INDEX OVER SOUTHERN BRITISH COLUMBIA⁵



WHAT IS THE UV EXPOSURE OF BRITISH COLUMBIANS?

- > The UV Index measures the intensity of ground-level ultra-violet radiation (UV) on a scale of 0 to 10.
- > Ground-level UV varies with the seasonal angle of the sun's rays, the thickness of the ozone layer, and the weather. Cloud cover and rain can greatly reduce UV, even in the summer.
- > UV intensity in British Columbia is at its highest in the summer. In June and July, the UV Index value for a clear day is usually between 7 and 8.
- > Under normal ozone levels, the UV Index over southern British Columbia ranges from under 1 in winter, to 4-5 in late spring and early fall, to 7 in summer.
- > In 2000, the UV Index for southern British Columbia was greater than 7 on 48 days, and greater than 9 on 2 days. According to preliminary data for 2001, the UV Index for southern British Columbia was greater than 7 on 23 days, but never greater than 9.

4) **SOURCE:** Survey of Pesticide Use in British Columbia: 1999. **NOTES:** Fifteen pesticide or groups of pesticides are among 44 substance included in the "1998 Nominating List of Toxic Substances in the Lower Fraser/Georgia Basin". The list emphasizes suspected endocrine disrupting chemicals and is being developed to track pesticide loading in the environment.

5) **SOURCE:** Environment Canada. World Ozone and Ultraviolet Radiation Data Centre 2002. **NOTES:** *Data for 2001 are preliminary. The scale used for the UV Index is: Low (0-3.9), more than one hour to burn; Moderate (4-6.9), about 30 minutes to burn; High (7-8.9), about 20 minutes to burn; and Extreme (9+), 15 minutes or less to burn. Missing days were due to mechanical failure or extremely rainy or overcast weather.





WHAT IS THE PRESENT SITUATION?

British Columbians generally have access to abundant sources of freshwater, but, in some areas supplies are limited. Most of the surface waterbodies in the province are in good condition, however, monitoring data are limited, and groundwater resources are under increasing pressure in populated areas. British Columbians are also among the world's highest domestic water users.

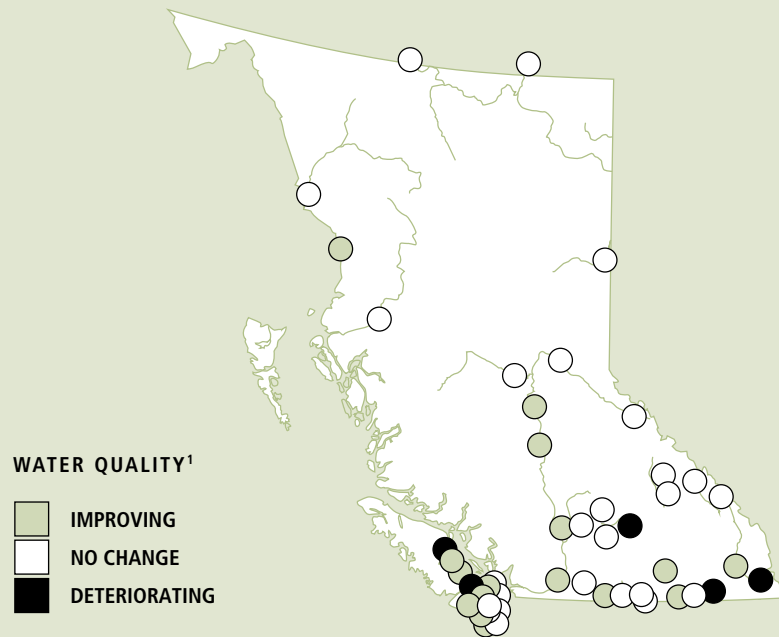
WHAT CAN WE EXPECT IN THE FUTURE?

As with much of our natural capital, British Columbia is at a turning point in the way we manage and value our water resources. The Government of British Columbia has recognised the need to implement comprehensive legislation to protect drinking water and mitigate the cumulative impacts of nutrient loading, contamination, impervious surfaces and climate change on freshwater resources.

BRITISH COLUMBIA'S GOAL:

Ensure safe, high quality drinking water and reduce effluent discharges that degrade water quality.

Surface Water Quality in British Columbia



TRENDS IN WATER QUALITY

- > Results of trend assessments at 53 water quality sampling stations for 47 waterbodies are shown on the map above. Most of the trends are based on ten years of data collected from the 1980s to the 1990s.
- > Five stations showed deteriorating water quality – Salmon River at Salmon Arm (turbidity from non-point sources), Quamichan Lake (fecal contamination from naturally high waterfowl populations), Quinsam and Elk rivers (industrial effluent), and Kootenay River (declining aquatic productivity due to low phosphorus caused by a dam).
- > Discharges from mining operations have the potential to affect aquatic life in the Quinsam River and in the Elk River.
- > Declining fisheries production in Kootenay and Arrow Lakes is a result of upstream dams, reservoirs and possibly the introduction of opossum shrimp. Nutrient fertilization efforts have been successful in Kootenay Lake and in Upper Arrow Lake.
- > Non-point source pollution comes from many diffuse sources. Pollution from agriculture, forestry and urban run-off, can degrade water quality for recreation, drinking water and aquatic life.

WHY IS IT IMPORTANT?

- > Protecting drinking water quality and maintaining the integrity of aquatic ecosystems are important environmental issues for British Columbians.
- > British Columbia has 25% of the flowing fresh water in Canada. Ongoing monitoring, protection and careful management of these water resources are of critical importance.

WHAT IS BEING DONE?

- > The government plans to improve drinking water source protection through the amended *Drinking Water Protection Act* and groundwater legislation.
- > Monitoring is a key component of water management. The government is committed to increasing the number of surface water monitoring stations where trend reporting is possible. Initiatives around the province, such as the Salmon River Watershed Roundtable, are coordinating efforts to reduce and mitigate the effects of non-point source pollution.

WATER QUALITY

MONITORING STATIONS

ARE ESTABLISHED ON

A PRIORITY BASIS AND

ARE CHOSEN WHEN

HUMAN ACTIVITIES

HAVE A HIGH

POTENTIAL FOR

DEGRADING WATER

QUALITY.

For detailed information:
wapwww.gov.bc.ca/soerpt

1] **SOURCE:** Ministry of Water, Land and Air Protection, 2001. **NOTES:** These data were collected as part of the Canada – British Columbia Water Quality Monitoring Agreement. The trend analysis for the majority of stations is based on ten years of data collected from about the middle of the 1980s to the middle of the 1990s (the exact dates differ for each station). Although data continue to be collected the trends have not been analysed. The five stations listed as deteriorating are an exception and have been updated to 2000.

STATUS OF WATER QUALITY

- > The Water Quality Index ranks water quality against objectives set for each water body. Objectives are set by the Province by considering the users of the water (humans and other organisms) and waste streams entering the water body.
- > Of the 33 water bodies monitored, 17 were rated Good or Excellent.
- > Fourteen water bodies were rated as Fair, indicating some impairment of uses and the need for actions to prevent further impairment. The main problem is pollution from non-point sources (such as agriculture and urban runoff), followed by impacts from mining and dams.
- > Tsolum River and Christina Lake both received a Borderline rating. Borderline water quality in Tsolum River is a result of copper loading from an abandoned mine. In Christina Lake, high spring phosphorus loading is likely due to a series of wet years causing high run-off and elevating the level of phosphorus in many interior water bodies.
- > No water bodies were rated as Poor.
- > The number of water bodies monitored for the attainment of water quality objectives has decreased from 124 in 1995 to 33 in 1999.



WATER QUALITY INDEX 1998-1999²

WATER QUALITY INDEX DEFINITIONS

Excellent: Conditions very close to natural or pristine. All uses are protected and none are threatened or impaired.

Good: Conditions rarely depart from natural or desirable levels. All uses are protected, with only minor threats or impairment.

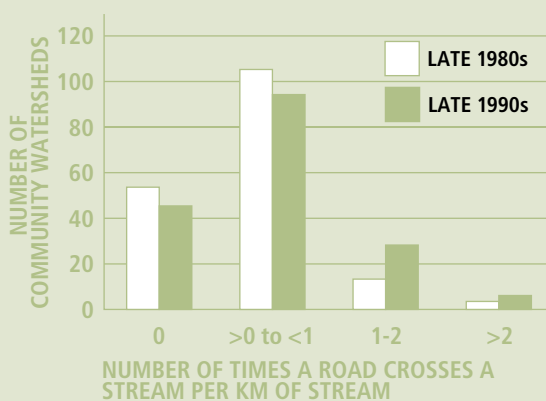
Fair: Conditions sometimes depart from natural or desirable levels. Most uses are protected, but a few are threatened or impaired.

Borderline: Conditions often depart from natural or desirable levels. Several uses are threatened or impaired.

Poor: Conditions usually depart from natural or desirable levels. Most uses are threatened, impaired or even lost.

STREAM CROSSINGS IN COMMUNITY WATERSHEDS

- > Roads are the greatest source of sediment in streams in developed forest watersheds. Sediment is most often deposited where roads cross the watercourse.
- > High suspended sediment loads in waterways increase treatment costs for domestic and many industrial uses. They also damage fish food supplies and habitat, and can injure fish directly.
- > Of the 175 community watersheds with late 1980s and late 1990s mapping, 16 (9%) had greater than one stream crossing per km of stream in the late 1980s. This increased to 34 (19%) in the late 1990s.
- > The Forest Practices Code recognizes drinking water as a priority use for community watersheds. A higher level of management is required for community watersheds than for non-designated watersheds.



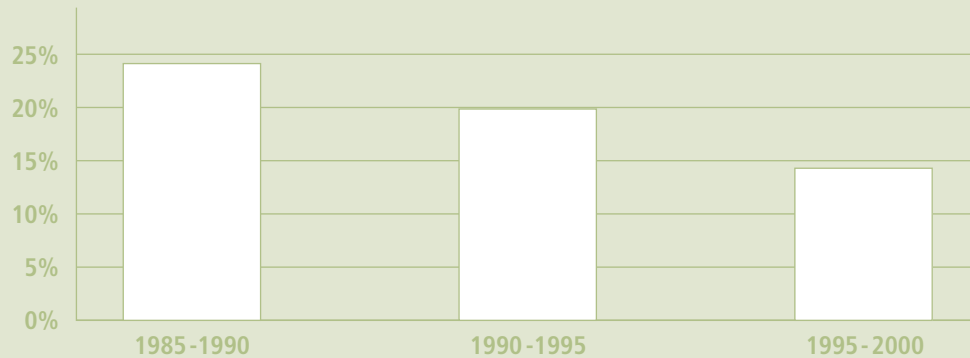
NUMBER OF STREAM CROSSINGS IN COMMUNITY WATERSHEDS³

2] **SOURCE:** Ministry of Water, Land and Air Protection, 2001. **NOTES:** The ratings are derived from a Provincial Water Quality Index (WQI), which measures the impact of pollutants on water quality. Since the WQI is based on sampling in areas where there are likely to be water quality concerns, the results may indicate a poorer status than if a random sampling of all water bodies in the province was considered. Individual indices are determined by the number of water quality objectives not met and the frequency and amount by which these objectives are exceeded. Most of the thousands of water bodies in the province are not monitored. Data for the WQI were taken from 33 water bodies (including fresh surface streams, rivers and lakes, and marine areas) and were based on the overall WQI for 1998 and 1999.

3] **SOURCES:** Decision Support Services, Ministry of Sustainable Resource Management, 2002. **NOTES:** As of 2001, 467 watersheds were classified as community watersheds under the Forest Practices Code of British Columbia. The data for the graph above were taken from 175 watersheds with data for both mapping times.

Groundwater in British Columbia

PERCENTAGE OF OBSERVATION WELLS THAT SHOW DECLINING WATER LEVELS DUE PRIMARILY TO HUMAN ACTIVITIES¹



IN BRITISH COLUMBIA
APPROXIMATELY 25%
OF THE POPULATION
IS DEPENDENT ON
GROUNDWATER
SOURCES FOR
DRINKING WATER.

STATUS AND TRENDS IN GROUNDWATER SUPPLY

- > This indicator was revised as a result of comments received from the last edition of Environmental Trends. It now accounts for natural climactic variation by reporting on only those wells that show declining water levels due primarily to human activities such as nearby groundwater pumping.
- > The percentage of observation wells with declining water levels due primarily to human activities was 14% in 1995-2000 (20 of 139 wells monitored).
- > The data show that groundwater levels are not declining across the province, but rather in local areas where groundwater withdrawal and urban development has been intensive. Of 20 observation wells showing water level decline in 1995-2000, 5 are on the Lower Mainland, 3 are in the Okanagan and 7 are along the southern east coast of Vancouver Island and on the Gulf Islands.
- > The decrease in the percentage of observation wells showing declining water levels due to human impacts since 1990 is believed to reflect the changing spatial distribution of observation wells and changes in groundwater demand.
- > Industry (e.g., manufacturing, mining and aquaculture) is the largest user of groundwater in British Columbia (approximately 55% by volume) followed by agriculture (approximately 20%) and municipalities (approximately 20%).

WHY IS IT IMPORTANT?

- > In some areas where available surface water supplies are already fully allocated, are too costly to develop, or are of marginal quality, groundwater is the only viable and cost-effective source of water supply.

WHAT IS BEING DONE?

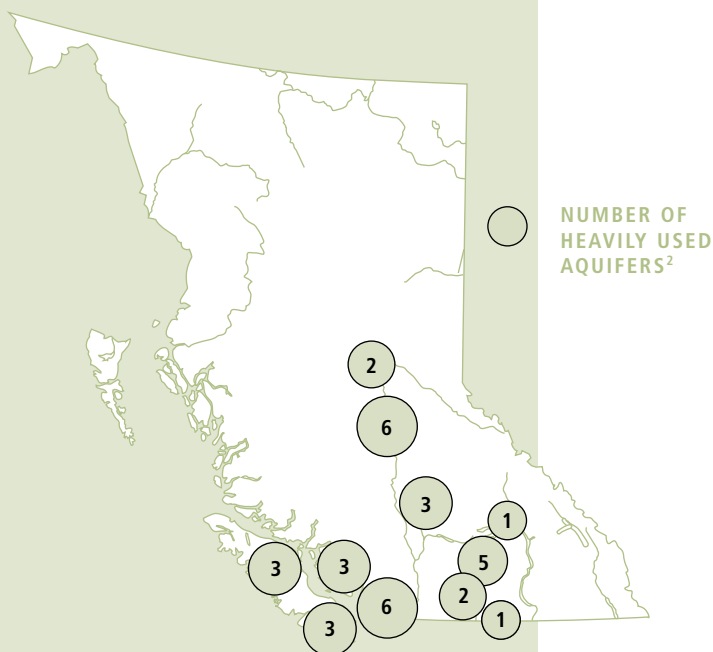
- > The government is working to develop comprehensive groundwater legislation to protect drinking water supplies in British Columbia.
- > Enhancements are being made to groundwater inventory activities, including automating data collection, establishing additional observation wells in new groundwater areas and reporting water level data on the Internet.
- > Development of well and aquifer protection plans at the community level, including measures to protect the quantity of groundwater supplies, are being encouraged in cooperation with local government and water purveyors.

1] SOURCE: Ministry of Water, Land and Air Protection, 2001. **NOTES:** Number of observation wells with suitable long-term trend data increased from 31 to 163 over a 35-year period. Due to missing data, loss of observers, etc., only 139 sites were suitable for assessing trends for the period 1995-2000.



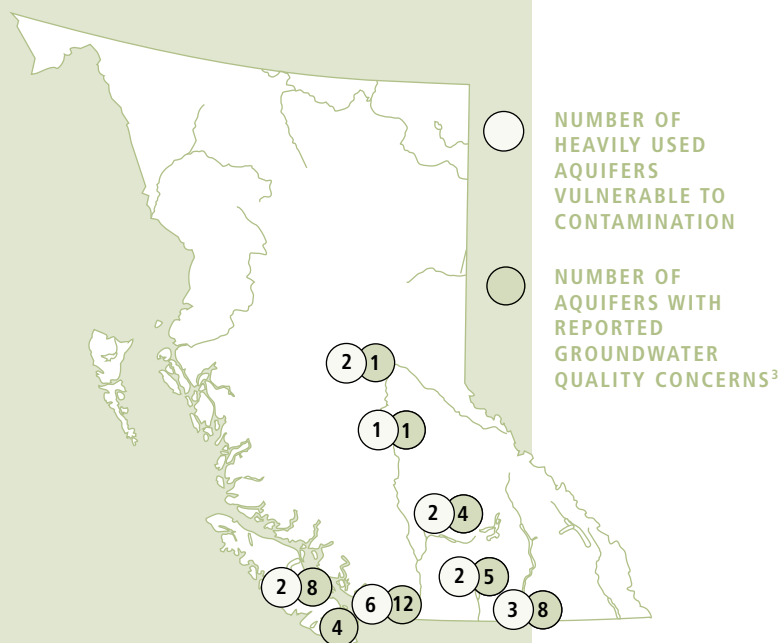
WHERE IS GROUNDWATER USE THE HEAVIEST IN BRITISH COLUMBIA?

- > Groundwater is a major source of water for drinking and crop irrigation in British Columbia.
- > The provincial government has identified and classified 438 groundwater reservoirs (aquifers) based on their level of development and vulnerability to contamination, and on geological and water use criteria. Since 1996, 246 aquifers have been added to the inventory.
- > Heavily used aquifers are those where the extraction rate is high relative to the natural recharge rate. This designation is applied to 35 aquifers (up from 17 in 1996). Most are in the Fraser Valley or Southern Interior and on the East Coast of Vancouver Island.
- > Heavy use puts water quality at risk. Excessive groundwater withdrawals in coastal regions are causing salt-water intrusion and groundwater quality degradation in some areas of the Gulf Islands and the Saanich Peninsula.
- > Continued aquifer classification mapping will likely identify additional heavily used aquifers.



WHAT ARE THE RISKS TO BRITISH COLUMBIA'S GROUNDWATER?

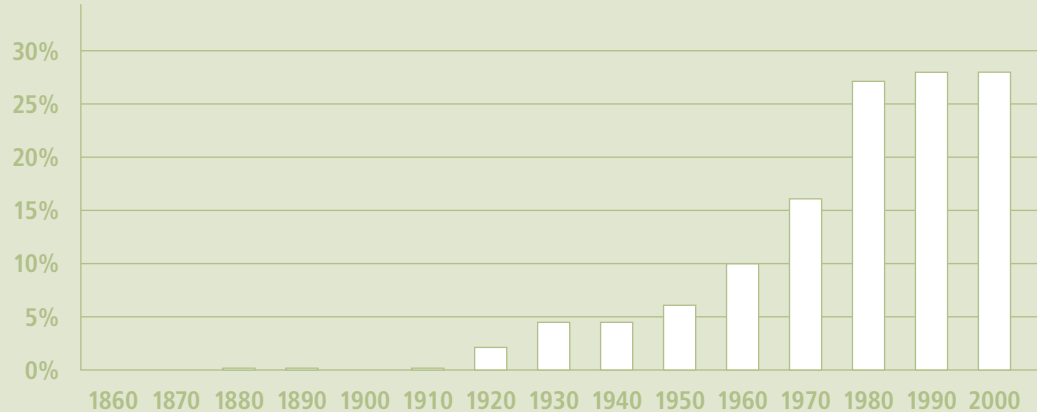
- > Eighteen of British Columbia's 35 heavily used aquifers are considered highly vulnerable to contamination (up from 11 in 1996). Many of these supply drinking water to large communities, such as Langley, Abbotsford and Prince George.
- > Health-related water quality concerns have been reported from specific sites within 43 aquifers. The majority are in the Southern Interior, on the Gulf Islands and the east coast of Vancouver Island.
- > Some contaminants (e.g., nitrates) primarily result from human activities and are of greatest concern in aquifers considered vulnerable to contamination. Others (e.g., fluoride, arsenic) are naturally occurring and affect water quality even in groundwater sources that are not at risk of contamination from human activities.
- > Through notifications to owners, bulletins and workshops, municipal, provincial and federal governments are beginning to work together to inform people in affected areas and to develop community-based solutions.



2] & 3] **SOURCE:** Ministry of Water, Land and Air Protection, Water, Air and Climate Change Protection Branch, Groundwater Section, 2001.
NOTES: The number in each circle represents the number of aquifers of concern within the given area. The BC Water Quality Status Report, 1996, describes in more detail the state of water quality in some aquifers. Most information is collected in areas where population is reliant on groundwater use. Little is known about groundwater in British Columbia outside these areas.

Surface Water Use in British Columbia

PERCENTAGE OF LICENSED STREAM LENGTH THAT HAS WATER ALLOCATION RESTRICTIONS BY DECADE¹



STATUS AND TRENDS IN
STREAM RESTRICTIONS
ARE INDICATIVE OF THE
INTENSITY OF WATER
USE, PRESSURES ON
WATER SUPPLY AND THE
INTENSITY OF WATER
MANAGEMENT.

STATUS AND TRENDS IN WATER USE

- > The provincial government places water allocation restrictions on streams when the demand for new water licenses threatens the human and non-human users of the water supply.
- > The percentage of licensed stream length that has water allocation restrictions is indicative of the intensity of water use in the province, pressures on water supply and the intensity of water management that is required to maintain that water supply.
- > Approximately 28% of licensed stream length in the province is currently restricted and has been since the 1990s.
- > Water use restrictions have been increasing since the 1920s, but before the 1980s, generally only human requirements received consideration. The biggest rise in restrictions occurring during the 1980s is likely due to the recognition of in-stream flow requirements for fish.
- > Stream restrictions are used as a management tool to ensure that water supply in the province is maintained. Restrictions may range from including minimum fish flow clauses in a water license, to suspending the issuance of any further licenses on a water body.

WHY IS IT IMPORTANT?

- > Water has numerous and often competing users. These include human uses such as agriculture, recreation, industry processes and waste disposal; domestic uses, including drinking water; and non-human uses such as habitat for aquatic organisms.
- > While British Columbia is perceived to have an abundance of water, it is not always accessible. The majority of new license applications are for water bodies with existing licenses.
- > Demand for water influences stream flows and water levels. Demand tends to be highest in summer, when water supplies are usually at their lowest.
- > Since 1950, the global renewable freshwater supply per person has fallen 58% as the world's population increased from 2.5 to 6 billion.

1] SOURCE: Ministry of Sustainable Resource Management, 2001. NOTES: Each bar represents the percentage of licensed stream length that had water allocation restrictions during that decade. The bar for 2000 represents the percentage of licensed stream length that had allocation restrictions during 2000 and 2001. The word "stream" covers all freshwater in British Columbia including rivers and lakes. Restrictions apply to all water upstream of the restriction.

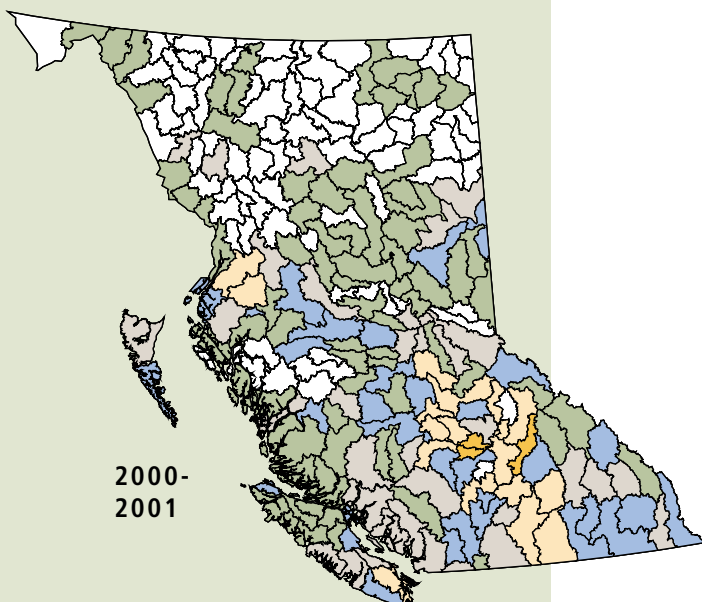
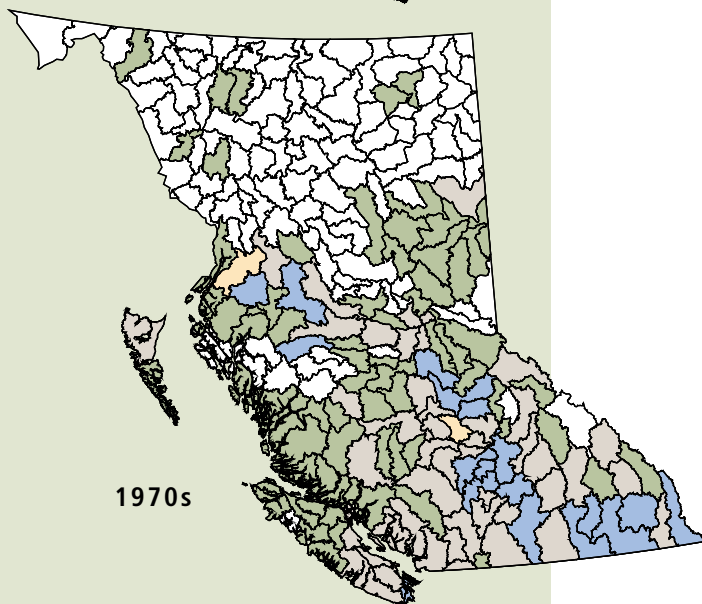
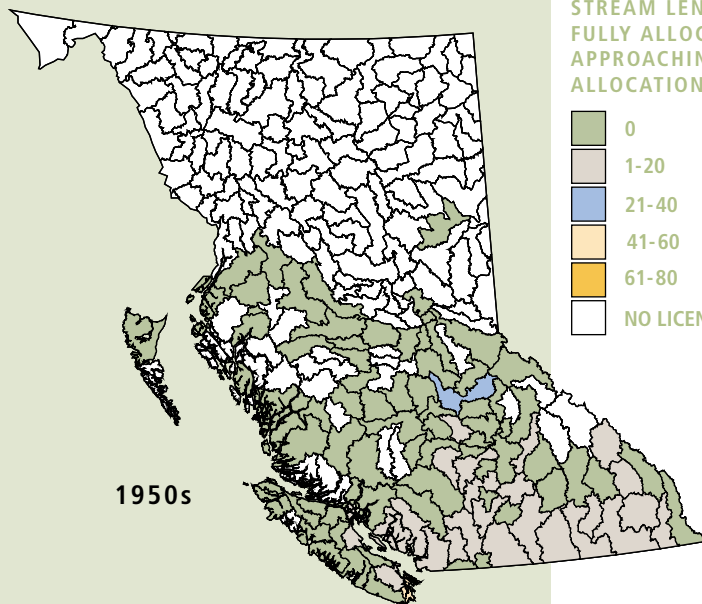
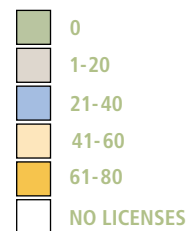
TRENDS IN WATER ALLOCATION RESTRICTIONS ACROSS BRITISH COLUMBIA

- > Since 1950, water licenses have been granted in 67 watershed groups raising the number of watershed groups with licenses to 168, or 68% of the 246 watershed groups in the province. Most of these new licenses have been granted in the northern half of the province.
- > In the 1970s, 2 watershed groups had water allocation restrictions on over 40% of the licensed stream length. In 2000, that number increased to 23 watershed groups.
- > The majority of water allocation restrictions occur in the southern interior.
- > About 97% of water licensed in British Columbia is for power production, including storage for power production. The remaining 3% of water licensed is for consumptive uses such as industrial, commercial, drinking water or agriculture.

WHAT IS BEING DONE?

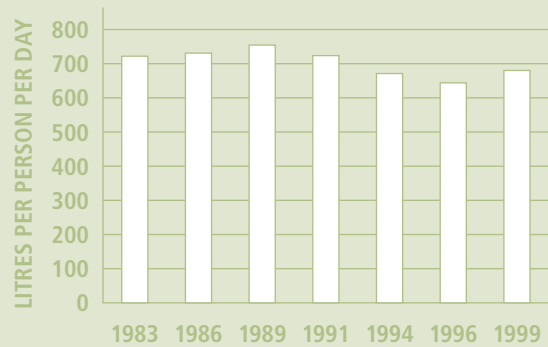
- > The *British Columbia Water Protection Act (1995)* prohibits large-scale diversions between watersheds for the export of bulk water.
- > The *Fresh Water Strategy for British Columbia (1999)* consolidated provincial initiatives into one cohesive strategy. Initiatives include: designating sensitive streams under the *Fish Protection Act*, which restricts the approval of new water licenses; continuing the *Water Conservation Strategy (1998)*, which includes public education about low flow plumbing fixtures and use of drought tolerant plants in landscapes; and implementing a three-year *Drinking Water Strategy*.

PERCENTAGE OF LICENSED STREAM LENGTH THAT IS FULLY ALLOCATED OR APPROACHING FULL ALLOCATION²

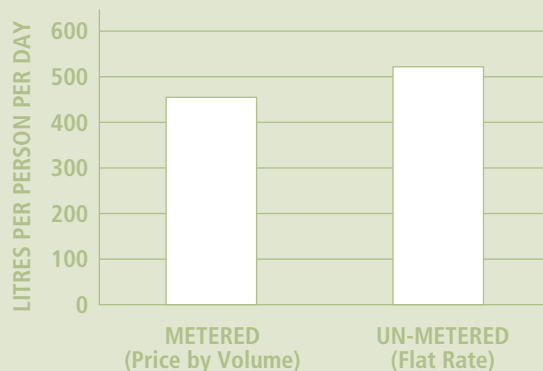


2] SOURCE: B.C. Ministry of Sustainable Resource Management, Water Management Branch, Water Allocation Section, November 2001.
NOTES: The total stream length licensed in 2001 was used as a denominator to calculate the percentages for all three maps.

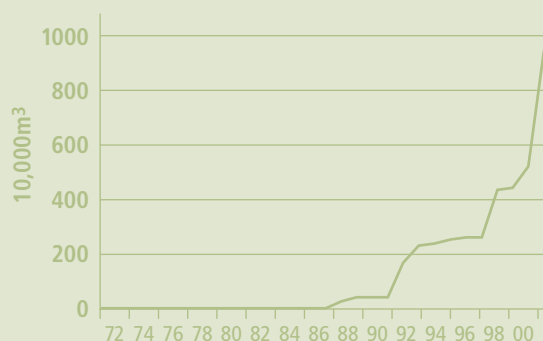
PER CAPITA MUNICIPAL WATER USE IN BRITISH COLUMBIA³



EFFECT OF METERING ON PER CAPITA DOMESTIC WATER USE FOR 1999⁴



CUMULATIVE VOLUME OF WATER LICENSED FOR BOTTLE SALES⁵



STATUS AND TRENDS IN MUNICIPAL WATER USE

- > In 1999, total municipal water use by British Columbians was 678 litres per person per day, a 60% decrease from 1983 (includes domestic, industrial and all other uses).
- > British Columbia's per capita water consumption is on par with the Canadian average (638 litres/day). The lowest per capita water use rates in Canada are in Ontario (549 litres/day) and the Prairie provinces (492 litres/day).
- > Canadians are among the world's highest water users. In 1996, each Canadian used more than twice as much water for domestic purposes as the average person in France.
- > Approximately 65% of domestic indoor water use occurs in the bathroom with toilets being the single greatest water user in the home. Only 10% is used in the kitchen and for drinking.

EFFECT OF METERING ON DOMESTIC WATER USE

- > In 1999, total domestic water use by British Columbians that pay a flat rate (76% of the province) was 524 litres/person. This was 15% more than was used by those who paid based on volume (455 litres/person)
- > For all of Canada, flat-rate users consumed 70% more water (457 litres/person/day) than metered users (269 litres/person/day).
- > The minimal impact of water metering in British Columbia compared to the rest of Canada may be due to metered rates being among the lowest in the country.
- > Canadian water prices are among the world's lowest, averaging about half the prices in most developed countries.

TRENDS IN VOLUME OF WATER LICENSED FOR BOTTLING

- > Bottling water is a relatively new use of licensed water in British Columbia. The first licenses for this use were issued in 1972 (13,267 m³/yr).
- > The volume of water licensed for bottled water sales has increased dramatically in the 1990s. As of February 2002, 9.4 million m³/yr were licensed for this use. This is still a tiny fraction of the total volume currently licensed for all uses.

3] SOURCE: Environment Canada Municipal Water Use Database (MUD) 2001. NOTES: Municipal water use includes water used for domestic, industrial, commercial and other uses. Other uses include water lost through leaks or uses that do not fall into domestic, industrial or commercial categories. It is important to note that after water has been used, it is subject to costly water treatment to make the receiving aquatic environment livable for aquatic organisms and safe for human consumption and recreation.

4] SOURCE: Environment Canada Municipal Water Use Database (MUD) 2001. NOTES: This graph shows the average volume of water consumed by the population with water meters (price by volume) versus the volume of water consumed by the population that pays a flat rate for water use (unmetered).

5] SOURCES: BC Ministry of Water, Air and Land Protection, 2002. NOTES: Licenses are for surface water only; the use of groundwater is not licensed. "Surface water" includes springs that naturally reach the surface, even if only for part of the year.





WHAT IS THE PRESENT SITUATION?

The risk to human and ecosystem health from contaminants released into the environment varies depending on exposure, toxicity and persistence. Some contaminants, including many persistent organic pollutants (POPs), have been banned from use in British Columbia due to the high risk posed by these contaminants.

As a result, levels of these contaminants in wildlife have also shown a decline. Levels found in wildlife, however, especially marine mammals and some other animals at the top of the food chain, are still high enough to impair health.

WHAT CAN WE EXPECT IN THE FUTURE?

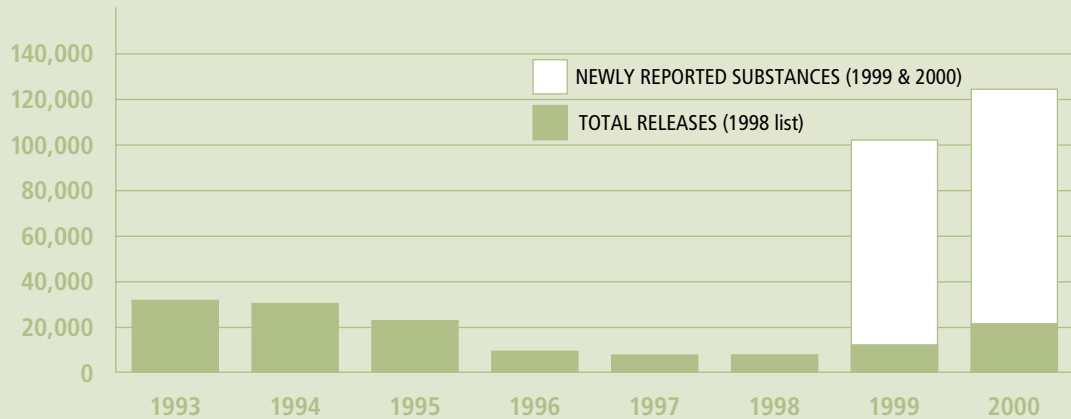
The Canadian and British Columbian governments have responded to threats of harmful chemicals by banning or restricting their use. As more chemicals are reviewed, the number of banned and restricted chemicals may increase. One source of contaminants in British Columbia is global transport through wind, water and animals. Canada is at particular risk because many contaminants are volatile and evaporate in hot places, circulate in the atmosphere and eventually condense in areas with cold, high snowfall climates. International recognition of this problem has led Canada to ratify the Stockholm Convention on Persistent Organic Pollutants (2001) which calls for an elimination of nine chemicals, including PCBs, and restricts the use of DDT.

BRITISH COLUMBIA'S GOAL:

Protect human health and safety by ensuring clean and safe water, land and air.

Toxic Contaminants in British Columbia

ON-SITE TOXIC SUBSTANCE RELEASES (tonnes)¹



STATUS AND TRENDS IN TOXIC WASTE RELEASES

- > In 2000, 165 industrial facilities in British Columbia reported on-site releases of 122,078 tonnes of toxic contaminants to the National Pollutant Release Inventory (NPRI). The pollutants reported in the greatest quantities were hydrogen sulphide (100,629 tonnes), ammonia (9,523 tonnes) and methanol (5,385 tonnes).
- > Hydrogen sulphide is a newly reported substance, added to the NPRI in 1999, thus does not appear in earlier totals of toxic substance releases. It is a flammable poisonous gas by-product of natural gas extraction. Once removed from the gas, it is injected into underground reservoirs.
- > Since 1996, permits for hydrogen sulphide injection have been issued under the provincial *Waste Management Act*.
- > There are arguments both for and against underground injection as a disposal method. Generally, it is accepted in BC that there is less potential risk to the environment from deep injection than might occur from processing the gas above ground and exposing air and surface water to treatment by-products.
- > The decline in releases between 1995 and 1996 is largely due to the closure of one mining operation, as well as reductions in releases to air and water from paper and mining industries.

WHY IS IT IMPORTANT?

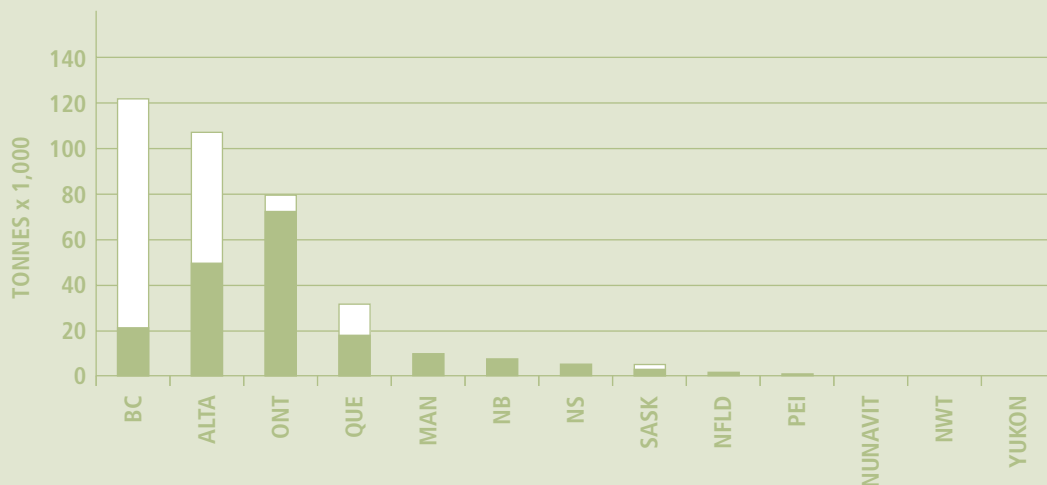
- > Human activities, including industry, transportation, waste disposal, agriculture, and forestry, release toxic substances into the environment.
- > Once in the food chain, these substances tend to accumulate (bioaccumulation) and increase in concentration as they rise through the food chain (biomagnification).
- > Low doses of some substances can disrupt the endocrine systems of organisms resulting in reproductive and immune dysfunction, developmental disorders and possibly cancer.

WHAT IS BEING DONE?

- > The *Canadian Environmental Protection Act* (CEPA), requires Environment Canada to have a national inventory of pollutant releases and to publish the results. If facilities meet the reporting criteria they are required by CEPA to report to the NPRI.
- > The Federal Accelerated Reduction/Elimination of Toxics Program is a joint industry and government initiative to reduce or eliminate emissions of toxic substances through voluntary measures.

POTENTIAL RISK
DEPENDS ON THE
TOXICITY AND
PERSISTENCE OF
THE SUBSTANCE,
ITS ABILITY TO
MIMIC BIOLOGICAL
CHEMICALS AND
THE EXTENT OF
EXPOSURE.

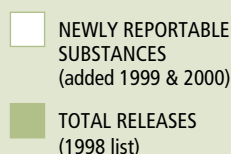
1] **SOURCE:** Environment Canada 2001. The National Pollutant Release Inventory (NPRI) 2000. **NOTES:** In 1996, NPRI included by-products resulting in more pollutants being included in the inventory than previous years. In 1998, changes in reporting techniques for electrical utilities increased reported releases from previous years. Newly reported substances include 73 substances added to the inventory in 1999 and 4 new substances in 2000. The 2000 analysis does not include mercury and 19 new substances added in 2000, because they were reported at alternate thresholds. Acetone was removed from the inventory in 1999. NPRI on-site toxic waste releases is not an indicator of all pollutants entering the environment. Other substances such as greenhouse gases or pesticides and substances scheduled for ban or phase-out (e.g., chlorofluorocarbons and PCBs) are not included on the list. In addition, not all sources of NPRI pollutants are captured by the inventory.



ON-SITE TOXIC SUBSTANCE RELEASES IN CANADA FOR 2000²

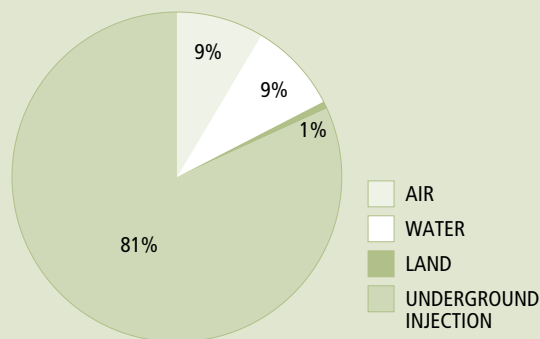
HOW DOES BRITISH COLUMBIA COMPARE?

- > British Columbia reported the largest amount of on-site toxic waste releases in 2000 (122,078 tonnes), accounting for about 33% of total Canadian releases.
- > The majority (82%) of British Columbia's reported waste releases were disposal of hydrogen sulphide, a flammable poisonous gas, by injection into known geological formations at great depth.
- > Underground injection of hydrogen sulphide comprised 47% of Alberta's releases, followed by ammonia at 18%.
- > In Ontario, the substances released in the greatest quantities were hydrochloric acid released to air during the production of electricity (13%), ammonia released to air and water (13%) and methanol released to air and water (9%).



WHERE ARE TOXIC SUBSTANCES RELEASED?

- > The majority of 2000 releases (82%) were injected underground, 9% into air, 9% to water and less than 1% was released on land.
- > Prior to 1999, reported releases underground were negligible; the substantial increase is due to the addition of hydrogen sulphide, a by-product of natural gas extraction, to the NPRI inventory by the federal government.
- > Underground injection is a waste disposal method subject to the provincial *Petroleum and Natural Gas Act*.
- > Since 1993, releases to water have decreased 56% from 24,440 tonnes to 10,690 tonnes and emissions to air have increased 48% from 7,220 tonnes to 10,640 tonnes. Releases to land have increased 83% from 400 tonnes to 730 tonnes.

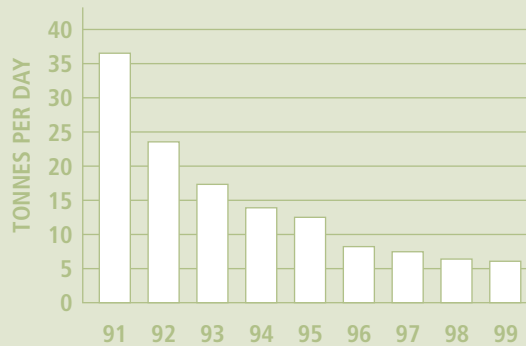


ON-SITE TOXIC SUBSTANCE RELEASES IN BRITISH COLUMBIA³ (Total for 2000 - 122,078 tonnes)

2] **SOURCE:** Environment Canada 2001. The National Pollutant Release Inventory (NPRI) 2000. **NOTES:** Newly reported substances include 73 substances added to the inventory in 1999 and 4 new substances in 2000. The analysis does not include mercury and 19 new substances added in 2000, because they are reported at alternate thresholds. Acetone was removed from the inventory in 1999. NPRI on-site toxic waste releases is not an indicator of all pollutants entering the environment. Other substances such as greenhouse gases or pesticides and substances scheduled for ban or phase-out (e.g., chlorofluorocarbons and PCBs) are not included on the list. In addition, not all sources of NPRI pollutants are captured by the inventory.

3] **SOURCE:** Environment Canada 2001. The National Pollutant Release Inventory (NPRI) 2000. **NOTES:** In 1996, NPRI included by-products resulting in more pollutants being included in the inventory than previous years. In 1998, changes in reporting techniques for electrical utilities increased reported releases from previous years.

ADSORBABLE ORGANIC HALIDE (AOX) DISCHARGE IN PULP AND PAPER EFFLUENT⁴



ARE MEASURES TO REDUCE PULP AND PAPER EFFLUENT EFFECTIVE?

- > AOX (adsorbable organic halide) is a surrogate measure of the amount of chlorinated organic compounds in pulp and paper effluent discharge.
- > In 1992, British Columbia established a legally binding requirement to eliminate AOX from the pulp and paper bleaching process by the end of 2002.
- > From 1991 to 1999, average pulp mill AOX discharges were reduced by 83%, from 36.6 to 6.2 tonnes per day.
- > A recent scientific review found that there was no evidence that current reduced levels of AOX discharge present a measurable risk to the aquatic environment.

HOW ARE PULP AND PAPER MILLS IN BRITISH COLUMBIA MITIGATING THEIR ENVIRONMENTAL IMPACTS?

- > There are presently 25 pulp and paper mills in British Columbia. Nine mills discharge into coastal waters, 13 into inland water bodies, two into municipal sewage systems and one evaporates effluent.
- > Effluent from mills that do not treat or have minimal treatment, contains high levels of AOX, making it acutely toxic. Acute toxicity kills fish and other species when they come in contact with the effluent.
- > Since the early 1990s pulp and paper mills in British Columbia have been adopting new technology that uses chlorine dioxide instead of elemental chlorine to bleach pulp. Mills that are elemental chlorine free (ECF) produce about one tenth the amount of AOX as they had when elemental chlorine was used.
- > Mills that use ECF technology and mills that are totally chlorine free still release organic compounds (i.e., 'black liquor'). 'Black liquor' contains the natural chemicals in wood that have been separated from the wood fibre during the pulp process. When these concentrated chemicals are released in large quantities to the receiving water bodies they can cause chronic toxicity to the aquatic organisms. Chronic or sub-lethal effects can affect an organism's size, growth rate, sexual maturation or ability to reproduce.

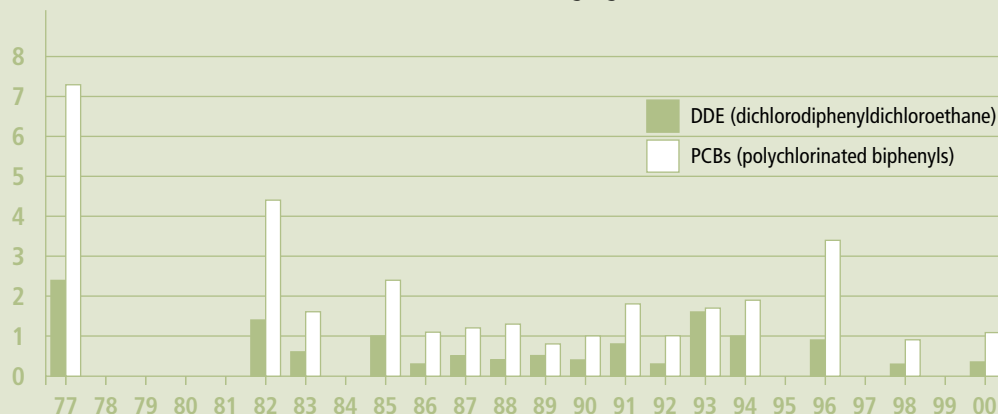


For detailed information:
wlapwww.gov.bc.ca/soerpt

4] **SOURCE:** British Columbia Ministry of Water, Land and Air Protection, 2001. Pollution Prevention and Remediation Branch. **NOTES:** The report, "A Review of Scientific Basis AOX Effluent Standard in British Columbia", can be found on the internet at www.AOXpanel.ca

Persistent Chemicals in Wildlife in British Columbia

CONTAMINANTS IN GREAT BLUE HERON EGGS (mg/kg)¹



STATUS AND TRENDS IN CONTAMINANTS

- > The level of some contaminants found in monitored wildlife species has been decreasing over the past 20 years. Since 1977, PCB levels detected in Great Blue Heron eggs at the University of British Columbia (UBC) colony have decreased by 85%.
- > PCBs were banned from open uses in Canada in 1977, but PCBs are still present in electrical equipment manufactured before that date. Current levels of PCBs in wildlife are due to persistence and food chain cycling of these compounds, leakage from old landfill sites and atmospheric deposition from distant sources.
- > Since 1977, levels of DDE, a breakdown product of the persistent pesticide DDT, decreased by 83% in Great Blue Heron eggs. Canada banned the use of DDT in the 1970s, but it persists in the environment and is still legally manufactured and used in some countries.
- > Scientific information is accumulating on the toxic effects of organochlorines still in use. For example, PBDEs (polybrominated biphenyl ethers), a commonly used flame retardant found in office equipment, cars and aircraft, has similar chemical properties as PCBs and DDT and is increasing in concentration in the Canadian Arctic.

WHY IS IT IMPORTANT?

- > Human activities, including industry, transportation, waste disposal, agriculture, forestry and recreation have contaminated the environment with substances that are toxic to humans and other living organisms.
- > One group of toxic substances, persistent organochlorines, includes pesticides, such as DDT, industrial compounds such as PCBs, and by-products of industrial processes and combustion, such as dioxins and furans. They are termed persistent because they linger in the environment for decades or even centuries before breaking down.
- > These substances tend to accumulate within exposed organisms (bioaccumulation) and increase in concentration as they rise through the food chain (biomagnification).

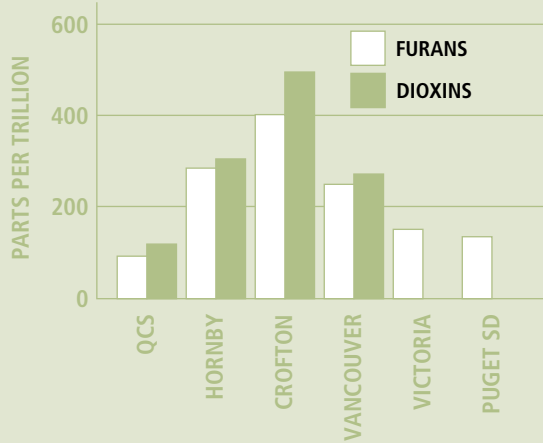
WHAT IS BEING DONE?

- > Measures designed to minimize or eliminate exposure to contaminants include: stringent regulations for the management of toxic wastes; the use of pollution prevention planning; industry initiatives; and a program for responsible management of household hazardous waste.
- > Pollution prevention planning encourages industry to reduce hazardous waste during the production process.

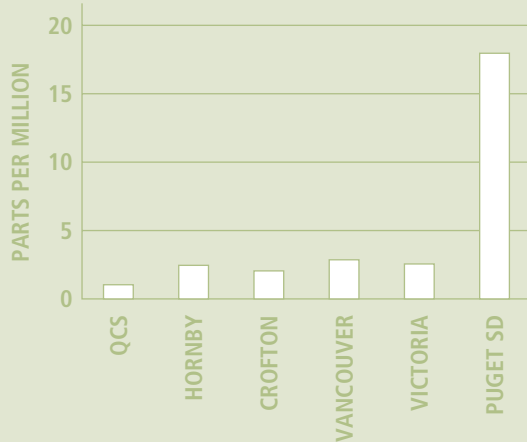
PERSISTENT ORGANIC
POLLUTANTS, (POPS)
ARE TRANSPORTED
LONG DISTANCES BY
WIND AND WATER
UNTIL THEY SETTLE
AT HIGH LATITUDES
AND HIGH ALTITUDES.
THIS IS A PROBLEM IN
THE MOUNTAINS OF
BRITISH COLUMBIA
AND IN THE
CANADIAN ARCTIC.

1] SOURCE: Environment Canada, Canadian Wildlife Service, 2000. NOTES: Data are presented as geometric means of eggs sampled. Data for 1982, 1983, 1991, 1993, 1994, 1996, 1998 and 2000 are based on pooled samples. Data are from the Great Blue Heron colony at the University of British Columbia.

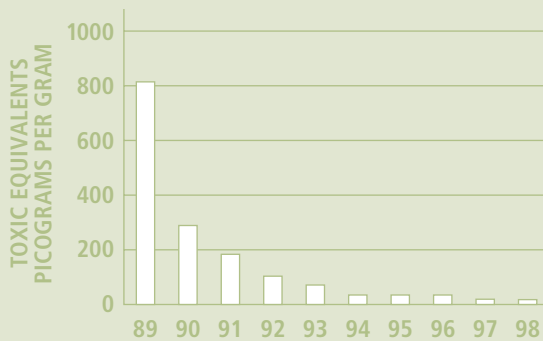
DIOXINS AND FURANS IN HARBOUR SEALS²



PCBs IN HARBOUR SEALS²



AVERAGE COMBINED DIOXIN AND FURAN LEVELS IN THE DIGESTIVE GLAND OF DUNGENESS CRAB³



WHAT ARE THE CONTAMINANT LEVELS IN HARBOUR SEALS?

- > Harbour seals are good indicators of the contaminant level in coastal food chains because they are at the top of the food chain and spend most of their time in the same place.
- > Harbour seals in the Strait of Georgia showed higher levels of dioxins and furans than those in Puget Sound. PCB levels, however, were more than seven times higher in Puget Sound seals.
- > The PCB levels found in Puget sound seals are similar to levels that have been found to suppress the immune systems of seals and other marine mammals, leaving them more susceptible to disease.
- > Although certain chemicals are banned from use in Canada they are still used in other countries. These chemicals can evaporate easily in hot climates and get carried by wind currents (atmospheric transport) to colder regions, such as mountains in British Columbia and the Canadian Arctic, where they condense.

TRENDS IN DIOXINS AND FURANS IN DUNGENESS CRABS NEAR PULP MILLS

- > Between 1989 and 1998, average concentration of dioxin and furans in the digestive gland of Dungeness crab most highly exposed to pulp mill effluent decreased by 97%. Dungeness crabs are a good indicator of contaminant levels in sediment because they are bottom dwelling foragers that generally stay in the same area throughout their lifetime.
- > In British Columbia, dioxins and furans were produced as a by-product of the chlorine bleaching process by pulp and paper mills. In the late 1980s, industries adopted technologies that minimize the release of dioxins and furans. The government introduced regulations in 1992 to motivate further reduction.
- > A newly identified source of atmospheric dioxins and furans is the burning of wood that has been soaked in salt water. Government and industry are currently working together to find a solution to this issue.

- 2] **SOURCE:** Ross, P.S. et al. 2001a. PCBs at the top of the food chain: geographical variation in British Columbia and Washington harbour seals. Puget Sound Research 2001 Bellevue, USA. Ross, P.S. et al. 2002. Spatial fractionation of PCB, PCDD, and PCDF congeners in free-ranging harbour seals (*Phoca vitulina*) from coastal British Columbia, Canada and Washington State, USA. submitted. **NOTES:** At all sites, blubber biopsy samples were taken from 4-6 week old free-ranging harbour seal pups in good condition. Samples were pooled for Vancouver due to a limited sample size. As a result, the location reflects the site where most samples were obtained, while extra samples were collected in adjacent areas.
- 3] **SOURCE:** Pollution Prevention and Assessment Division, Environment Canada, Pacific and Yukon Region, 2001. **NOTES:** To approximate total risk from the most toxic chemical forms of dioxin and furans (17 of which are assessed in this analysis), all are assessed by comparing their toxicity to that of 2,3,7,8-tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD), the most toxic of this group using an internationally accepted procedure. Concentrations derived in this manner are referred to as toxic equivalents (TEQs).



Environmental Trends in
British Columbia 2002

Climate Change

WHAT IS THE PRESENT SITUATION?

Average global air temperature increased by 0.6°C during the 20th century. This rate of warming is faster than at any other time during the past 1,000 years. The United Nations Intergovernmental Panel on Climate Change (1997) has concluded that most recent warming is likely due to an increase in atmospheric greenhouse gas concentrations as a result of the burning of fossil fuels, land clearing, and other human activities.

Average temperatures increased across British Columbia during the 20th century. Changes in temperature drive changes in other parts of the climate system, in related physical systems, and in biological and human systems. British Columbia is already starting to feel the early effects of climate change.

WHAT CAN WE EXPECT IN THE FUTURE?

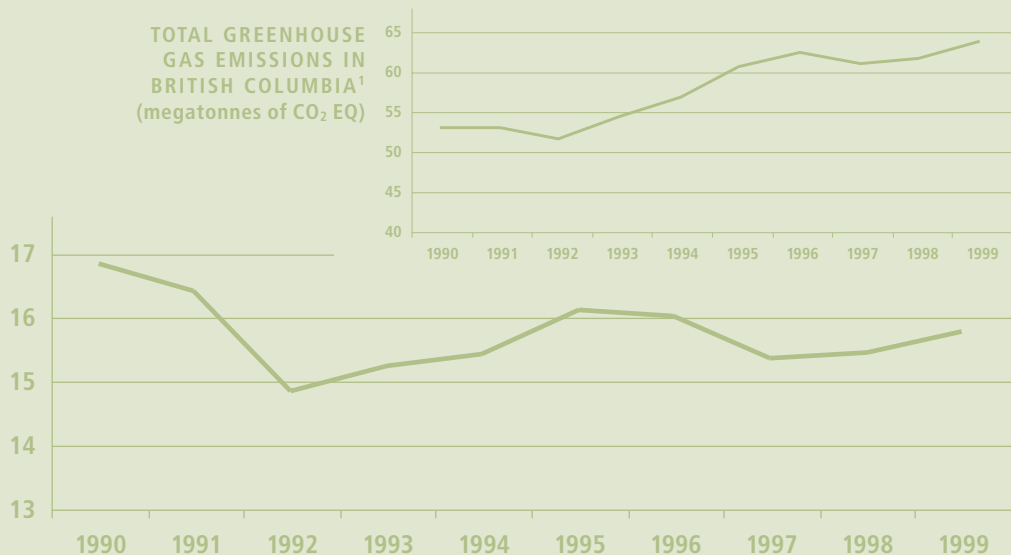
Climate models suggest that average temperatures in British Columbia will increase by another 1°C to 4°C during the 21st century. Climate change is expected to have impacts on ecosystems, communities, and businesses in British Columbia.

BRITISH COLUMBIA'S GOAL:

Contribute to meeting global atmospheric objectives.

Greenhouse Gas Emissions in British Columbia

PER CAPITA
GREENHOUSE GAS
(GHG) EMISSIONS IN
BRITISH COLUMBIA¹
(tonnes of CO₂ EQ)



TRANSPORTATION IS
THE SINGLE LARGEST
SOURCE OF GHG
EMISSIONS IN THE
PROVINCE,
ACCOUNTING FOR
42% OF THE TOTAL
GHG EMISSIONS.

STATUS AND TRENDS IN GREENHOUSE GAS EMISSIONS

- > Gases such as carbon dioxide and methane are called greenhouse gases. As they build up in the atmosphere, they act like the transparent roof of a greenhouse, which allows in sunlight while trapping the heat.
- > In British Columbia, per capita greenhouse gas (GHG) emissions decreased by 6.3% between 1990 and 1999. During this time, the population increased by 29%, from 3.1 million to just over 4 million.
- > In 1999, total GHG emissions were 63.5 megatonnes of carbon dioxide equivalent, an increase of 10.8 megatonnes or 20% since 1990.
- > Population growth accounts for part of the increase in total GHG emissions; however, the increase in emissions from the transportation sector exceeded the population growth rate.
- > Transportation is the single largest source in the province, accounting for 42% of the total emissions.
- > GHG emissions are strongly influenced by energy prices and economic activity. A decrease in GHG emissions in the early 1980s (not shown above) was largely attributed to increasing energy costs and the economic recession.

WHY IS IT IMPORTANT?

- > Human activities, such as the burning of fossil fuels, are adding significant quantities of carbon dioxide and other greenhouse gases to the earth's atmosphere. There is widespread agreement among scientists that elevated levels of greenhouse gases are causing changes to the global climate.

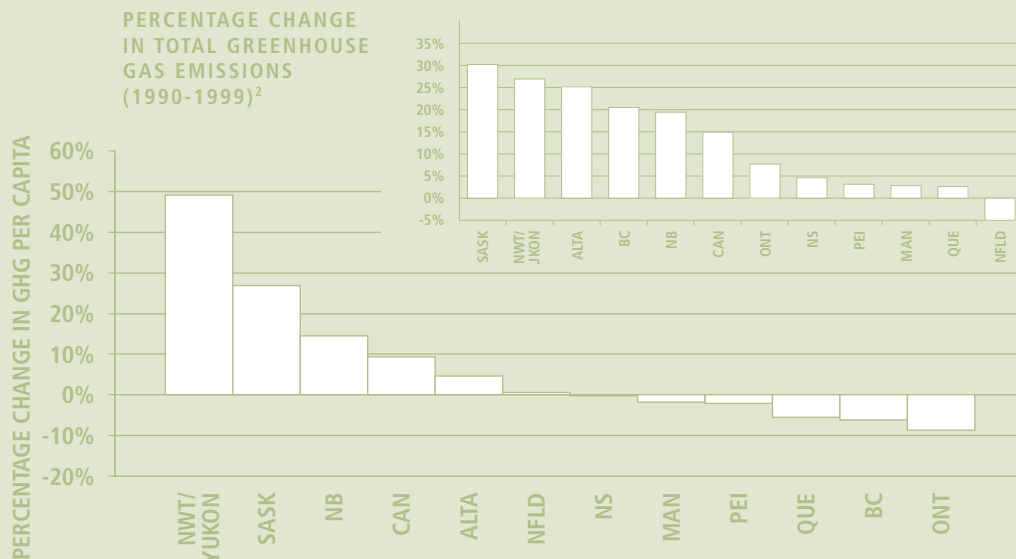
WHAT IS BEING DONE?

- > The 1997 Kyoto Protocol would commit ratifying countries to reducing their GHG emissions. Canada's Kyoto target is to cut emissions to 6% below 1990 levels by the period 2008 to 2012.
- > The British Columbia government is preparing a provincial climate change strategy that will include initiatives that address issues such as the use of clean, renewable energy, efficiency of energy use associated with buildings, and GHG emissions in the industrial and transportation sectors.
- > British Columbia is participating with other jurisdictions in the national process to develop a Canadian climate change strategy.



For detailed information:
wlapwww.gov.bc.ca/soerpt

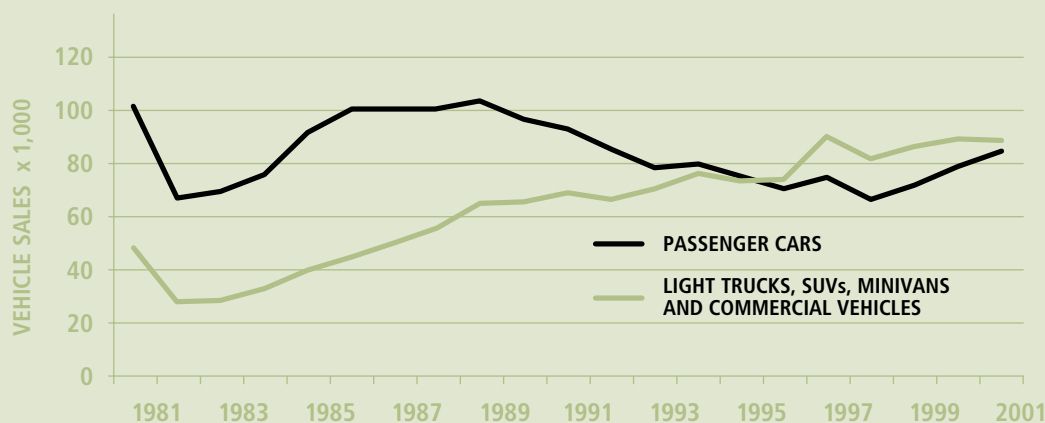
1] SOURCE: Ministry of Water, Land and Air Protection, 2001.



PERCENTAGE CHANGE IN TOTAL GREENHOUSE GAS EMISSIONS PER CAPITA (1990-1999)²

HOW DOES BRITISH COLUMBIA COMPARE?

- > Across Canada, GHG emissions have increased by 15%.
- > If current trends in British Columbia continue between 1990 and 2010, GHG emissions are expected to increase by 38%. This represents one of the largest expected increases in Canada, exceeded only by Alberta and Saskatchewan.
- > Saskatchewan experienced the greatest increase (30.5%) in total GHG emissions between 1991 (46.9 megatonnes of carbon dioxide equivalents) and 1999 (61.2 megatonnes). Approximately 25% of Saskatchewan's emissions come from electricity generation.



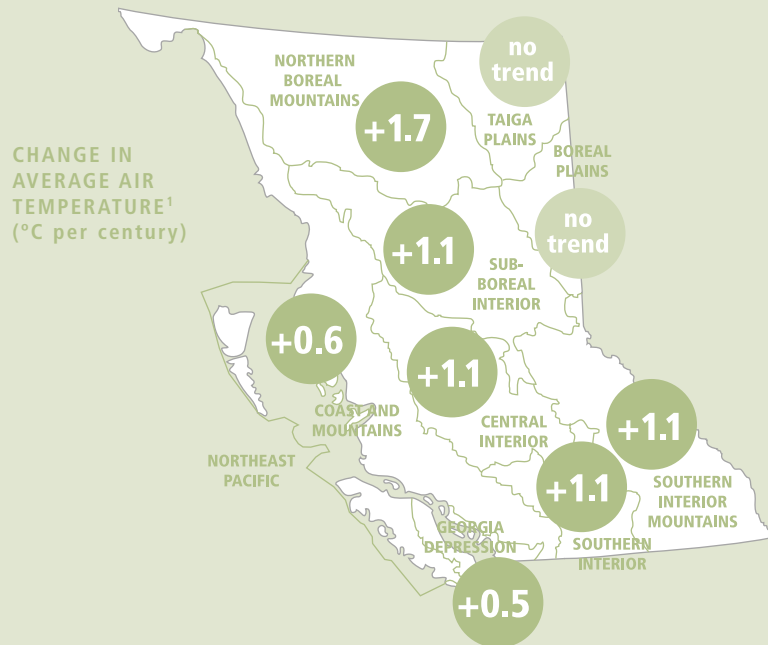
VEHICLE SALES IN BRITISH COLUMBIA³

NUMBER OF VEHICLES SOLD IN BRITISH COLUMBIA

- > An increase in the GHG emissions from the transportation sector is due to more vehicles on the road, an increase in the number of less fuel-efficient vehicles and to vehicles being driven longer distances.
- > Although the total number of vehicles sold in 2000 was only 7% higher than in 1990, proportionately more (an increase of 36%) were in the commercial category, which includes light trucks, sports utility vehicles (SUVs) and minivans.
- > A small car uses 38% less gas per kilometer of city driving and 40% less gas on the highway than an SUV. This means that on average a small car emits 36% less greenhouse gases than an SUV.
- > Driving a fuel efficient vehicle doesn't just benefit the environment: a driver of a small car can expect to spend 42% less on fuel than an owner of an SUV.

2] SOURCE: Air Resources Branch, Ministry of Water, Land and Air Protection. 2001. The 1999 data for NWT & Yukon includes Nunavut.
3] SOURCE: Statistics Canada CANISM II 2002.

Climate Change in British Columbia



STATUS AND TRENDS IN CLIMATE CHANGE

CLIMATE MODELS
PROJECT FURTHER
WARMING IN
BRITISH COLUMBIA
AT THE RATE OF 1°C
TO 4°C DURING THE
21ST CENTURY, WITH
THE INTERIOR
WARMING FASTER
THAN THE COAST.
YEAR TO YEAR
VARIABILITY IN
PRECIPITATION AND
OTHER ASPECTS OF
CLIMATE IS
EXPECTED TO
INCREASE.

- > During the 20th century, coastal British Columbia warmed by 0.5°C to 0.6 °C – or at about the same rate as the global average. The central and southern interior regions warmed by 1.1°C, or twice the global average. Trends for coastal and southern BC and the interior are based on 100 years of data and are likely the result of climate change.
- > The warming trend of 1.7°C for northern BC is nearly three times the global average. This trend is based on only 52 years of data and may therefore reflect natural climate variability as well as climate change.

WHY IS IT IMPORTANT?

- > Warmer average temperatures affect other parts of the climate system. In British Columbia, the impacts may include increased precipitation and evaporation, changes in the snowpack, warmer coastal waters, and greater year-to-year variability in climate.
- > Climate change affects related physical systems. In British Columbia, the impacts may include receding glaciers, earlier spring ice breakup, earlier river discharge, warmer

river temperatures, reduced soil moisture in some areas, and higher sea levels.

- > Changes in physical systems affect biological systems. In British Columbia, the impacts may include disruption of salmon migration and spawning, the spread of pests such as mountain pine beetle and diseases, and changes in the distribution of marine, freshwater, and terrestrial species.
- > Heat-related and respiratory illnesses may also increase.

WHAT IS BEING DONE?

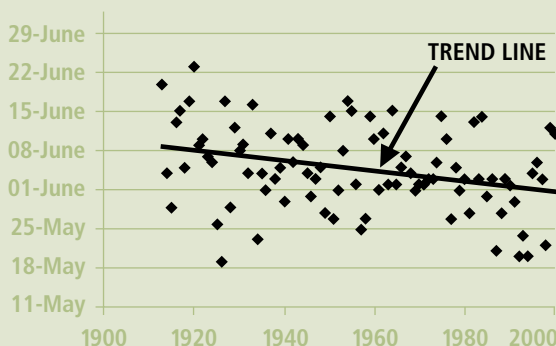
- > The British Columbia government is preparing a provincial adaptation strategy to respond to the impacts of climate change.
- > The government has released a report that documents recent climate trends and impacts in British Columbia.
- > The government is also identifying ways in which climate change affects provincial programs for managing water quality and supply, fish, wildlife and habitats.
- > The provincial government, in partnership with universities and the federal government, is promoting research into climate change impacts and adaptations.

1] SOURCE: Data from Environment Canada. Analysis by Canadian Institute for Climate Studies, 2001, for Ministry of Water, Land and Air Protection. NOTES: A positive sign indicates a warming trend. All values are statistically significant at the 95 percent level. The data do not show statistically significant trends for northeastern BC.



WHAT IS THE RELATIONSHIP BETWEEN CLIMATE AND RIVER FLOW?

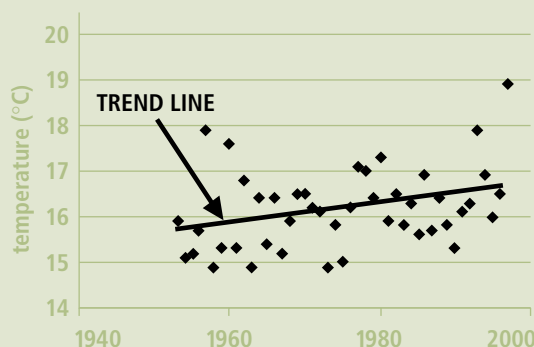
- > A larger part of the total annual flow of the Fraser River is occurring earlier in the year than it did 90 years ago. The date by which one-third of the cumulative flow now passes the town of Hope has advanced at a rate equivalent to 11 days per century. The date by which one-half of the annual cumulative flow occurs has advanced by 9 days per century.
- > Most of the streams and rivers that contribute to the Fraser River system are dominated by snowmelt. Warmer spring temperatures and earlier melting of snow and ice will result in more water flowing through the river system earlier in the year, with less water available in the summer and fall.
- > Lower river flows are associated with warmer river temperatures, and reduced water quality, with potential impacts on aquatic ecosystems, and domestic water supplies.



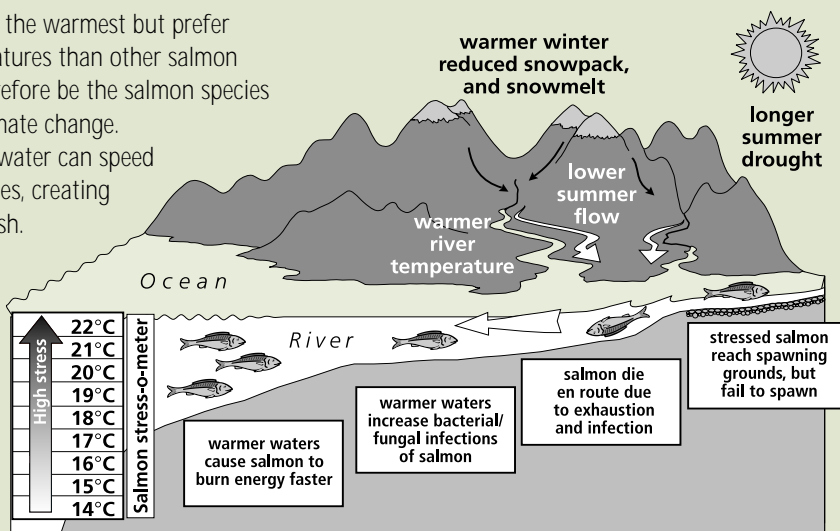
TIMING OF ONE-THIRD OF FRASER RIVER ANNUAL FLOW, 1912 - 1988²

WHAT IS THE RELATIONSHIP BETWEEN CLIMATE AND MIGRATION SUCCESS OF SOCKEYE SALMON?

- > The average summer temperature of the Fraser River increased by 1.1°C between 1953 and 1998. This warming trend appears to be largely due to changes in local climate, including increasing air temperature, during the same time period.
- > The Fraser River supports important salmon runs. Every year, Sockeye migrate upriver to spawn at more than 150 sites in the river system.
- > In several recent years, en route mortality for some Fraser River Sockeye runs was greater than 50%. Sockeye migrate in the summer when water temperature is the warmest but prefer colder water temperatures than other salmon species and may therefore be the salmon species most sensitive to climate change.
- > Exposure to warmer water can speed up metabolic processes, creating stress in migrating fish. Fish may die from exhaustion or infection or they may reach the spawning grounds but be unable to spawn.



AVERAGE FRASER RIVER TEMPERATURE 1953-1998³



EFFECT OF WARM RIVER TEMPERATURES ON SOCKEYE SALMON⁴

2] SOURCE: Data from the Canadian Historical Homogenized Temperature Datasets. Analysis by Canadian Institute for Climate Studies, 2001, for Ministry of Water, Land and Air Protection. NOTES: All values are statistically significant at the 95 percent level. All trends are positive and indicate warming.

3] SOURCE: Historical temperature data from the Pacific Salmon Commission, 1941-1998. Historical weather data from Meteorological Service of Canada, Environment Canada 1953-1998. Analysis by John Morrison, Institute of Ocean Sciences, 2001 for the Ministry of Water, Land and Air Protection. NOTES: Results are statistically significant at the 95 percent level.

4] SOURCE: Graphic from Temperature Rising: Climate Change in Southwestern British Columbia. 1999. Poster.





WHAT IS THE PRESENT SITUATION?

Stewardship, as used in this report, is the concept of responsibly managing resources for the benefit of present and future generations. British Columbia's environmental resources provide a wide range of benefits that contribute to the social, environmental, and economic well being of British Columbians. There are considerable efforts being made to protect these resources, by minimizing or reducing waste discharges from both point sources and non-point sources, and through product stewardship programs.

Nonetheless, there are many areas where there remains considerable stress on the environment.

WHAT CAN WE EXPECT IN THE FUTURE?

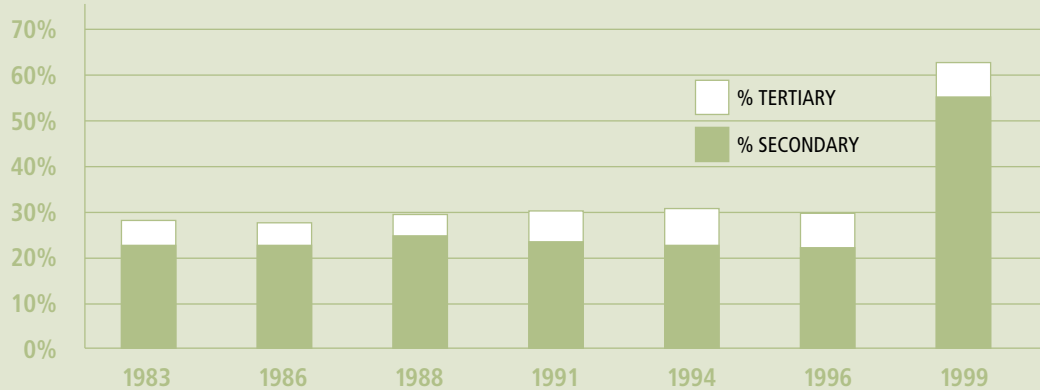
Environmental stewardship is expected to improve in British Columbia as responsibilities for stewardship are shared between citizens, industry, business and government. Several factors will contribute to better environmental stewardship, including greater use of partnerships, allowing more flexibility in how results are achieved, technological improvements and expanded markets for these technologies, and a more informed and concerned public.

BRITISH COLUMBIA'S GOAL:

Assist industry, local government and business to develop sustainably.

Mitigating Environmental Impacts in British Columbia

PERCENTAGE OF POPULATION SERVED BY SECONDARY OR TERTIARY WASTEWATER TREATMENT IN BRITISH COLUMBIA¹



STATUS AND TRENDS IN WASTEWATER TREATMENT

- > The purpose of wastewater treatment is to protect human health and to reduce stress on the receiving environment.
- > Preliminary treatment removes solid material using screens. Primary treatment removes material through settling chambers. After primary, secondary treatment removes suspended material and organic matter, while tertiary goes beyond this to remove target substances such as nutrients.
- > In 1999, 7% of British Columbians with municipal wastewater treatment were served by preliminary treatment, 29% were served by primary, and 63% were served by secondary treatment or better.
- > The increase from primary to secondary treatment between 1996 and 1999 is a result of the Annacis Island and Lulu Island wastewater treatment plants. Together these plants serve a million people before discharging into the Fraser River.

WHY IS IT IMPORTANT?

- > Wastewater not only consists of human waste, which can carry disease-causing pathogens; it also contains other substances such as motor oil, heavy metals, paint thinner, pesticide residues, pharmaceuticals and solvents, which can threaten human and ecological health.
- > Substances found in sewage effluent are capable of affecting the endocrine systems of biological organisms. This could result in reproductive and immune system dysfunction, neurological, behavioural and developmental disorders, and possibly certain forms of cancer.
- > In Canada, 80% of marine pollution comes from terrestrial activities including industrial and agricultural runoff.

WHAT IS BEING DONE?

- > The Federation of Canadian Municipalities best practices guide encourages the development of sustainable municipal infrastructure.
- > Federal and provincial agencies are developing strategies for consistent and improved wastewater management, which include two municipal investment funds to support the upgrade of municipal infrastructure.

WASTEWATER

CONTRIBUTES TO

ECOLOGICAL,

ECONOMIC AND

HUMAN HEALTH

IMPACTS INCLUDING

ALGAL BLOOMS,

FISH KILLS AND

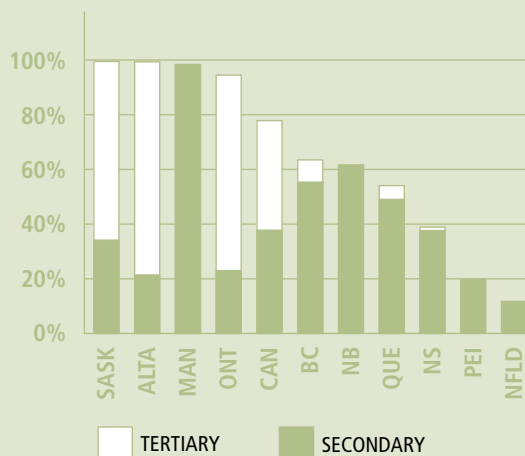
BEACH AND SHELLFISH

AREA CLOSURES.

1] **SOURCE:** Environment Canada, Municipal Water Use (MUD) data, 2001. Ministry of Water, Land and Air Protection. Summary of Municipal Treatment Facilities, 2001. **NOTES:** Secondary treatment includes waste stabilization ponds. These data refer to the proportion of the municipal population in British Columbia that is served by a municipal wastewater system. Approximately 17% of British Columbians have on-site sewer systems under the Ministry of Health, which are excluded from this analysis.

HOW DOES BRITISH COLUMBIA COMPARE?

- > In 1999, the liquid waste of 63% of the population served by sewer systems received secondary or tertiary treatment. The 1999 Canadian level was 78%, up from 56% in 1983.
- > In Alberta, Saskatchewan and Manitoba, more than 99% of the population served by sewers has secondary wastewater treatment or better. In Ontario it is 94%.
- > Of the coastal provinces in Canada, British Columbia has the highest proportion of the populations served by secondary or tertiary wastewater treatment.



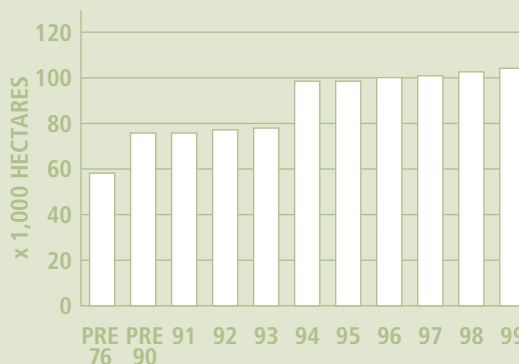
HOW CAN WE FARM AND PROTECT WATER QUALITY?

- > Managing livestock manures in a responsible manner is a key to environmental sustainability on livestock farms. Manures, which can be stored during the non-cropping and/or rainy season, can be recycled to provide nutrients to crops during the growing season, thereby preventing escape into surface and groundwater.
- > Coastal farmers are restricted from applying manures in November, December and January. Farmers with 150 days manure storage capacity are able to meet this requirement and apply manure in a legal and responsible manner.
- > In 1998, roughly 40% of dairy and hog farms in the Lower Fraser Valley had greater than 150 days manure storage.



HOW DOES SEWAGE AFFECT THE MARINE ENVIRONMENT?

- > Shellfish feed by filtering large volumes of water to remove suspended food particles. As a result, any harmful bacteria, viruses or toxic substances present in the marine environment are concentrated in these organisms.
- > Between 1991 and 1999 a total of 105 closures were issued, affecting a total of 28,000 hectares. During this time only 18 closures were revoked.
- > Sanitary shellfish closures are attributed to a combination of sources including urban runoff, primary sewage discharge, septic system seepage, boat sewage discharge and agricultural runoff.

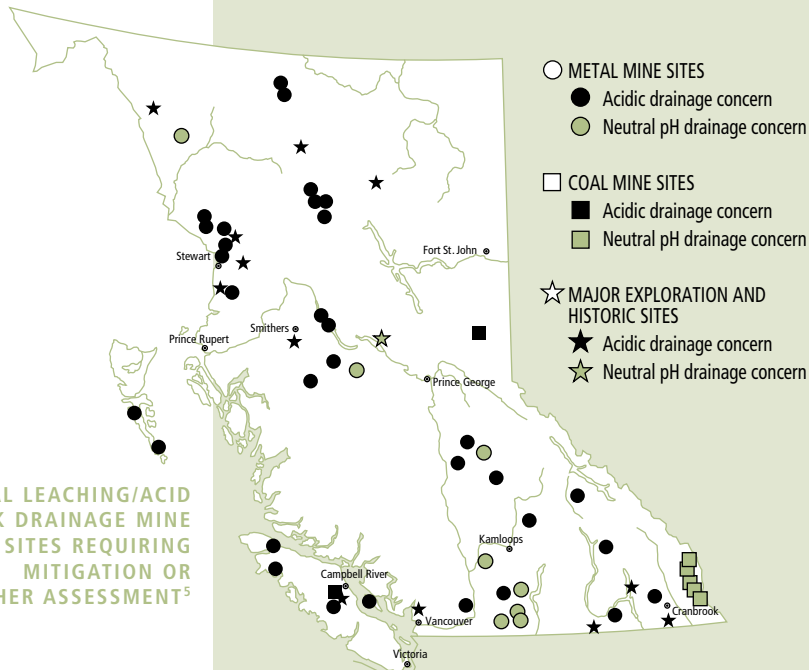


2] **SOURCE:** Environment Canada. MUD database. 2001. **NOTES:** Secondary treatment includes waste stabilization ponds. Insufficient data exist to adequately assess the degree of treatment in NWT, Yukon or Nunavut. The data for Canada do not include the Territories. Data refer to the proportion of the municipal population served by a municipal wastewater system. In Canada, nearly 75% of the population (22.5 million) are served by municipal sewer systems. Population served by on-site sewer systems are excluded.

3] **SOURCE:** State of Resources Report, Ministry of Agriculture, Food and Fisheries, 2002. **NOTES:** Only farms that reported a gross return of greater than \$25,000 in 1995 were used. Sample size for dairy is 144 farms and for hog it is 37 farms.

4] **SOURCE:** Environmental Protection Branch, Environment Canada, Pacific and Yukon Region, 2000.

METAL LEACHING/ACID ROCK DRAINAGE MINE SITES REQUIRING MITIGATION OR FURTHER ASSESSMENT⁵



METAL LEACHING (ML) AND ACID ROCK DRAINAGE (ARD)

- > Metal leaching (ML) and acid rock drainage (ARD) are caused when sulphide minerals are weathered and exposed to air and water.
- > Sulphide weathering produces acidic compounds that can become dissolved in water if they are not neutralized by other minerals on the site.
- > Many metals become highly soluble under acidic conditions; significant metal leaching can also happen in neutral or alkaline drainage conditions.
- > ML/ARD is a concern at most metal mines and some coal mines, where there are high concentrations of the sulphide minerals and other trace metals. This is because mining greatly increases the amount of rock surfaces exposed to the weathering processes that result in ML/ARD.
- > There are more than 60 mines in British Columbia with the potential to generate sufficient ML/ARD to significantly affect the receiving environment. Most of these are no longer in production.
- > Once conditions conducive to ML/ARD have been established, significant impacts can persist for hundreds of years and mitigation efforts can be very expensive. Therefore, most ML/ARD mitigation measures need to be designed, constructed and operated in a manner that allows them to perform indefinitely.

WHY IS IT IMPORTANT?

- > Dissolved metals such as copper, zinc and cadmium can be toxic to fish and animals and can adversely affect ecosystem health. Metals can also be absorbed and accumulate in plant and animal tissue.
- > ML/ARD mitigation can be very expensive with capital costs of over \$10 million and operating costs up to \$1.5 million per year at a single site.
- > A number of historic mines (e.g., Britannia and Mt. Washington), which closed prior to the enactment of modern day ML/ARD regulations, have caused significant environmental impacts due to unmitigated ML/ARD.

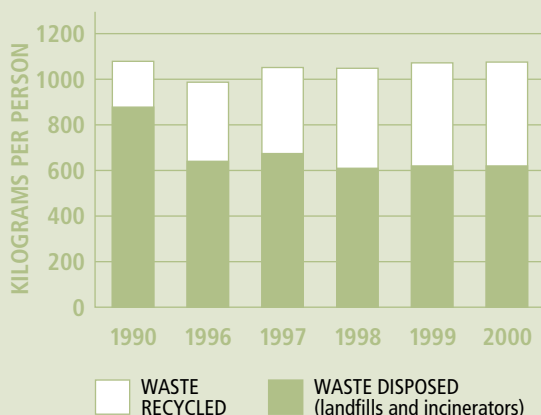
WHAT IS BEING DONE?

- > In British Columbia, regulations for managing mine wastes are included in the *Waste Management Act*, *Mines Act* and federal *Fisheries Act*.
- > Under the *Mines Act*, metal and coal mines are required to predict the ML/ARD potential of all the wastes produced. Where mitigation is necessary, mines must provide reasonable assurance of environmental protection and their ability to cover future mitigation costs.
- > Under the *Waste Management Act*, the Province can set conditions for discharges to the environment and for pollution abatement. It also authorizes the Province to include previous owners of mines in a cleanup order and for pollution abatement and prevention.
- > Many mines with the potential for significant ML/ARD, flood mine wastes to limit oxidation or apply compacted soil covers to reduce leaching.
- > Large-scale drainage collection and chemical treatment can be very effective in removing metals from drainage. However, due to on-site impacts and high costs it tends to be a mitigation strategy of last resort.
- > There are a large number of processes that control ML/ARD and many of these continue to change and evolve over time. Even where mitigation measures have been implemented, the full extent and potential cost of ML/ARD mitigation may not be known. Therefore, conservative design criteria, detailed monitoring, regular maintenance, ongoing review and adaptive management are key components of successful ML/ARD mitigation.



STATUS AND TRENDS IN MUNICIPAL SOLID WASTE

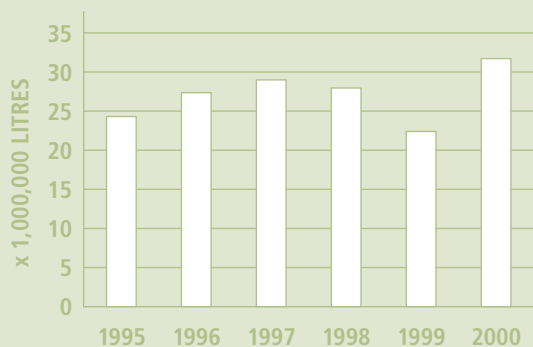
- > It is estimated that British Columbians generated 1,070 kg of solid waste per person in 2000. Of this, 618 kg required disposal. This represents a 30% reduction since 1990 in waste disposed of per person.
- > In 2000, 452 kg of solid waste per person was diverted from disposal for recycling. Waste recycled increased from 19% of waste generated in 1990, to 42% in 2000. Approximately 80% of households are served by curbside collection of recyclables.
- > The amount of waste disposed to landfills and incinerators decreased from 2.9 to 2.5 million tonnes between 1990 and 2000. During the same period, the population increased by 32%.
- > Ninety percent of British Columbia's disposed waste is sent to landfills; 10% is incinerated.



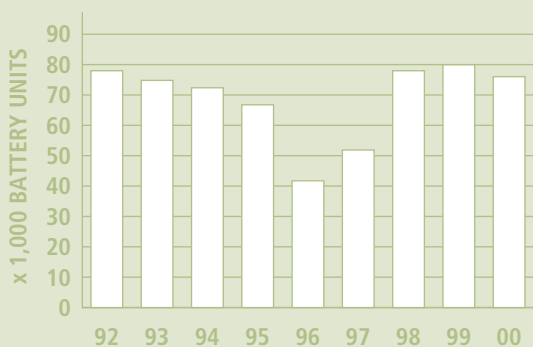
MUNICIPAL SOLID WASTE DISPOSED OF AND RECYCLED⁶

WHAT ARE THE RESULTS OF CONSUMER AND INDUSTRIAL PRODUCT STEWARDSHIP PROGRAMS?

- > Product stewardship initiatives involve industry and consumers taking responsibility for waste from products they produce or use.
- > Since 1995, the amount of lubricating oil recycled increased 25% from 24.4 to 30.4 million litres.
- > The polyaromatic hydrocarbons (PAHs) and heavy metals found in lubricating oil are toxic to plants and animals at low concentrations and can restrict plant physiology at higher concentrations.
- > In 2000, the British Columbia Lead Acid Battery Collection Program provided incentives that helped to recycle 759,000 lead-acid batteries.
- > Almost all of the lead-acid batteries generated each year in the province are recycled in British Columbia or exported for recycling. Recycled lead can be processed to make new lead-acid batteries.
- > Lead-acid batteries break down in landfills, releasing lead into the environment. Lead accumulation in body tissue is toxic.



WASTE OIL RE-REFINED⁷



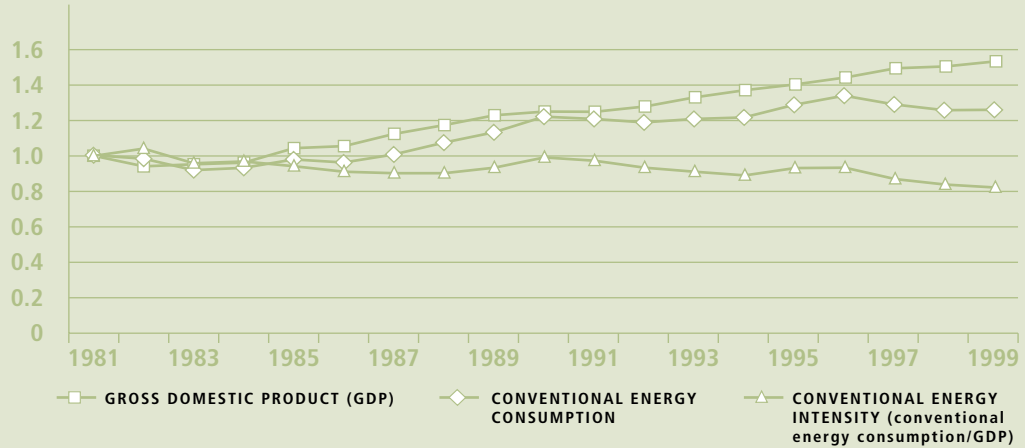
NUMBER OF LEAD-ACID BATTERY UNITS RECYCLED⁷

6] SOURCE: BC Ministry of Water, Land and Air Protection, 2002. BC Municipal Solid Waste Tracking Report 2000. **NOTES:** Data for recycled and disposed wastes were obtained from regional districts where available, and disposal data estimated according to the methodology in the 1998 report for regional districts that did not supply data. Tracking methodology was improved in 1996, increasing the reliability of the data. Estimates of recycled waste are underestimated as the amounts handled by private recycling facilities are not included in most regional district data. The material recycled through industry stewardship initiatives account for 8.9% by weight of the total amount of recycling reported in BC for 2000, although this figure is also underestimated, since several stewardship programs report data in units that cannot reliably be converted to weight.

7] SOURCE: BC Ministry of Water, Air and Land Protection, 2001. **NOTES:** Waste Oil was received at Mohawk's North Vancouver Re-refinery. The BC Lead-Acid Battery Collection Program was implemented by the Ministry of Environment, Lands and Parks in June 1991.

Linking Economy and Environment in British Columbia

CONVENTIONAL ENERGY CONSUMPTION AND INTENSITY (INDEXED 1981=1)¹



STATUS AND TRENDS IN INTENSITY OF CONVENTIONAL ENERGY USE

- > Economic activity uses energy, and energy use has environmental impacts. Therefore, estimating the amount of conventional energy consumed per unit of Gross Domestic Product (GDP) is used as an indicator of how much impact economic activity has on the environment. (Conventional energy sources include fossil fuels and large hydroelectric sources and exclude alternative energy sources such as wind and solar.)
- > From 1981 to 1999, a 53% increase in GDP in British Columbia was achieved while energy use from conventional sources increased by only 26%. This means that the intensity of conventional energy use has declined by 18% over that time.
- > These results are due to a combination of factors, including a shift in the structure of the economy towards less energy-intensive sectors (e.g., knowledge-based, service, tourism), increased energy efficiency of existing activities, and a larger amount of energy consumption from alternative energy sources. Other factors that are not related to energy used for economic activity, such as weather, also affect the energy/GDP ratio and have not been accounted for in the indicator.

WHY IS IT IMPORTANT?

- > The production, transportation, transmission and use of conventional energy have impacts on the environment, including the emission of greenhouse gases and atmospheric pollutants through the combustion of fossil fuels and flooding of lands for large hydroelectric sources. These impacts can be reduced by decreasing energy consumption, by using energy more efficiently and by developing alternative energy sources that are less stressful on the environment.

WHAT IS BEING DONE?

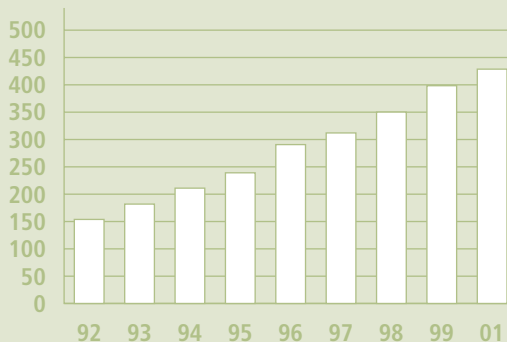
- > Since the 1980s there have been extensive campaigns in British Columbia to encourage energy conservation through increased energy efficiency of appliances and buildings, and use of more environmentally friendly modes of transportation.
- > BC Hydro plans to add new "green" energy technologies to meet 10 percent of its load growth over the next 10 years. Plans are to start operating a demonstration project on Vancouver Island using wind, micro hydro and ocean wave energy between 2003 and 2004.
- > An energy policy framework is being developed for British Columbia. It will include specific reference to environmentally sound energy supplies, including developing alternative energy sources.

THE SOURCE AND USE OF ENERGY IS AN IMPORTANT FACTOR DETERMINING THE IMPACT OF ECONOMIC ACTIVITY ON THE ENVIRONMENT.

1] **SOURCES:** Ministry of Water, Land and Air Protection, 2001; Statistics Canada (CANSIM - Canadian Socio-economic Information Database), 2001; and BC Stats (BC Economic Accounts), 2001. **NOTES:** The indicator is based on economy-wide energy consumption and GDP data. The estimates of conventional energy intensity must be interpreted carefully because terms such as "conventional", "alternative" and "green" energy are not consistently defined. In addition, no adjustment has been made to account for factors that are not related to energy used for economic activity that affect the estimates. The link between energy intensity and the associated environmental impacts must also be interpreted carefully because different types of energy have different environmental impacts.

TRENDS IN ORGANIC AGRICULTURE

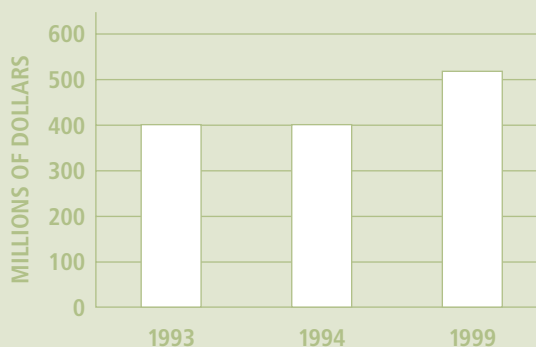
- > Organic agriculture is a method of farming that largely prohibits the use of synthetic fertilizers and pesticides, feed additives and genetically modified organisms.
- > British Columbia Certified Organic means the product was produced according to standards set by the Certified Organic Associations of British Columbia, in collaboration with the Ministry of Agriculture, Fisheries and Food.
- > The number of certified organic producers and processors in British Columbia nearly tripled from 1992 to 2001, reflecting growing marketplace demand.
- > The global organic market is estimated to have doubled between 1997 and 2000. The 2001 estimate for the international organic foods market is \$US 20-26 billion.



NUMBER OF CERTIFIED ORGANIC PRODUCERS AND PROCESSORS IN BRITISH COLUMBIA²

TRENDS IN ECONOMIC GAINS FROM PROVINCIAL PARKS

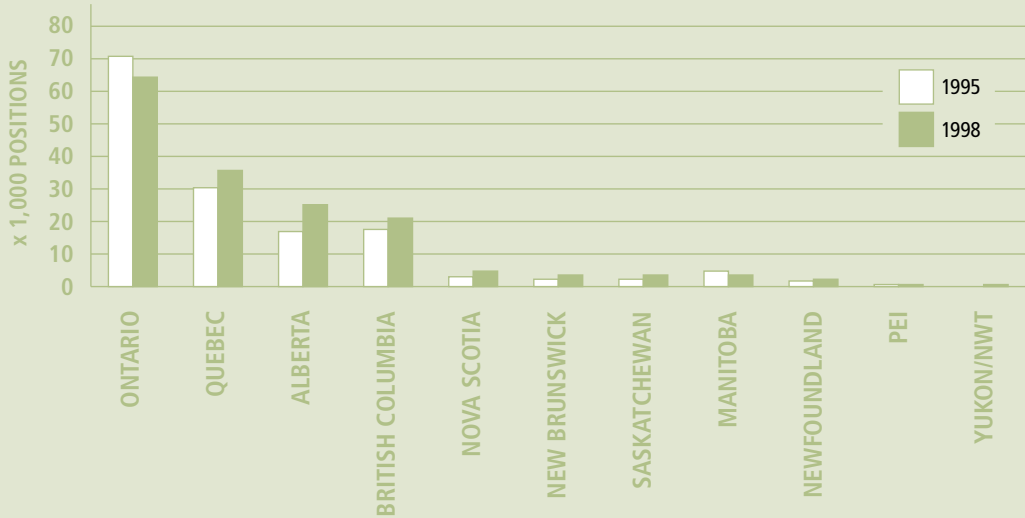
- > British Columbia's protected areas system provides a wide range of benefits that contribute to the social, environmental, and economic well-being of the province.
- > In 1999, British Columbia's provincial parks contributed an estimated \$521 million to the provincial Gross Domestic Product (GDP), up 30% from 1993.
- > In 1999, economic activity generated by provincial parks directly and indirectly sustained about 9,100 jobs.
- > Economic and employment benefits of parks are distributed across the province. More than 50% of GDP and jobs are generated outside the Lower Mainland and Victoria regions.



GDP GENERATED BY PROVINCIAL PARKS³

2] **SOURCE:** Canadian Organic Growers Association, 2001. **NOTES:** A producer is an individual or organization that produces fruits, vegetables, grains, mushrooms, dairy, meat or any other agricultural product. A processor is an individual or organization that processes certified organic produce into a good, such as salsa or cheese.

3] **SOURCE:** Economic Benefit of British Columbia's Provincial Parks, September 2001. British Columbia Ministry of Water, Land and Air Protection. **NOTES:** Estimates of economic benefits from BC Parks are derived from input/output models based on visitor and government expenditures on the parks system.

ENVIRONMENT
INDUSTRY
EMPLOYMENT⁴

THE EMPLOYMENT TRENDS IN THE ENVIRONMENTAL INDUSTRY

- > The environmental technology and services industry is a dynamic component of British Columbia's rapidly diversifying economy. It provides leading-edge solutions in recycling, energy efficiency, alternative fuel, air emissions control and waste management.
- > In 1998, British Columbia's environmental industry generated nearly \$1.8 billion in revenues and employed 20,910 people. This represents a 15% increase since 1995.
- > Over 800 environmental firms, about 12-15% of Canada's environment industry, are active in British Columbia. Most are small to medium-sized companies with fewer than 25 employees.
- > The industry is focused on both domestic and international markets. More than 75% of environmental technology providers are pursuing projects internationally.
- > The top two forces promoting environmental industry growth are enforcement of current environmental standards and development of new standards.





WHAT IS THE PRESENT SITUATION?

British Columbia has retained a large portion of its native flora and fauna, making it unique in North America. Nevertheless the concentration of people in south-central and southwestern British Columbia has led to a regional concentration of species and ecosystems “at risk”, due largely to the loss and fragmentation of indigenous habitats. Similarly, broad-ranging species, such as Caribou, and Steelhead and Bull Trout appear to be in decline, and in some cases locally extinct, in the southern portions of their British Columbia ranges.

WHAT CAN WE EXPECT IN THE FUTURE?

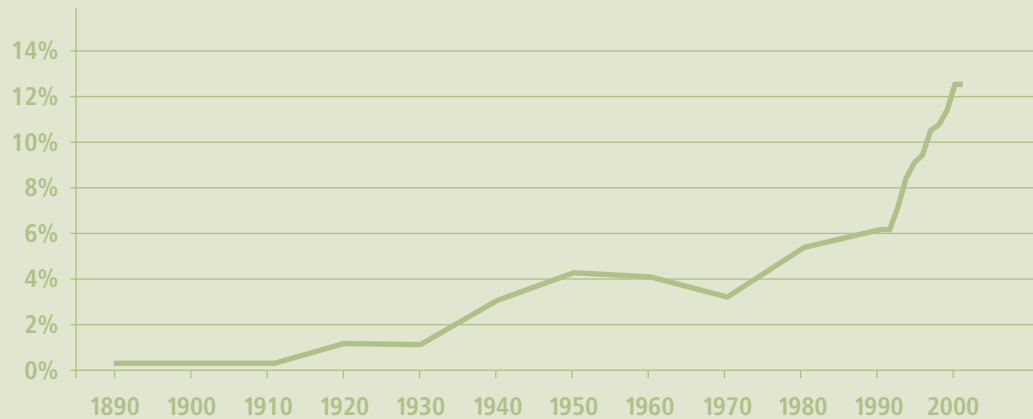
The ranges of some species that once covered large portions of the continent will continue to contract. Conservation efforts will be focused on preventing fragmentation of the landscape, which results in “isolated” populations. Maintaining these populations over the largest possible range helps conserve the genetic variability of the species; a genetically diverse population is able to adapt to changing conditions. In some cases, contracting population ranges will place a large portion of the responsibility for their global survival with British Columbia.

BRITISH COLUMBIA’S GOAL:

Manage and protect the natural diversity of ecosystems, fish and wildlife species and their habitats.

Protected Areas in British Columbia

PERCENTAGE OF PROVINCE IN PROTECTED AREA STATUS¹



PROTECTED AREAS

HAVE BECOME

AN IMPORTANT

COMPONENT OF

LAND USE PLANNING,

CONTRIBUTING TO

THE MAINTENANCE OF

ECOSYSTEMS, SPECIES

AND GENETIC

RESOURCES.

STATUS AND TRENDS IN PROTECTED AREAS

- > British Columbia's goal is to protect viable, representative examples of the natural diversity, culturally and special natural, and recreational features.
- > British Columbia met and surpassed the goal recommended in the 1988 Brundtland Report of reaching 12% of the provincial land base dedicated to protected areas by 2000.
- > In 1991, approximately 6.1% (5.74 million hectares) of the land base was dedicated to protected areas; by the end of 2001, approximately 12.5% (11.86 million hectares) was dedicated to protected areas.
- > Significant increases in ecosystem representation have occurred in the Province including the Northern Rockies (Muskwa-Kechika), Northwest (Tatshenshini-Alsek), Central Interior (Ts'il ?os), Southern Interior (Lac du Bois, Snowy) and on Vancouver Island (Carmanah Walbran).
- > In 2001, 23.3 million visits were made to provincial parks in British Columbia.

WHY IS IT IMPORTANT?

- > The protected areas network is an integral part of British Columbia's strategy to protect the province's biological and cultural heritage. This is becoming increasingly important as British Columbia has a high number of species "at risk" relative to other provinces and territories in Canada.
- > The protected areas network also provides outdoor recreational opportunities, for both residents and visitors.
- > A recent study demonstrated that parks annually contribute over \$521 million to the provincial economy and 9100 person-years of employment.

WHAT IS BEING DONE?

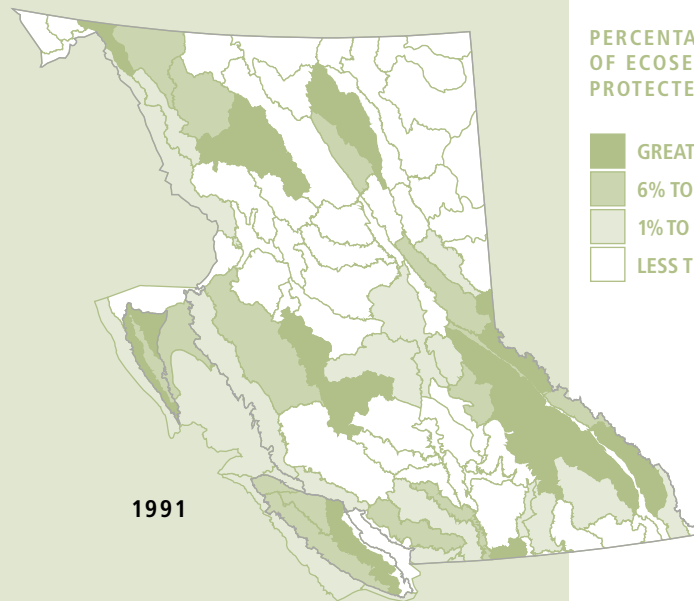
- > The province continues to develop the land use planning processes that are a critical part of identifying new protected areas.
- > The federal and provincial governments are working together towards a new national park reserve on the southern Gulf Islands.

1] SOURCE: BC Parks, 1995 and Ministry of Sustainable Resource Management, 2001. NOTES: Data for this graph were compiled by decade until 1990, and do not reflect annual trends. Protected areas include those which have been designated and those announced but not yet designated under the Protected Areas of British Columbia Act, Park Act, Ecological Reserve Act or other provincial or national protected areas legislation. In British Columbia, protected areas include national parks, ecological reserves, class A and C provincial parks, recreation areas and protected areas established under the Environment and Land Use Act. They do not include wildlife management areas, migratory bird sanctuaries and regional parks.

IS BRITISH COLUMBIA'S RICH ECOSYSTEM DIVERSITY PROTECTED?

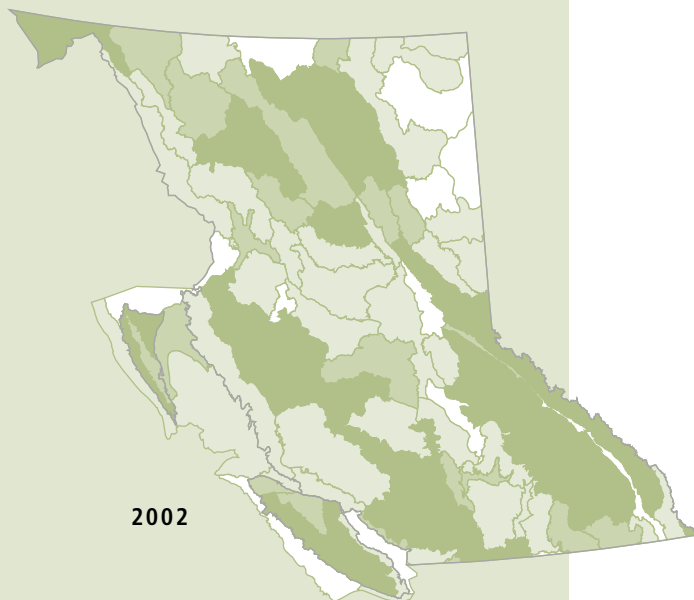
- > An ecological classification system divides British Columbia into 112 ecosections, representing different ecosystem types. Twelve of these are predominantly marine.
- > A provincial objective is to increase the protection of ecosystem diversity. The amount of protection will vary with each ecosection.
- > Significant progress has been made in improving ecosystem representation in the protected areas system (see table).
- > Some areas of the province such as the most northern, the north east and some marine ecosystems, still have less than 1% protected.

PERCENTAGE OF TERRESTRIAL ECOSECTIONS IN PROTECTED AREAS STATUS		
	1991	2002
Less than 1%	53	11
1 to less than 6%	19	33
6 to 12%	12	19
Greater than 12%	16	37



1991

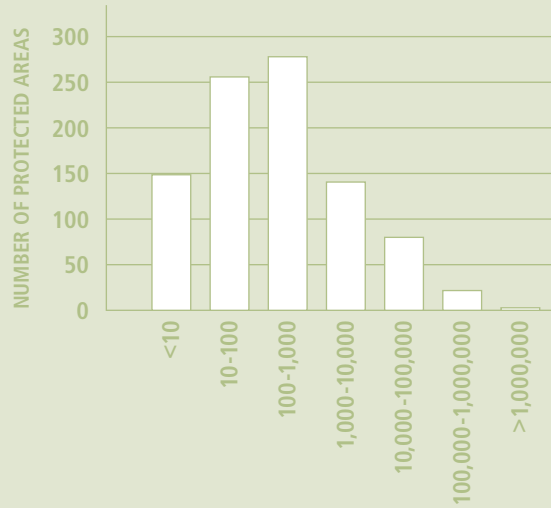
PERCENTAGE OF ECOSECTIONS PROTECTED²



2002

2] **SOURCES:** Ministry of Sustainable Resource Management, Decision Support Services, 2002. **NOTES:** The delineations represent ecosections, as described in Ecoregions of British Columbia, D. Demarchi, 1993, except for the 12 marine ecosections, which are found in The Marine Ecoregions of British Columbia, D.E. Howes, M.A. Zacharias and J.R. Harper, 1996.

NUMBER OF
PROTECTED
AREAS IN EACH
SIZE CATEGORY³
(Size in hectares)



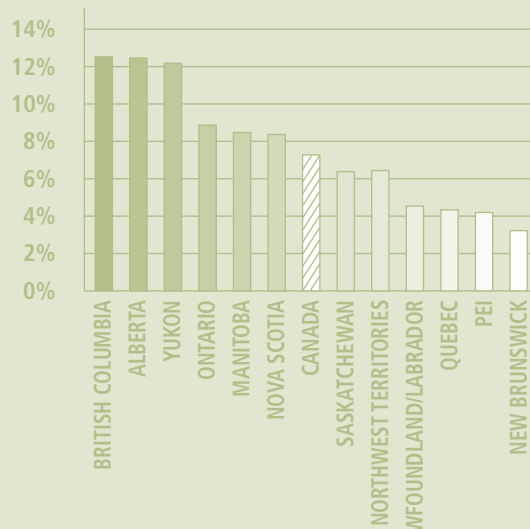
HOW BIG ARE BRITISH COLUMBIA'S PROTECTED AREAS?

- > British Columbia has 877 protected areas composed of national and provincial parks, ecological reserves and other designations, comprising 926 distinct areas.
- > Large protected areas are vital to maintain viable populations of animals with large home ranges, such as Grizzly Bears.
- > When contiguous protected areas are viewed as a single unit, 21 protected areas in British Columbia are larger than 100,000 hectares; two of those are larger than 1 million hectares.
- > Small protected areas provide protection for rare and endangered species and their habitats, when larger reserves are not possible, and help to link together larger reserves.
- > 150 protected areas in British Columbia are smaller than 10 hectares.

HOW DOES BRITISH COLUMBIA COMPARE?

- > By the end of 2001, the percentage of the provincial land base in protected areas was 12.5%, tied with Alberta for the highest in Canada.
- > In 2001, approximately 7.3% of Canada's land base was protected, up from 3.0% in 1989.
- > Between 1989 and 2001, Manitoba had the greatest increase in the percentage of protected areas (from 0.5% to 8.4%) followed by British Columbia (from 5.3% to 12.5%).
- > From 1989 to July 2000, almost 39 million hectares were added to Canada's protected areas network. Over 1,000 new parks and reserves were designated, more than doubling the land area protected from coast to coast.
- > In 2000, Canada ranked 33rd, globally, for percentage of land base in protected areas.

ACROSS CANADA
COMPARISON OF
PROTECTED AREAS⁴
(Percentage of land
base protected)



3] **SOURCE:** Decision Support Services, Ministry of Sustainable Resource Management, 2002. **NOTES:** This analysis includes both terrestrial and marine protected areas.

4] **SOURCE:** Numbers for British Columbia, Alberta, Yukon, Ontario, Manitoba, Nova Scotia, Saskatchewan, Newfoundland/Labrador and the Northwest Territories are current for 2001 and are provided by the jurisdictions. The remaining numbers are from World Wildlife Fund, Canada July 2000. **NOTES:** Numbers stated for PEI and New Brunswick are considered current to 2001. No numbers are available for Nunavut. The value for Canada is slightly underestimated, as it does not include up to date information from Quebec or Nunavut. Areas included in this analysis must be exempted from any type of resource extraction or human manipulation that would cause long-term or large-scale impacts to natural character; exempted activities include logging, mining, the development of hydroelectric dams and oil or gas extraction. These protected areas are managed for the conservation of natural diversity and maintenance of ecosystem integrity as defined by the World Conservation Union (IUCN) categories I, II, and III. Protected areas include national parks, ecological reserves, class A and C provincial parks, recreation areas and protected areas established under the Environment and Land Use Act. They do not include wildlife management areas, migratory bird sanctuaries and regional parks.

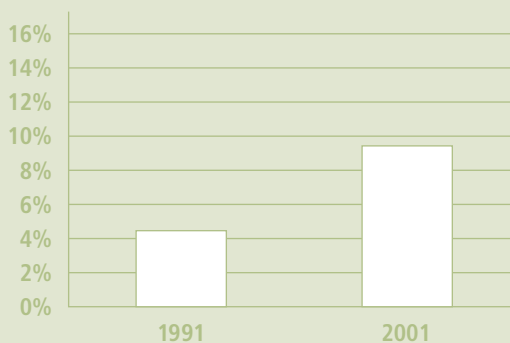


PERCENTAGE OF FORESTED AREA THAT IS PROTECTED⁵

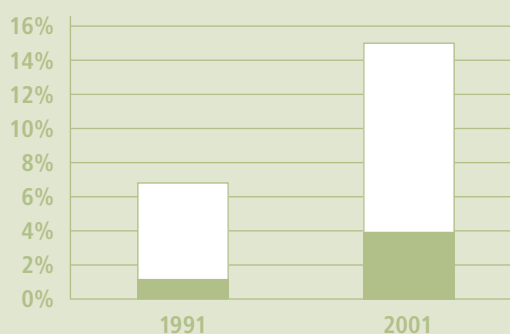
- > About two-thirds of British Columbia is forested. The area of forests protected by provincial or national legislation increased between 1991 and 2001 from 2.62 million to 5.84 million hectares (from 4.3% to 9.5% of all forests).

IS THE ECOLOGICAL DIVERSITY OF BRITISH COLUMBIA'S FORESTS ADEQUATELY PROTECTED?

- > Forests of different tree species, elevations and ages provide critical habitat to various animal and plant species. Protected forests should include a variety of forest types at different elevations and ages to ensure the continued existence of habitat types and the species that are reliant upon them.
- > Protection of high elevation forests increased from 6.8% in 1991 to 15% in 2001. About three quarters of protected high elevation forests are older than 140 years (2.05 million hectares protected in 2001).
- > Protection of low elevation forests more than doubled from 3.2% in 1991 to 7.1% in 2001. Low elevation forests account for 70% of all forests in the province. More than half of the protected low elevation forests in 2001 are older than 140 years (1.67 million hectares protected in 2001).
- > The amount of old forest (older than 140 years) that can be protected depends in part on the amount of old forest available due to natural ecosystem dynamics, such as fire, and on the history of timber harvesting, which generally began in low elevation forests. As of 2001, the total remaining area of old forests in British Columbia was 26.1 million hectares, 14.2% of which was in protected areas. Of the remaining old forests at low elevation, 11.8% are protected.
- > Features indicative of "old growth" forests such as large trees, an open and structurally diverse canopy layer and thick moss, take from 100 to more than 250 years to develop fully, depending on the natural dynamics of each ecosystem.
- > Forests older than 140 years were used to represent mature forests in this analysis because of data limitations.

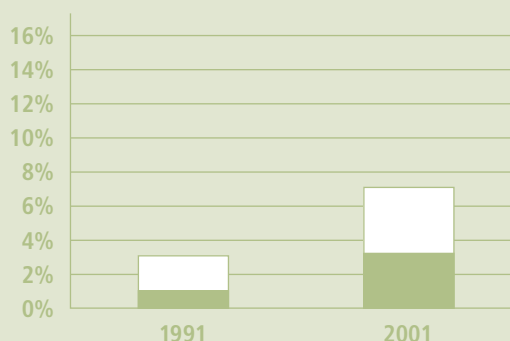


TOTAL PROVINCIAL FOREST PROTECTED⁵



HIGH ELEVATION FOREST PROTECTED⁵

OLDER THAN 140 YEARS
 140 YEARS OR YOUNGER



LOW ELEVATION FOREST PROTECTED⁵

5] SOURCE: Ministry of Sustainable Resource Management and Ministry of Forests 2002. NOTES: Protected areas include those which have been designated and those announced but not yet designated, under the Protected Areas of BC Act, Park Act, Ecological Reserve Act or other provincial or national protected areas legislation. Regional parks and urban water supply watersheds in which timber harvests are not permitted are not included. High elevation forests are those found in four biogeoclimactic zones: alpine tundra, spruce-willow-birch, Engelmann spruce-subalpine fir, and mountain hemlock. Forests in all other biogeoclimactic zones are defined as low elevation forests. The total area of forested land at high elevation is 18.5 million ha and at low elevation it is 43.1 million ha.

Species at Risk in British Columbia

SPECIES STATUS DEFINITIONS

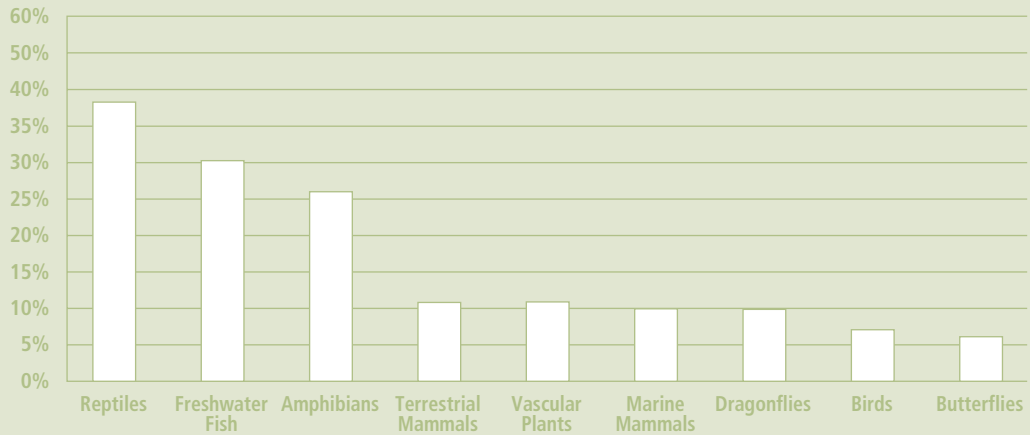
Extirpated: No longer exists in the wild in BC, but occurs elsewhere.

Endangered: Facing imminent extinction or extirpation.

Threatened: Likely to become endangered if the limiting factors are not reversed.

Special Concern: Vulnerable because of characteristics that make it particularly sensitive to human activities or natural events.

SPECIES ON THE BRITISH COLUMBIA RED LIST (as percentage of known species)¹



BIODIVERSITY IS THE FOUNDATION OF A WIDE ARRAY OF 'FREE' ECOLOGICAL SERVICES, SUCH AS CLEAN WATER AND AIR, POLLINATION, PEST CONTROL, WASTE ASSIMILATION, DECOMPOSITION OF ORGANIC MATTER, NUTRIENT CYCLING AND EROSION CONTROL.

STATUS OF SPECIES AT RISK

- > The province maintains lists of species grouped according to their conservation risk. "Red" list species have been legally designated as Endangered or Threatened under the *Wildlife Act*, or have been listed as candidates for either status by the Conservation Data Centre; extirpated species are also included. "Blue" list species are those of Special Concern.
- > In British Columbia, 84 species of native vertebrate animals (16% of provincial total), 9 dragonfly species (10%), 12 butterfly species (7%), and 257 vascular plant species (11%) are on the provincial Red list.
- > An additional 97 vertebrate animals, 339 vascular plants and 46 invertebrate species are on the provincial Blue list. These include the White Glacier Lily and Grizzly Bear.
- > Since 1999, five species of freshwater fish including the Green Sturgeon, five birds including the Double-crested Cormorant, three mammals including two newly discovered species of shrew, and 19 vascular plants have been added to the Red and Blue lists. In that time, one bird (Black-throated Green Warbler), one amphibian (Coeur d'Alene Salamander) and 14 vascular plants have been redesignated from Red to Blue, or removed from the lists altogether.
- > Recently, Red and Blue lists have been expanded to include 67 butterfly and dragonfly species, 359 moss species and 195 plant communities (unique ecosystems categorized by their species composition). The butterflies and dragonflies have been added to the 2002 indicator.

WHY IS IT IMPORTANT?

- > Biodiversity represents the biological portion of natural resources on which economic and social well-being depends. This is particularly true in British Columbia, where important aspects of our economy draw directly from our natural resources.
- > The proportion of species at risk is used internationally as an indicator of the status of biodiversity. Global concern for biodiversity stems from evidence that the current rate of extinctions is higher than would be expected naturally.

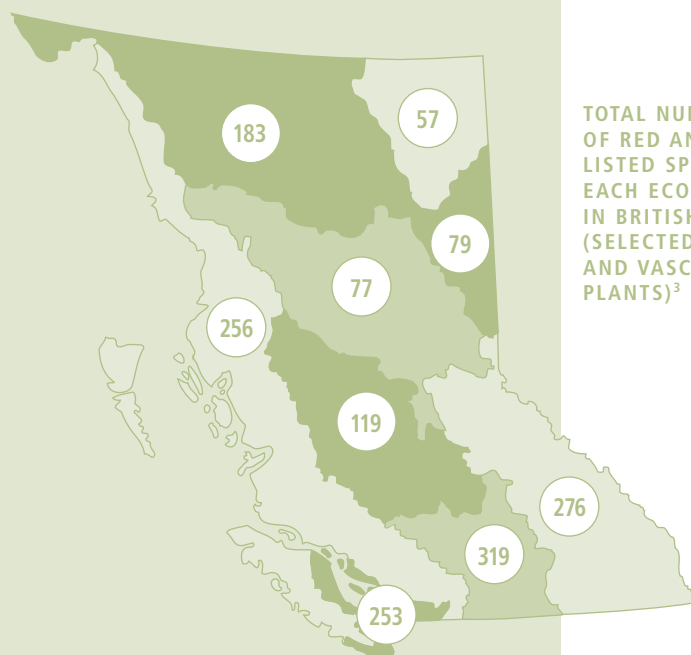
WHAT IS BEING DONE?

- > British Columbia has committed to the National Accord for the Protection of Species At Risk. All provinces and territories have agreed to protect species and their habitats and develop recovery plans for designated species. The National Accord emphasizes preventative measures, stewardship initiatives and the need for partnerships on both public and private lands. The goal of the National Accord is to prevent species in Canada from becoming extinct as a consequence of human activity.
- > The Conservation Data Centre will continue to do peer-reviewed annual updates regarding the status of British Columbia species at risk.

1] SOURCE: Ministry of Sustainable Resource Management, 2001. Conservation Data Centre. **NOTES:** The total threatened or endangered species /native species in each group is: reptiles 5/16; freshwater fish 24/80; amphibians 5/19; terrestrial mammals 11/104; marine mammals 3/29, vascular plants 257/2333; dragonflies 9/87; birds 35/465; butterflies 12/187. "Plants" are restricted to vascular plants. Totals may exclude listed subspecies or populations depending on the overall status of the species in the province.

WHERE ARE SPECIES AT RISK FOUND?²

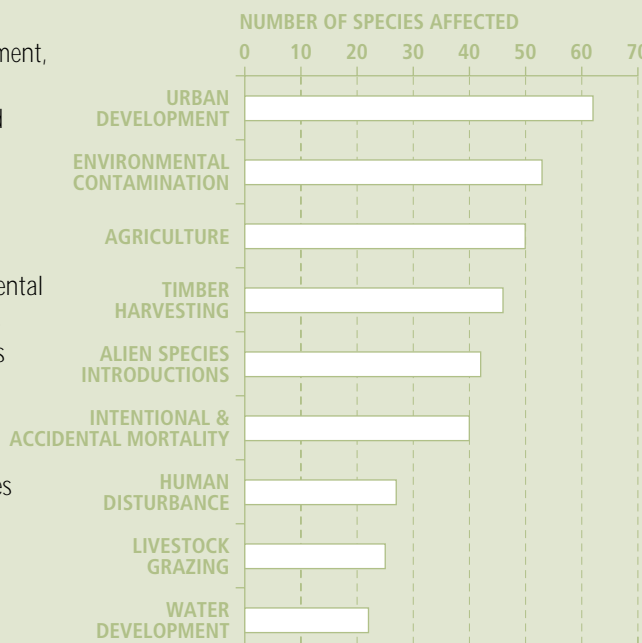
- > The Southern Interior ecoprovince has the largest number of species at risk (319), followed by the Southern Interior Mountains (276), Coast and Mountains (256), and the Georgia Depression (253).
- > In these ecoprovinces, regions of high biodiversity coincide with areas of rapid human expansion resulting in loss of critical habitat for these species.
- > Species at risk in the Southern Interior include the Grasshopper Sparrow and the Night Snake. Both species are threatened by habitat disturbance and loss from urban and agriculture development.
- > Species at risk in the Georgia Depression include the Pacific Water Shrew and the Oregon Spotted Frog. These species are threatened by urban development and loss of riparian and wetland habitat.



TOTAL NUMBER OF RED AND BLUE LISTED SPECIES IN EACH ECOPROVINCE IN BRITISH COLUMBIA (SELECTED ANIMALS AND VASCULAR PLANTS)³

WHAT ARE THE THREATS TO SPECIES AT RISK?²

- > The largest threat to species at risk in British Columbia is habitat loss. Urban development, agriculture, timber management, livestock grazing and water development result in the destruction, modification and fragmentation of natural habitats upon which many species at risk depend.
- > The increased relative importance of environmental contamination and alien species since the last edition of Environmental Trends, reflects the inclusion of butterflies and dragonflies in this analysis. Butterflies are threatened by pesticide applications and displacement of native plants by alien invasive species.
- > Environmental contamination also includes threats to marine mammals from bioaccumulation of persistent chemicals in the marine environment.
- > Introduction of alien (non-native) fish species to freshwater environments poses a significant threat to amphibians and many freshwater fish.



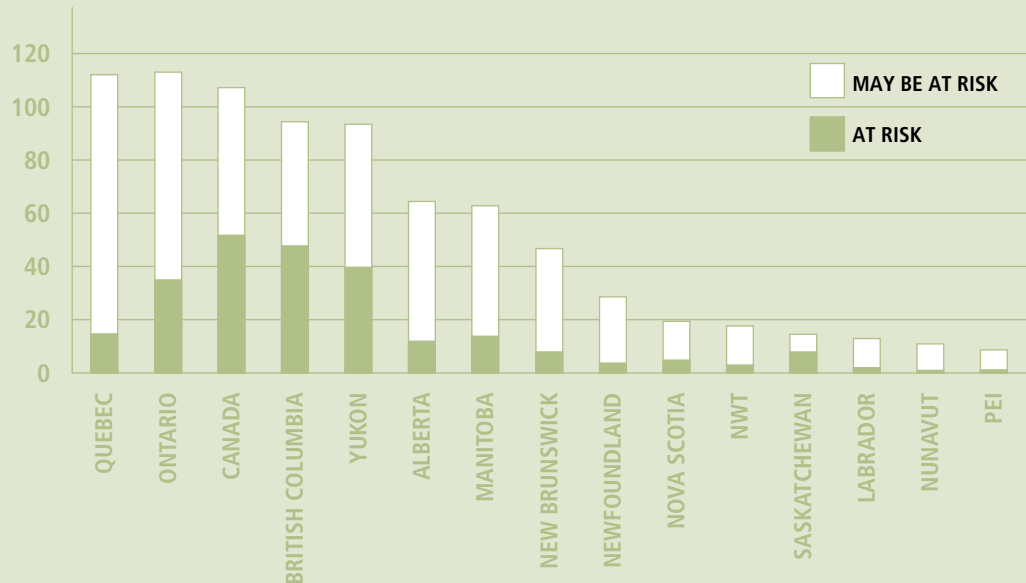
RELATIVE IMPORTANCE OF THREATS TO RED LISTED ANIMALS (for description of threats see footnote)⁴

2] **NOTE:** For the purpose of this indicator "Species" includes sub-species, which are geographical variants of species, as well as distinct and geographically defined populations.

3] **SOURCE:** Ministry of Sustainable Resource Management, Conservation Data Centre, 2001. **NOTES:** Circled numbers indicate the total number of Red and Blue listed vertebrate animals, dragonflies, butterflies, and vascular plant species and sub-species. Since the release of Environmental Trends in British Columbia 1998, a significant improvement in regional tracking has resulted in increased numbers of total species at risk for most ecoprovinces. The delineations on the map represent ecoprovinces, as described in Ecoregions of British Columbia, D. Demarchi 1993.

4] **SOURCE:** BC Ministry of Water, Land and Air Protection, Wildlife Branch, 2002. Based on Conservation Data Centre species assessment records and on expert opinion. **NOTES:** This analysis includes terrestrial and marine mammals, birds, amphibians, reptiles, fresh water fish, butterflies and dragonflies. **Environmental Contamination** includes any chemical introduced to the environment that affects species at risk; **Intentional & Accidental Mortality** includes illegal or intentional killing, road kill, pest control, mortality of prey species, and incidental take in fish nets; **Human Disturbance** includes intentional or deliberate disturbance to animals; and **Water Development** includes the diversion of water for agriculture, livestock, residential use, industry use, dams, reservoirs, and barriers to flow. **NOTE:** Some species are effected by more than one threat.

NUMBER OF SPECIES AT RISK ACROSS CANADA IN EACH PROVINCE OR TERRITORY (BIRDS, MAMMALS, REPTILES, AMPHIBIANS, FRESHWATER FISH, ORCHIDS AND FERNS)⁵



The Canadian Endangered Species Conservation Council uses an international ranking system for conservation risk. The categories used are: "at risk" for species that have been formally assessed by the Committee on the Status of Endangered Species in Canada/ or by an equivalent provincial or territorial body; and, "may be at risk" for endangered or threatened species that lack a formal assessment. Most species listed on British Columbia's Red list are in one or the other of these two categories. Blue list (Special Concern) species are not included.

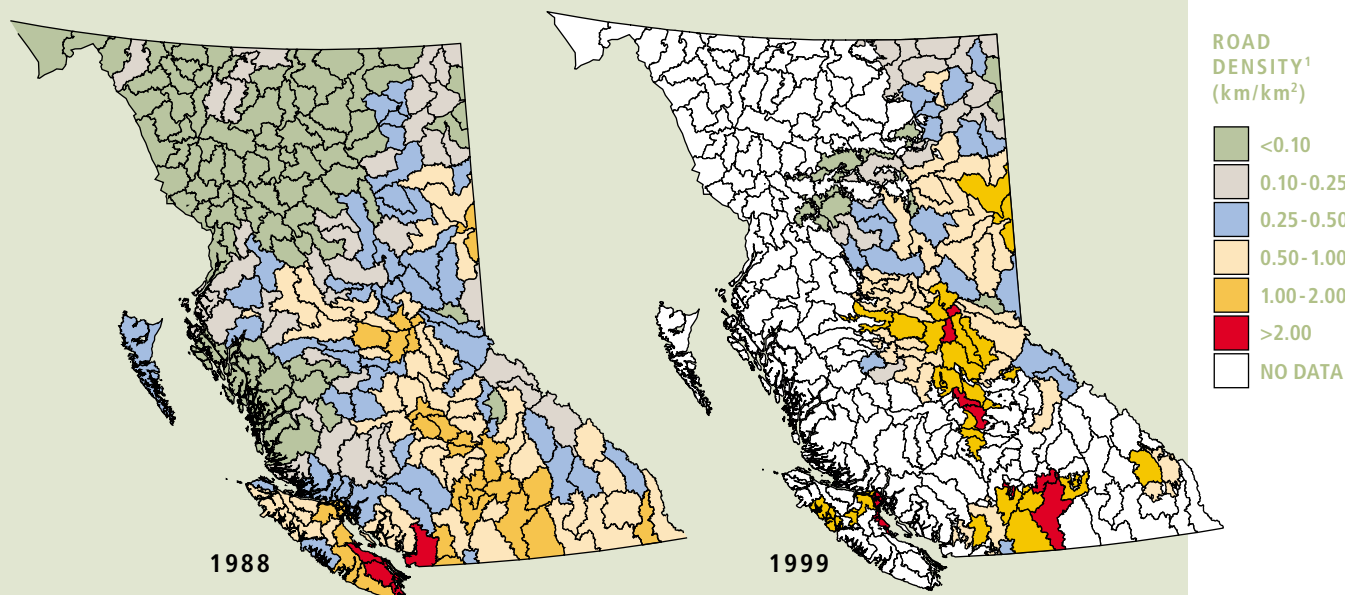
HOW DOES BRITISH COLUMBIA COMPARE?

- > British Columbia ranks third among provinces and territories for the number of species ranked nationally as "at risk" or "may be at risk".
- > British Columbia has the highest number of species designated "at risk" of any other jurisdiction in Canada. This is in part because the province has made a concerted effort to assess the status of its species. British Columbia and Ontario are also home to more species than other provinces or territories in Canada.
- > About 72% (660) of all native species assessed in Canada are secure; 6% (52) are known to be at risk and another 6% (56) may be at risk but require a scientific assessment to confirm their status.
- > The status of species shown in this indicator was determined as a component of the National Accord for the Protection of Species at Risk. The provinces, territories and the federal government have agreed to report on the status of wild species in Canada every 5 years; the first report was released by the Canadian Endangered Species Conservation Council in 2001.

⁵ **SOURCE:** Canadian Endangered Species Conservation Council (CESCC), 2001. *Wild Species 2000: The General Status of Species in Canada*. Ottawa. **NOTES:** Eight groups of species were analysed for this report – 7 were used in the analysis above. Butterflies were excluded from the comparative analysis because 5 provinces and territories were unable to assess their butterflies. The Canadian total is not the sum of provincial totals because species can be at risk in a province but not nationally. Note that vascular plants other than orchids and ferns are not included.



Habitat in British Columbia



STATUS AND TRENDS IN ROAD DENSITY IN BRITISH COLUMBIA

- > As of 1988 there were 387,000 km of roads in British Columbia. Seventy-six percent of these are used to access forests for timber and recreation. The other 24% are main and secondary highways and other non-forest roads.
- > In 1999, part of the province was re-surveyed, making it possible to see trends in road density for 40% of the area covered by both map sets.
- > Total road length increased by 45% (to 277,000 km of roads) in the area of the province with updated 1999 data.
- > As of 1999, road density was greater than 1 km/km² in approximately 30% of watershed groups within the portion of British Columbia mapped to date.
- > In approximately 15% of the watershed groups mapped to 1999, road density was less than 0.1 km/km² (meaning roads cover about 2% of the total area). The remaining 55% of the area had a road density between 0.1 and 1.0 km/km².

WHY IS IT IMPORTANT?

- > Roads provide access for urban and industrial development and to previously inaccessible forest areas. Their presence can alter local hydrology, fragment habitat, increase road kill, increase legal and illegal fishing and hunting, and create disturbance from both traffic and off-road vehicles.
- > Some species will avoid roads, resulting in isolated wild populations and a disruption in seasonal movements and genetic interchange.
- > Examples of road densities above which wildlife species have been negatively affected include: Grizzly Bear 0.4km/km²; Black Bear 1.25 km/km²; Elk 0.62 km/km² and Bull Trout 0.1 to 1.31 km/km². These examples are not applicable to all areas of the province because the impact of roads also depends on the amount and type of traffic.

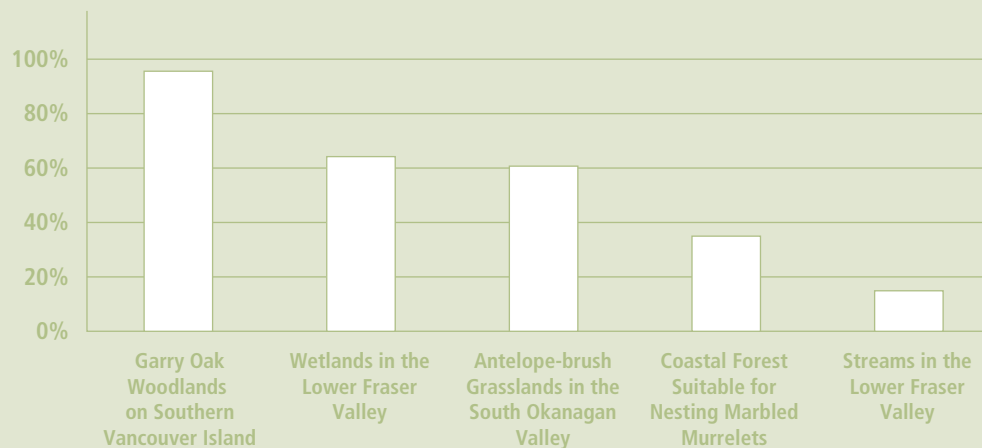
WHAT IS BEING DONE?

- > Regular road maintenance and access management, including road deactivation and access restriction, can mitigate some of the negative impacts of roads.

ROADS KILLS ARE AN IMPORTANT THREAT TO ENDANGERED SPECIES SUCH AS THE NIGHT SNAKE AND THE AMERICAN BADGER.

1] SOURCE: Decision Support Services, Ministry of Sustainable Resource Management, 2002. **NOTES:** 1988 map data are taken from 1981-1988 air photos (TRIM). For the 1999 map, updated air photos taken between 1996-1999 are only available for 40% of the province. Road types included in this analysis are all paved and non-paved roads. Seismic lines are not included. The delineations on the map represent the 246 watershed groupings, as described in the British Columbia Watershed Atlas. Wildlife thresholds from: Jalkotzy, M., P. Ross and M. Nasserden. 1998. The effect of linear development on wildlife: A review of selected scientific literature. Canadian Association of Petroleum Producers, Alberta.

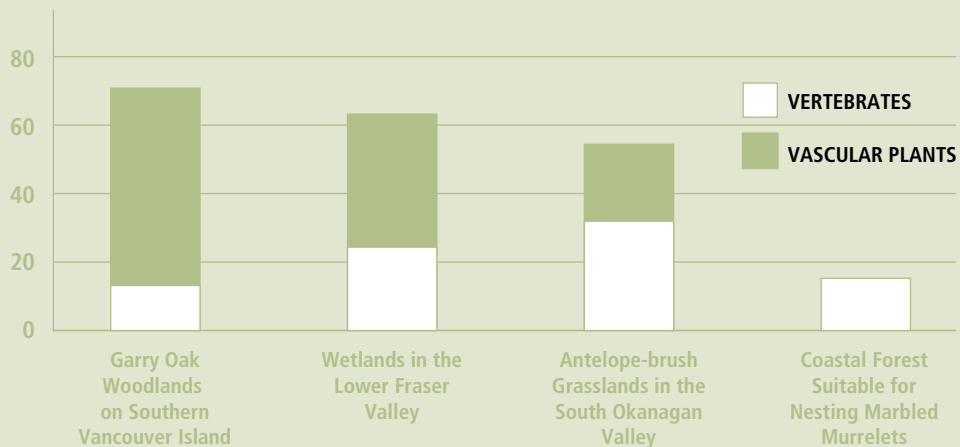
PERCENTAGE LOST OF SELECTED HABITAT TYPES²



STATUS OF SELECTED HABITATS IN BRITISH COLUMBIA

- > Maintaining viable areas of different habitat types is a key component of protecting biodiversity.
- > The southern Vancouver Island Garry Oak Woodlands and South Okanagan Antelope-brush grasslands are the most endangered ecosystems in British Columbia and are among the most endangered ecosystems in Canada.
- > About 7% (706 ha) of the historical area of South Okanagan Antelope-brush grasslands are currently protected in parks, wildlife areas and other federal, provincial and private conservation areas. A multi-agency recovery plan dedicated to conserving the last of the Garry Oak ecosystems has been developed.
- > Development in the Lower Fraser Valley has resulted in a reduction of wetland cover from 10% to less than 1.5%. Also, 15% of streams that once existed in the Lower Fraser Valley no longer exist.
- > Thirty-five percent of coastal old growth forests suitable for nesting Marbled Murrelets (mature trees with large branches) have been replaced with managed forests.

NUMBER OF ENDANGERED, THREATENED AND SPECIAL CONCERN VERTEBRATE ANIMALS AND VASCULAR PLANT SPECIES DEPENDENT UPON SELECTED HABITAT TYPES³



STATUS OF SPECIES IN SELECTED HABITATS

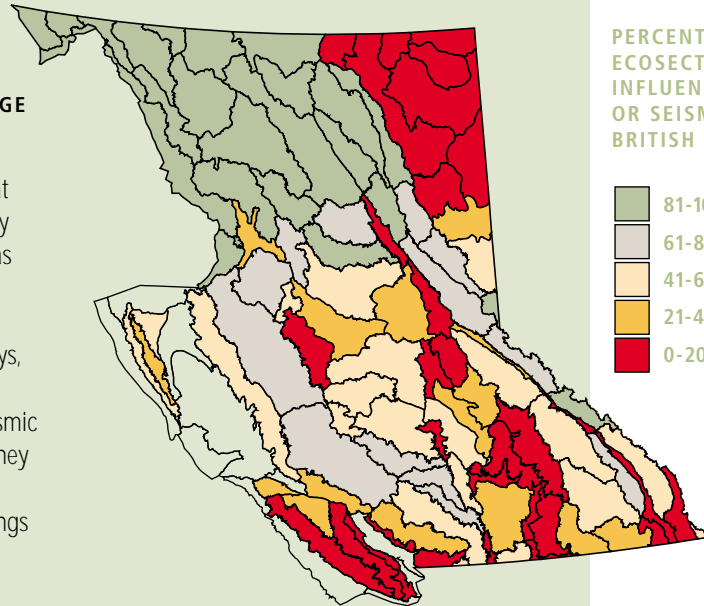
- > The loss or degradation of habitat can endanger the species that depend on it and ultimately reduce regional and provincial biodiversity.
- > Nine birds, three mammals and two reptiles that are associated with Garry Oak Woodlands are Threatened, Endangered or of Special Concern. These include Sharp-tailed Snake and Lewis' Woodpecker, the latter which is extirpated from Garry Oak Woodlands.
- > Twelve species of freshwater fish, 4 amphibians, 6 birds, 2 reptiles, 1 mammal and 39 vascular plants are dependent on wetlands in the Lower Fraser Valley and are currently Threatened, Endangered, or of Special Concern. These include the Oregon Spotted Frog, and the Pacific Water Shrew.

2] **SOURCES:** Garry Oak Woodlands – Ministry of Sustainable Resource Management, 2002; Antelope-brush Grasslands – Ministry of Water, Land, and Air Protection, 2002; Wetlands in LFV – Boyle et al., 1997; Streams in the Lower Fraser Valley – Fraser River Action Plan, Fisheries and Oceans Canada, 1998; Coastal forest suitable for nesting Marbled Murrelets – Demarchi and Button, 2000. **NOTES:** Dates used for analysis remaining/historical are: Garry Oaks 1800/1997; Wetlands in LFV 1827/1990; Antelope-brush grasslands 1860/2001; Streams in the LFV C. 1860/1997; Coast Forest analysis based on comparison of current habitat suitability and habitat capability.

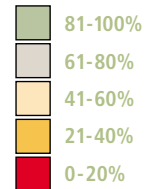
3] **SOURCES:** Garry Oak Woodlands – Garry Oak Ecosystems Recovery Team, 2002; Other habitat types – Ministry of Sustainable Resource Management and Conservation Data Centre, 2002. **NOTES:** A list of old-growth-dependent plant species has not been compiled for British Columbia. Complete species lists are available in the Habitat Indicator Technical Document.

WHAT AREAS OF THE PROVINCE PROVIDE LARGE AREAS OF NATURAL HABITAT?

- > This indicator identifies areas in the province that are remote, have not been significantly altered by human development, and that provide large areas of natural habitat condition and backcountry recreation opportunities.
- > Seismic lines are straight or meandering pathways, 1.5 to 7 m wide and at least 2 km long, that are used in oil and gas exploration. Unlike roads, seismic lines are not maintained as clearings, however, they may fragment the landscape, carving open areas through formerly unbroken habitats. Such clearings may disturb species that deliberately avoid open edges and may increase their vulnerability to predators. Although seismic lines do not provide the level of human access associated with roads, they may create temporary routes for all-terrain vehicles and snow machines in winter.
- > Forty-four ecosections in the province have greater than 60% of the area that is not influenced by roads or seismic lines. Of these, 30 have over 80% of the area road-free.
- > For an area to be considered roadless, it must be natural or in a natural appearing condition, be one km or more away from an existing road or seismic line, and be at least 1000 hectares.

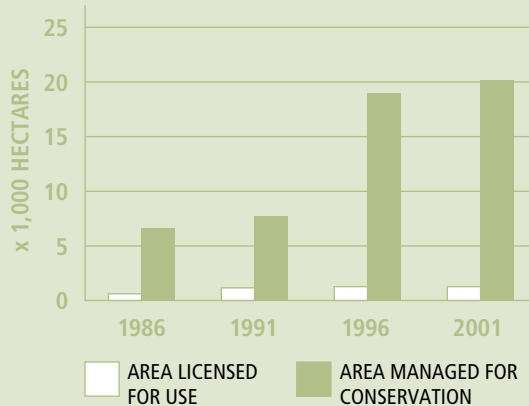


PERCENTAGE OF
ECOSECTION NOT
INFLUENCED BY ROADS
OR SEISMIC LINES IN
BRITISH COLUMBIA⁴

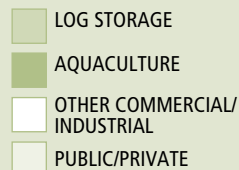
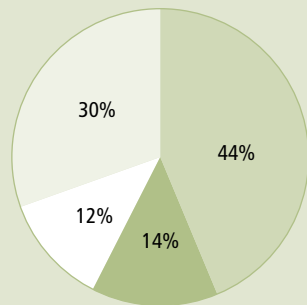


⁴ **SOURCE:** Ministry of Sustainable Resource Management, 2002. **NOTES:** Data are derived from the Recreation Opportunity Spectrum Inventory conducted on Crown lands administered by the Ministry of Forests. They were collected over a 10-year period from 1988 to 1998. Data are incomplete for some ecosections (e.g., missing for most federal and provincial parks). Therefore, the percentage roadless area is a conservative estimate.

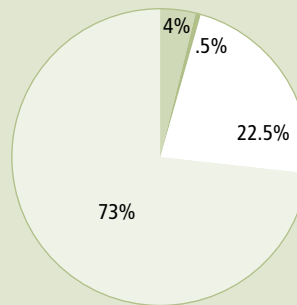
AREA UNDER
LICENSE FOR
USE OR
MANAGED FOR
CONSERVATION
IN 51 COASTAL
ESTUARIES⁵



USES OF
LICENSED AREAS
IN ESTUARIES - 2001



DESIGNATIONS
FOR ESTUARY CONSERVATION
MANAGEMENT - 2001

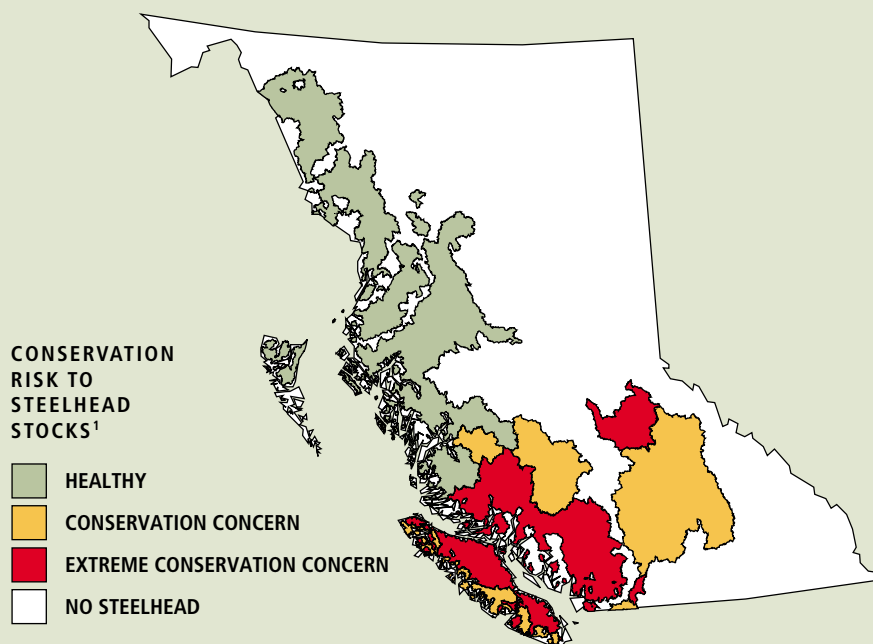


HOW ARE ESTUARIES USED AND MANAGED IN BRITISH COLUMBIA?

- > Estuaries are the unique interface of terrestrial, freshwater and marine habitats that are essential habitat for many species, including fish, marine birds, and terrestrial and marine mammals.
- > This analysis is based on only 51 (combined area of 29,000 hectares) of the hundreds of estuaries in British Columbia that have not yet been assessed.
- > Estuaries were selected based on known importance to wildlife species and degree of associated threats.
- > Between 1986 and 2001, commercial and public use of estuaries increased from 600 hectares affected (2.1% of total area) to 1375 hectares (4.7% of total area). The primary use of these estuaries in 2001 is log storage and handling (604 hectares).
- > During this time the area managed for conservation increased from 23% of total area (6,700 hectares) to 69% (20,300 hectares). Most of this increase (80%) is accounted for by conservation efforts on the Fraser River estuary, including Roberts and Sturgeon Banks, and Boundary Bay.
- > Areas managed for conservation include land designated under a number of provincial statutes, which provide differing degrees of protection.

5] **SOURCES:** Ministry of Sustainable Resource Management, 2002; Crown Land Registry, 2002; Ministry of Energy and Mines, 2002; Laracorp Land and Resources Analysis, 2002. **NOTES:** Bar graph is based on biased selection of 51 coastal estuaries, not likely representative of the changes in use/designation for the province as a whole. Data are accurate to the end of 2001. Aquaculture includes shellfish, finfish, and other fishery facilities. Other Commercial/ Industrial includes marinas, commercial wharfs, Commercial type A and type B, heavy industrial and light industrial uses. Public/Private includes residential, private moorage, public wharf, roadway, utilities, ferry terminals, and military bases. Analysis does not include adjacent lands, and was almost exclusively confined to areas under provincial jurisdiction.

Fish in British Columbia



STATUS OF STEELHEAD STOCKS

- > Steelhead Trout can be used as an indicator of environmental quality over broad areas of coastal British Columbia because they are widely distributed and sensitive to environmental degradation.
- > With respect to conservation risk, fish stocks are described as of 'conservation concern' (the stock is over fished) and of 'extreme conservation concern' (there is a probability the stocks could be extirpated).
- > Forty-eight percent of Steelhead stocks (defined as discrete, relatively isolated populations) in British Columbia are healthy while 23% are of conservation concern, and 29% are of extreme conservation concern.
- > Recent declines in southern stocks of Steelhead have been attributed to environmental change rather than over-fishing as many of these populations are not subject to significant harvest by sport or commercial fisheries.
- > Risks to Steelhead Trout include alteration and loss of habitat, altered flow and stream blockage as a result of water withdrawals or dams, and by-catch in commercial fisheries.

WHY IS IT IMPORTANT?

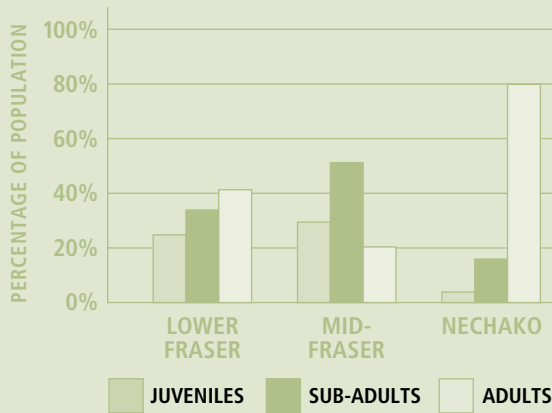
- > About 1/3 of fish species in British Columbia are on the provincial Red list (classified as Threatened or Endangered).
- > Salmon and trout are an integral part of British Columbia's culture, heritage and economy. Salmon have sustained aboriginal people for centuries and have supported commercial and recreational fisheries since the 1830s.
- > Sea-going species such as salmon and Steelhead Trout bring essential marine-derived nutrients to British Columbia's coastal forest and stream ecosystems, which benefits a wide range of species.

WHAT IS BEING DONE?

- > Recovery initiatives directed at species-at-risk and at entire watersheds are being developed and implemented through partnerships that include all levels of government, First Nations, stakeholders and industry.
- > The Living Rivers Strategy will provide a science-based program to set priorities and co-ordinate watershed management activities, including a 10-year restoration program.

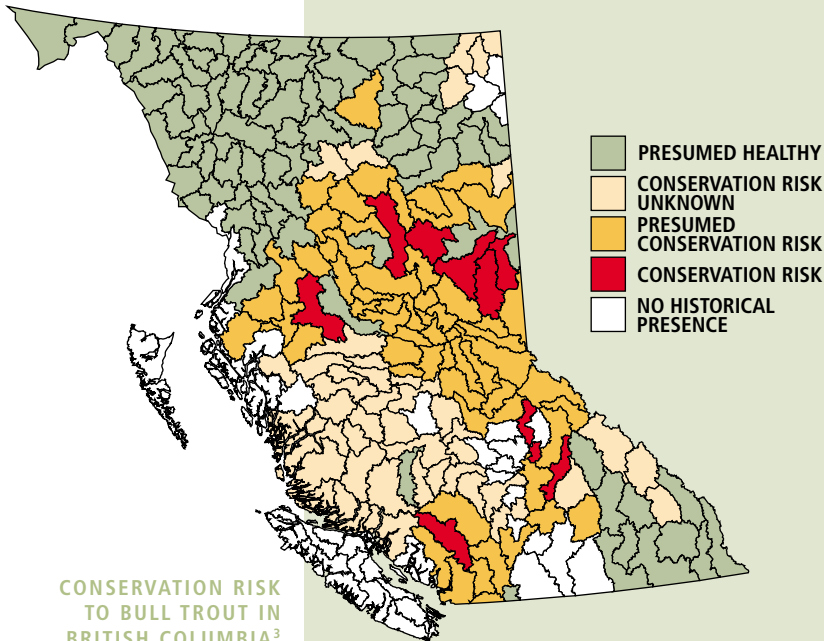
ABOUT HALF OF THE STEELHEAD STOCKS IN BC ARE HEALTHY AND HALF ARE CLASSED AS EITHER OF CONSERVATION CONCERN OR OF EXTREME CONSERVATION CONCERN.

1] SOURCES: Ministry of Water, Land and Air Protection, BC Fisheries, 2001. **NOTES:** Steelhead stocks are rated for conservation risk by using mathematical models extrapolated from well-studied populations. Few data are available for most populations.

AGE DISTRIBUTION
OF WHITE STURGEON²

WHAT IS THE STATUS OF WHITE STURGEON?

- > White Sturgeon are the largest freshwater fish in Canada. They spawn in only three river systems in the world – the Fraser, Columbia and Sacramento, all on the Pacific coast of North America.
- > The proportion of juveniles to sub-adults and adults in the population is a good

CONSERVATION RISK
TO BULL TROUT IN
BRITISH COLUMBIA³

DEFINITIONS FOR CLASSIFICATIONS ARE:

- presumed healthy** – viable for at least twenty years if no new threats are added to watershed and either real data showing populations are healthy or absence of significant threats and known occurrence in watershed;
- conservation risk unknown** – no presence/absence information; risk unknown – Bull Trout known to be present, but no information is available on population status or threats;
- presumed conservation risk** – current threats are believed to be significantly affecting the population and/or population is considered to be at risk;
- conservation risk** – population is known to be in decline (data available) and threats are identified;
- no historical presence** – Bull Trout are known to be historically absent from the watershed group.

indicator of long-term viability of White Sturgeon. Viable populations are dominated by young Sturgeon. The near absence of juvenile fish indicates repeated spawning failures and an aging population. Such a population may be at risk of extirpation.

- > All White Sturgeon populations in British Columbia are considered to be threatened; three populations (Nechako, Columbia and Kootenay) are at high risk of extirpation.
- > Modifying the natural flow regime with dams can reduce the suitability of rivers for spawning and rearing and is considered the most significant threat. Other significant risk factors include pollution and habitat alteration (through activities such as dredging or gravel mining).
- > Recovery planning is underway for Nechako River, and both the Columbia and Kootenay/Kootenai rivers in partnership with the USA.

WHAT IS THE STATUS OF BULL TROUT?

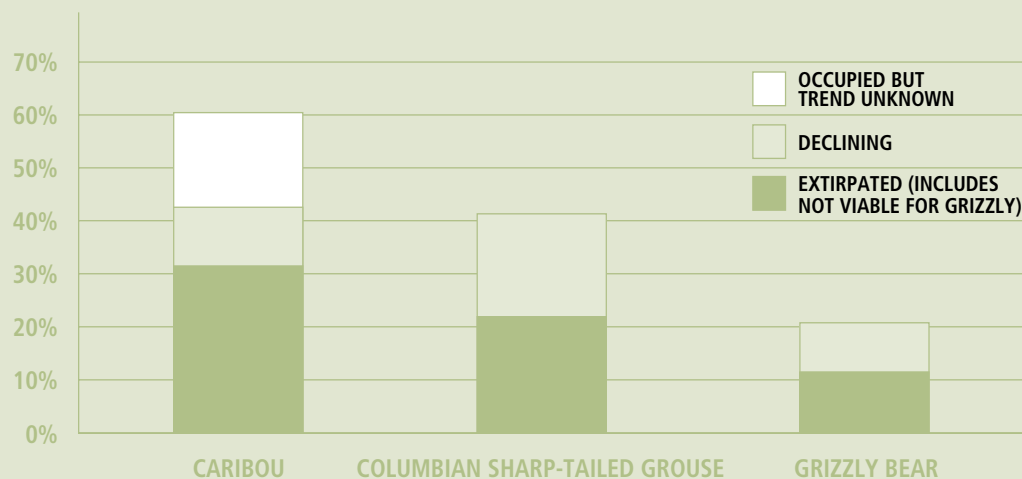
- > Bull Trout is used as an indicator because it is widely distributed in British Columbia and known to be sensitive to habitat changes, therefore its status may be representative of the health of the watershed.
- > Bull Trout are the only fish identified under the Forest Practices Code as "Identified Wildlife" requiring special management considerations. In British Columbia, Bull Trout are classified as Special Concern, and stringent fishing regulations are in place.
- > Few records have been collected on Bull Trout population trends. This indicator shows the opinion of regional experts on the conservation risk to Bull Trout populations in British Columbia.
- > Bull Trout populations in 34% of the watershed groups with known occurrences are considered to have a conservation risk.
- > Forty-two percent of watershed groups with known Bull Trout populations are presumed healthy and experts are uncertain of the status of Bull Trout in 22% of the watershed groups.
- > The main threat to Bull Trout is resource development (such as forestry and hydro-electric generation) that alters habitat at the watershed level. Road access also opens the area to over fishing and poaching.

2] NOTES: Lower Fraser River data collected between Mission and Hell's Gate, mid-Fraser River Data between Boston Bar and Red Rock Creek from May 1995 to October 1999. Nechako River data collected between its mouth and the Nautley River from June 1995 to September 1999.

3] SOURCE: BC Ministry of Water, Land and Air Protection 2002. NOTES: Conservation risk data are based on expert opinion, as few data were available. This map delineates 246 watershed groupings, as described in the British Columbia Watershed Atlas.

Wildlife in British Columbia

PERCENTAGE OF HISTORIC RANGE IN WHICH SELECTED SPECIES ARE EXTIRPATED OR DECLINING¹



STATUS OF WILDLIFE POPULATIONS

- > As a group, Caribou, Columbian Sharp-tailed Grouse, and Grizzly Bear represent species of wildlife managed for conservation, recreation and sustenance uses.
- > Caribou and Grizzly Bear have historically ranged over most of the province, in a variety of habitats. Columbian Sharp-tailed Grouse have traditionally occupied grasslands in the Southern half of British Columbia.
- > As of 2000, a large portion of caribou herds in British Columbia are in decline. Caribou are extirpated or declining throughout 42% of their historic range, and potentially 60% if areas of unknown trend are considered.
- > Sharp-tailed Grouse are extirpated or declining throughout 41% and Grizzly Bears are extirpated, not viable or threatened in 21% of their historic ranges.
- > Mountain Caribou, which occur in southern British Columbia, are candidates for legal status as Threatened in British Columbia. All other Caribou in the province are considered of Special Concern. A large portion of the province's Caribou also have national status as Threatened.
- > Columbia Sharp-tailed Grouse are considered of Special Concern in British Columbia.
- > Grizzly Bear are considered of Special Concern both provincially and nationally.

WHY IS IT IMPORTANT?

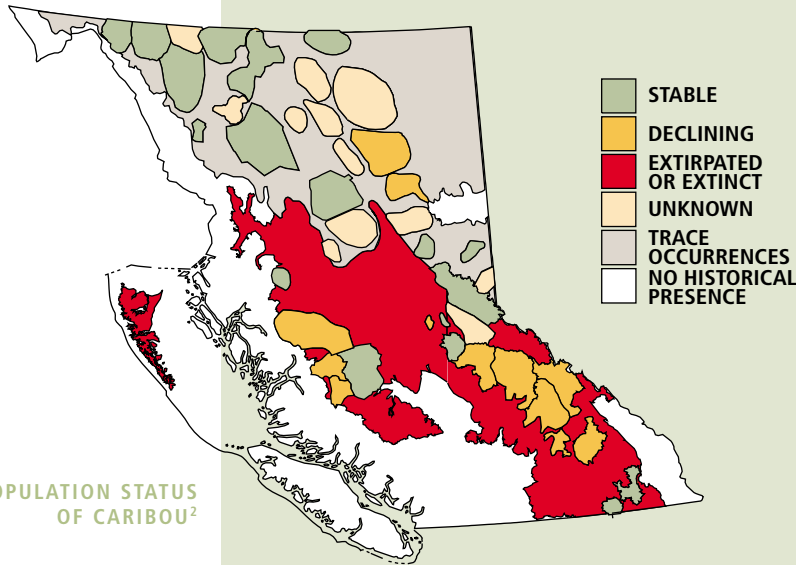
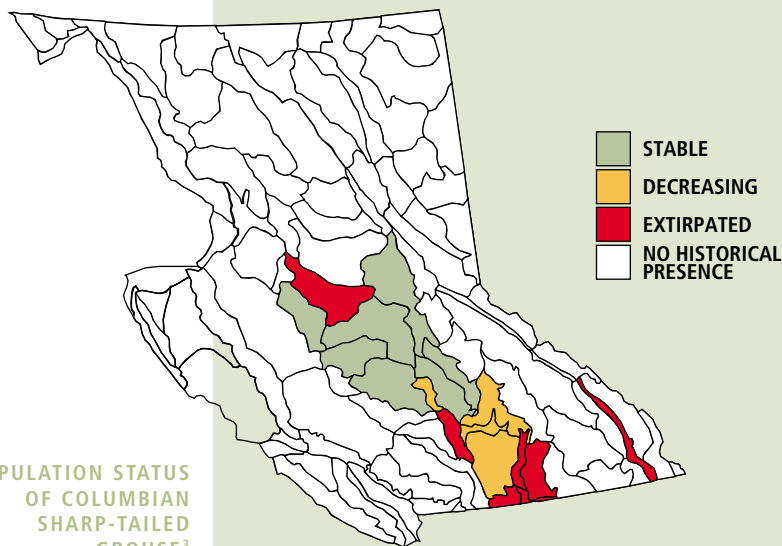
- > British Columbia's managed wildlife provides economic and natural diversity benefits.
- > Many of British Columbia's managed wildlife populations are of national and international significance.
- > Maintaining species across their ranges is fundamental to preserving biodiversity.
- > First Nations have a right to harvest wildlife for sustenance and cultural uses.

WHAT IS BEING DONE?

- > Land Use Planning initiatives and the Protected Areas Strategy will help protect and conserve some wildlife habitat.
- > Recovery strategies are being developed for Grizzly Bear, Mountain Caribou and Northern Caribou within the southern part of the province. Conservation planning is also underway for the Southern Interior ecosystem (home to some Columbian Sharp-tailed Grouse populations).
- > Forty species and ecosystems, including winter range for hoofed mammals, are presently designated as "Identified Wildlife" under the Forest Practices Code and are subject to special management considerations.
- > Harvest levels and area closures for wildlife are assessed annually to ensure conservation priorities are met.

A NUMBER OF MANAGED WILDLIFE SPECIES, SUCH AS CARIBOU, COLUMBIAN SHARP-TAILED GROUSE AND GRIZZLY BEAR, NO LONGER OCCUPY SIGNIFICANT PORTIONS OF THEIR HISTORIC RANGES.

1] SOURCE: Ministry of Water, Land and Air Protection, 2002. The range of Sharp-tailed Grouse was calculated using ecoregions; Caribou and Grizzly Bear ranges were calculated based on the distributions of sub-populations. **NOTES:** For Caribou, demographic trends are unknown for several subpopulations that occupy >110,000 sq. km of range. Historic range includes range where Caribou occur sporadically. For Grizzly Bear, graph represents the percentage of historic range in which sub-populations are extirpated, not viable or threatened. Extirpated includes areas that are not viable. Threatened includes both Poor and Fair population viability classes. Columbian Sharp-tailed Grouse are a subspecies of Sharp-tailed Grouse.

POPULATION STATUS
OF CARIBOU²POPULATION STATUS
OF COLUMBIAN
SHARP-TAILED
GROUSE³**HAS THE RANGE OF CARIBOU CHANGED?**

- > British Columbia is home to an estimated 18,400 Caribou. The 42 sub-populations of Caribou vary in size from the Spatsizi herd, with 2,200 Caribou, to the George Mountain herd, which has declined to approximately 5 Caribou.
- > The provincial status of Mountain Caribou, which occur in the province's southeast, declined from Special Concern to Threatened in 2000. The same year, Boreal Caribou in the northeast and Caribou in the southern two-thirds of British Columbia were both designated as Threatened by the Committee on the Status of Endangered Wildlife in Canada.
- > Today Caribou populations are stable in 16%, declining in 11% and extirpated in 31% of their historic range. Demographic trends are unknown over 17% of historical range.
- > Records from 2002 show an accelerating decline for Mountain Caribou, and 4 southern herds previously considered stable are now in decline.
- > The main threat to Caribou in British Columbia is fragmentation of habitat through logging, disturbance and natural fires in the north. Predation, which may be augmented by fragmentation, also poses a threat.

HAS THE RANGE OF COLUMBIAN SHARP-TAILED GROUSE CHANGED?

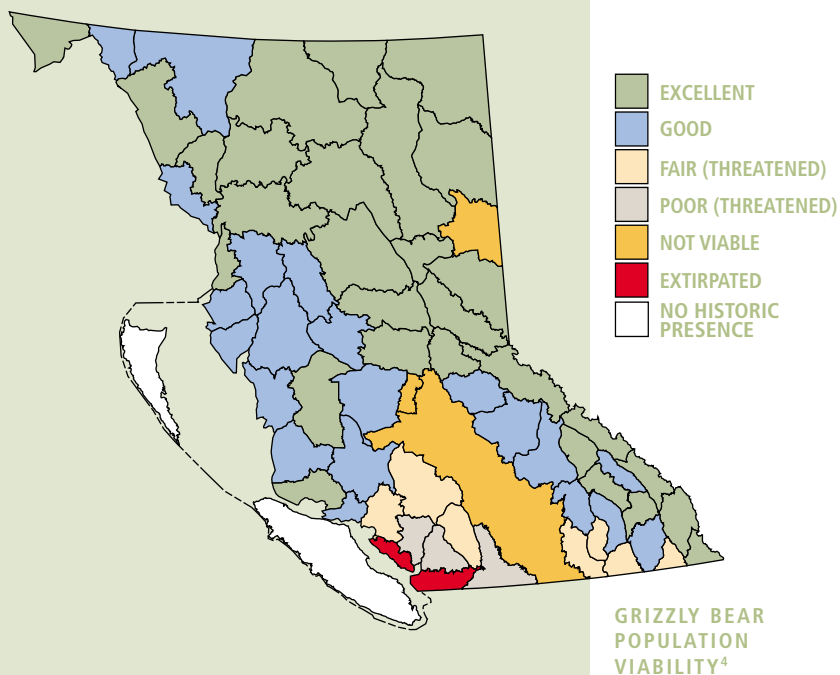
- > Columbian Sharp-tailed Grouse retained their provincial status as a species of Special Concern in 2002. These birds have disappeared over much of their range in northwestern North America, and this pattern is continuing in southern British Columbia. The grasslands and clearcuts/sedge meadows of south-central British Columbia appear to be the last remaining habitats occupied by this very sensitive species.
- > The distribution of this subspecies in British Columbia has contracted markedly over the past 100 years, and as much as 70% of the population may have been lost.
- > Based on an evaluation of provincial ecoregions, Columbian Sharp-tailed Grouse are stable in 59%, declining in 19% and extirpated in 22% of their historical range in British Columbia.
- > Urban and agricultural development, and forest encroachment from fire suppression are major threats to Columbian Sharp-tailed Grouse and their habitat.

2] SOURCE: BC Ministry of Water, Land and Air Protection 2001. NOTES: The range for Caribou was calculated using the estimated historical and current range. The delineations on the map are sub-populations.

3] SOURCE: BC Ministry of Water, Land and Air Protection 2001. The delineations represent ecoregions, as described in Ecoregions of British Columbia, D. Demarchi, 1993.

HAS THE RANGE OF GRIZZLY BEAR CHANGED?

- > Current estimates suggest that British Columbia is home to a minimum 13,800 Grizzly Bears — half of Canada's and one-quarter of North America's current Grizzly Bear population. New inventory techniques are helping to improve our knowledge of Grizzly Bear numbers in British Columbia.
- > Grizzly Bears retained their provincial status of Special Concern in 2002, by both the province and by the Committee on the Status of Endangered Wildlife in Canada.
- > Historically, Grizzly Bears have ranged over most of the province. Today, their population is extirpated (locally extinct) or not viable in 12%, threatened in 9%, and excellent or good in 80% of their historical range.
- > A scientific panel established by the Government of British Columbia is reviewing harvest management procedures, including methods currently used to estimate Grizzly Bear populations. The review will be completed in December 2002.
- > A pilot project to recover threatened Grizzly Bear populations in the North Cascades is underway. Recovery efforts are planned for 11 of the 60 Grizzly Bear sub-populations in British Columbia.
- > Grizzly Bears move over hundreds of square kilometers. Their sensitivity to disturbance makes them particularly vulnerable to human settlement, transportation, recreation and resource development.



4] **SOURCE:** BC Ministry of Water, Land and Air Protection 2001. **NOTES:** The delineations on this map represent Grizzly Bear sub-populations. Sub-population estimates are expressed as a percentage of the capability of the habitat to support Grizzly Bears. For example, excellent population viability means that the habitat is supporting more than 75% of the Grizzly Bears that it has the capability to support. The population viability for each category is: excellent >75%; good 50–75%; fair 25–50%; poor <25%. Zones designated "not viable" show where there are no resident adult female Grizzly Bears. The Ministry of Water, Land and Air is not actively managing grizzly bear habitat or promoting population recovery inside this zone. Grizzly Bears may be occasionally sighted inside this zone, but these animals are usually lone male transients or problem bears, likely to come into conflict with humans.

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