



Georgia Basin-Puget Sound Ecosystem Indicators Report

Spring 2002



WORKING TOGETHER
FOR THE
GEORGIA BASIN

AU TRAVAIL
POUR LE
BASSIN DE GEORGIA



Government
of Canada Gouvernement
du Canada



BRITISH
COLUMBIA

*PUGET SOUND
WATER QUALITY
ACTION TEAM*



Georgia Basin-Puget Sound

This report concerns the binational area known as the Puget Sound region in the United States and the Georgia Basin in Canada, including the Strait of Juan de Fuca, as illustrated on the map shown below. In this report, the area will be referred to as Georgia Basin-Puget Sound.



National Library of Canada cataloguing in publication data
Transboundary Georgia Basin-Puget Sound Environmental Indicators Working Group
Georgia Basin-Puget Sound: ecosystem indicators report [computer file]
Mode of access: WWW site of Environment Canada, Georgia Basin Ecosystem Initiative.

“EC/GB-01-034”
Includes bibliographical references.
ISBN 0-662-31312-7
Cat. No. En40-649/2001E-IN

1. Ecosystem Indicators – Georgia Basin/Puget Sound
 2. Environmental indicators — Georgia Basin (British Columbia)
 3. Environmental indicators — Puget Sound (Washington State)
 4. Environmental conditions — Georgia Basin/Puget Sound Region
- I. Georgia Basin Ecosystem Initiative (Canada)
II. Canada. Environment Canada. Pacific and Yukon Region.
III. Title.

GE140.T72 2001 333.7'09711'3 C2001-980359-1

Georgia Basin Ecosystem Initiative Publication Number: EC/GB-01-034
Washington State Department of Ecology Publication Number: 02-01-002

A MESSAGE FROM THE SPONSORING AGENCIES

This document presents the first joint report by Canadian and United States agencies on a number of environmental stresses affecting the binational Georgia Basin - Puget Sound ecosystem.

The underlying message is the challenge that we regionally share of maintaining the long-term environmental, social, and economic sustainability of the region in the face of continued population growth and current, resource-intensive consumption levels. The high air quality that is basic to healthy lives and important aspects of economic well being, for example, will be affected by choices about transportation technologies and strategies, settlement patterns, energy use and individual consumption practices. Also, critical wildlife habitats, species, and related economic resources will be significantly influenced by development patterns and land-use decisions.

Our governments, on both sides of the border, are working more closely than ever before on these issues. Through the B.C. - Washington Environmental Cooperation Council and the Environment Canada - Environmental Protection Agency Statement of Cooperation on the Georgia Basin and Puget Sound Ecosystem, we are improving the transfer of knowledge and best practices, developing shared goals and strategies, and implementing joint action programs. Ecosystem-wide initiatives such as the Georgia Basin Ecosystem Initiative in British Columbia and the Puget Sound Water Quality Action Team in Washington State are supporting on-the-ground action to begin addressing these complex problems through partnerships and capacity building.

While a number of these activities have already begun to have real effect, the solutions are not only the purview of specialized agencies, or even all of our governments acting alone. The many citizens, communities, volunteer organizations, commercial enterprises, industries, First Nations and Tribes that live in or otherwise influence the region, must also take collaborative action.

If the stewardship of our natural resources is a shared goal among governments, other organizations and individuals, we must all be equipped to work in a collaborative and focused manner. Providing scientifically sound, shared and commonly understood information, such as the indicators found in this report, is an essential step in the process.

Our thanks go out to the many scientific and technical staff from our agencies, as well as other organizations, that have contributed to the development of this report.



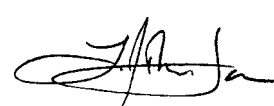
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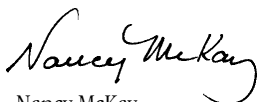
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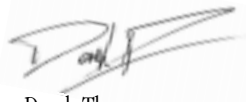
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ACKNOWLEDGEMENTS

This transboundary indicator report was prepared with the generous assistance of many individuals and organizations that play important roles in monitoring ecosystem indicators in British Columbia and Washington State. Warm thanks and recognition are extended to the following people who contributed data, text, analysis and critiques.

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TABLE OF CONTENTS

A Message from the Sponsoring Agencies	i
Acknowledgements	ii
Table of Contents	ii
Overview	1
Population	2
Air Quality from Inhalable Particulates	5
Solid Waste	8
Persistent Organic Pollutants (POPs) in Harbour Seals	10
Species At Risk	13
Terrestrial Protected Areas	16
What Can I Do?	19
Sources and References	41

OVERVIEW

This report examines selective aspects of the state of the environment in the binational transboundary region consisting of the Puget Sound region in the United States and the Georgia Basin in Canada, including the Strait of Juan de Fuca. The report discusses six indicators that describe some of the stressors and human responses that account for the present state of this shared ecosystem. It represents an initial attempt to provide a sense of the current state and trends in this ecosystem in an integrated way across the Canada-United States boundary. The objective is to provide citizens, governments and other decision makers with information that can help them make better decisions for the future of this richly endowed yet fragile region that Canadians and Americans share.

Environmental Indicators are representations of data that reflect the status of, or trends in, key aspects of the environment. They can help draw attention to the challenges our communities face, our progress in addressing them, and possible responses necessary for achieving sustainability. These responses will require choices that reduce the over-consumption of natural resources and the degradation of our environment, while providing for long-term environmental, social and economic well being.

In 1999, data specialists from the United States and Canada met to assess options for identifying key indicators for which data were available on both sides of the boundary. It became apparent that even the selected indicators were not all identical in their format or methodology across the boundary. There are often differences in the purpose, measurement and classification of data from different jurisdictions. The differing regulatory and administrative frameworks presented a further challenge to presenting an integrated basin-wide picture.

Following the 1999 meeting, a Canada-United States Working Group on Environmental Indicators was established, building on an existing Environment Canada - US Environmental Protection Agency Joint Statement of Cooperation and the work of the BC-Washington Environmental Cooperation Council (ECC). This Working Group has developed the six indicators in this report with assistance from other scientific and data management experts listed in the Acknowledgements section.

The first indicator provides data on basin population and its distribution across the region. The growing population of the Georgia Basin-Puget Sound region is a major underlying force contributing to the cumulative stresses on the land, air, water and other ecosystem resources. This growth presents significant environmental, economic and social challenges both locally and across the basin ecosystem. As a result, all levels of government, the private sector and individuals need to make decisions that are responsive to the observed and expected environmental trends.

The impacts of this growing population, its affluent lifestyles and use of resources are reflected in measures of Air Quality, Species at Risk, Solid Waste, and Contaminants in Harbour Seals, each of which offers a different perspective on environmental quality and stresses in the region. Other indicators, including the amount of the solid waste being recycled and the areas that have been designated for protection, reflect social responses to recognized stresses.

As these indicators, and others yet to be developed in a binational framework, are tracked over time, they should provide a sense of how we as individuals and a society are affecting our basin ecosystem and whether we are moving towards or away from a more sustainable future. Each indicator is presented in terms of what is happening, why it is happening, why it is important, how it compares with other regions or locations, and what is being done to address the issues of concern.

The final section of the report, "What Can I Do?" provides some practical ways in which we can collectively take ownership of some of these challenges and move towards a more positive environmental legacy for future generations. We hope that you will be inspired to take action by these suggestions and information links.

More detailed information for each indicator is available as technical background documents, by calling **Georgia Basin Ecosystem Initiative Coordination Office (604) 664-9100** or **Washington State Department of Ecology (360) 407-7000**. Information on other indicators being measured and reported in Georgia Basin-Puget Sound is available through the contact information provided inside the back cover of this report.



POPULATION

The Indicator

The population indicator describes human population trends, rates of change and regional distribution in the Georgia Basin-Puget Sound area.

The growing population in this binational area, currently at seven million and therefore one of the large metropolitan centres of North America, is a major factor in generating environmental stress.

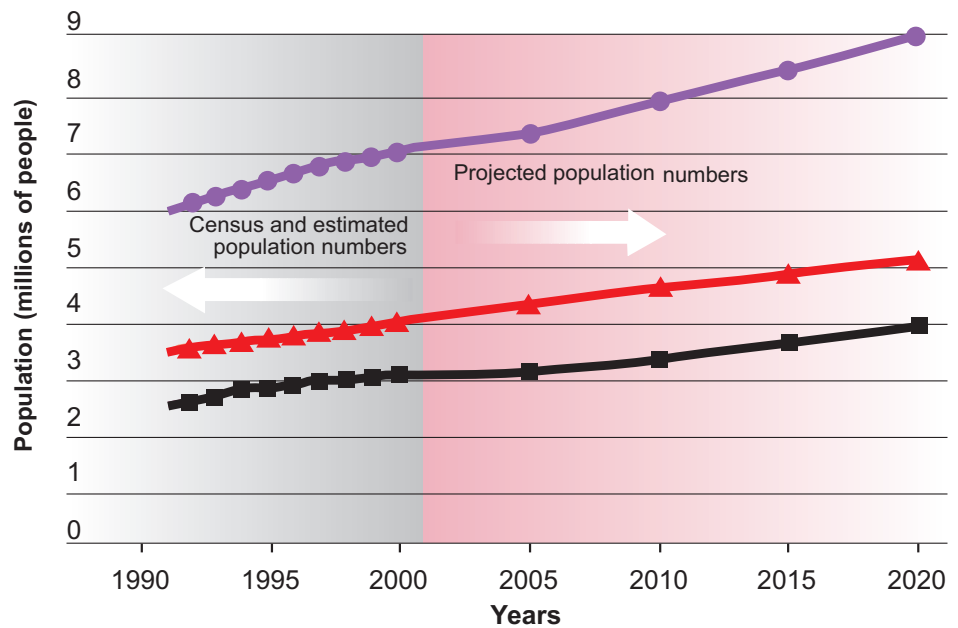
What Is Happening?

In 2000, nearly seven million people were living in the Georgia Basin-Puget Sound area. Just fewer than four million (57 per cent) of these people lived in the United States and about three million (43 per cent) in Canada.

Population in the Georgia Basin-Puget Sound region increased steadily and markedly between 1991 and 2000, growing by 576,000 (17 per cent) in the Puget Sound region and almost 520,000 (21 per cent) in the Georgia Basin. By 2020 the population is projected to exceed five million people (a further 29 per cent growth) in the Puget Sound region and four million people (35 per cent growth) in the Georgia Basin. This growth would bring the total Georgia Basin-Puget Sound population to more than nine million, almost a third higher than 2000 and more than one and one half times that of 1991.

In 2000, the major population areas immediately around Vancouver (Greater Vancouver Regional District)

TOTAL POPULATION IN GEORGIA BASIN-PUGET SOUND



- Total Georgia Basin & Puget Sound
- ▲ Puget Sound
- Georgia Basin

Note: Since this report was prepared, Canada 2001 Census data have been released indicating that population growth rates have been lower than predicted throughout the BC portion of the region, although adjustments for undercounting may yet occur. Thus, the total population, its distribution and recent growth rates for the Georgia Basin may need to be adjusted, though the basic conclusions and projections remain unaltered. A comment by BC Statistics on the relationship between its estimates, used in this report, and the new Census can be found at <http://www.bcstats.gov.bc.ca/DATA/CEN01/estnote.htm>.

and Seattle (King County) had 29 per cent and 25 per cent of the overall basin population, respectively, so that over half the Georgia Basin-Puget Sound population was living in those areas. Even higher concentrations can be noted (especially in the Seattle area) when taken in conjunction with neighbouring jurisdictions. By 2020, these two core urban areas are together expected to have about a million additional people within their boundaries.

Elsewhere in the basin, locations such as Squamish and the Sunshine Coast in British Columbia, and Jefferson and Kitsap Counties in Washington State, have high projected growth rates while some others are projected to have relatively small increases. These relative growth patterns can help identify where the various associated environ-

mental, social and economic issues will arise and will need to be addressed.

Why Is It Happening?

People are attracted to the Georgia Basin-Puget Sound region for its spectacular natural amenities and quality of life, as well as its economic opportunities. A major contributor of population growth is migration from outside the region. In the British Columbia portion, the net in-migration rate during the mid 1990's was about three-quarters of the total population growth rate. In Puget Sound Counties, almost two thirds of the growth over the 1990's was due to net in-migration.

The sub-regional differences in growth rates shown in the second map

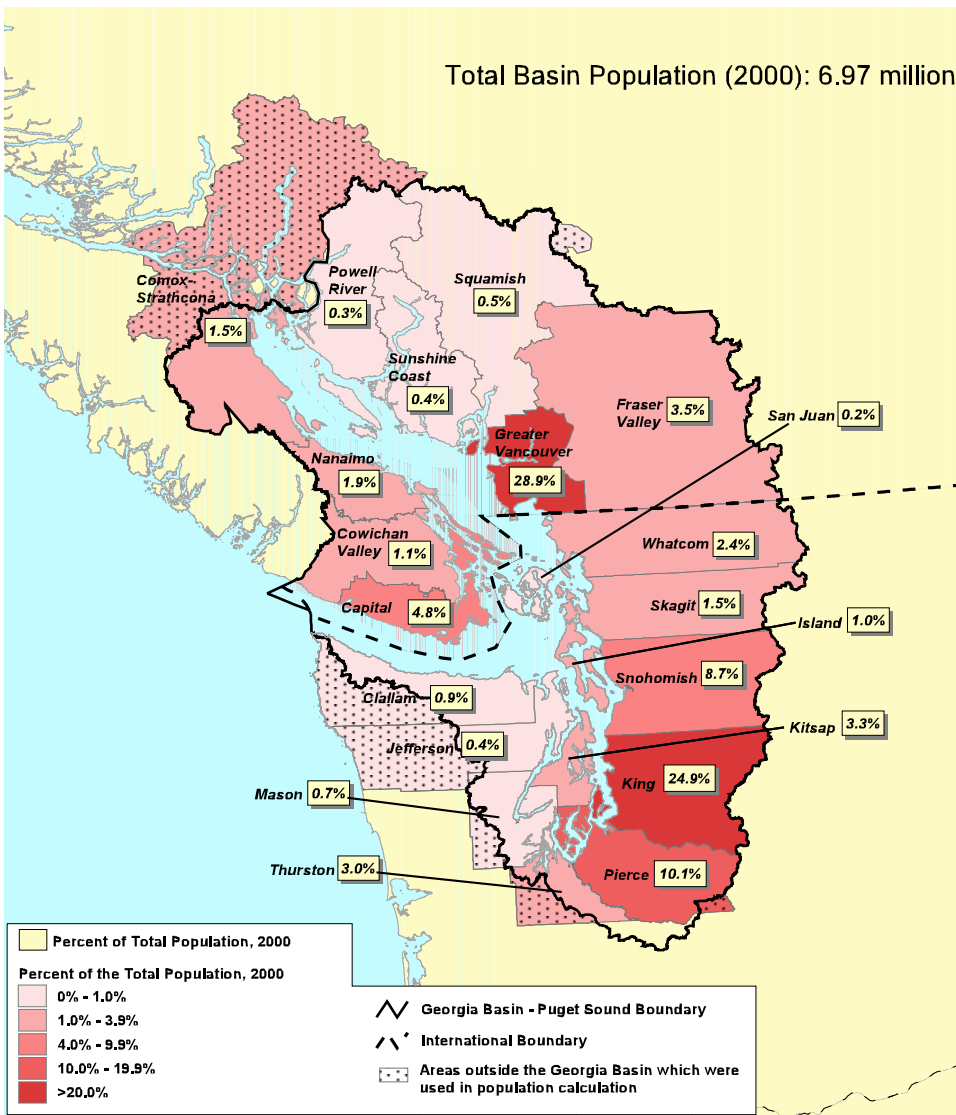
suggest that the population distribution is shifting somewhat from the large urban areas to outlying areas. This may be due to considerations such as perceived quality of life differences, economic and demographic changes, housing affordability and transportation issues. In Jefferson County, for example, the high growth rate can be attributed, in part, to an expanding retirement population, proximity to significant natural areas and less than average rainfall.

Why Is It Important?

Population growth affects all aspects of sustainability (environmental, social and economic) at various scales (locally, regionally and globally). Additional people generally require more jobs, goods and services, land for housing,



PERCENTAGE OF GEORGIA BASIN-PUGET SOUND POPULATION BY REGIONAL DISTRICT AND COUNTY, 2000



Percent of total population (2000) is shown by Regional Districts in Canada and Counties in the United States with both colour gradations and boxed numerical values.
 Note: Comox-Strathcona consists of the sub area of that Regional District within the Georgia Basin, while Squamish is similarly a sub area of the Squamish-Lillooet Regional District. Data are for the Local Area Health Areas with populations primarily within those areas.

businesses and transportation facilities, recreational space and associated environmental resources. Unless these activities are significantly modified to reduce their current impacts, they will continue to increase the stresses on the land, biota and other natural resources, as well as the human systems that

support modern life. Understanding the population trends across the region, along with the status of other environmental indicators in these areas, can help us develop strategies to better manage available resources, and address the economic, environmental and social

sustainability issues associated with them.

How Does It Compare?

Between 1991 and 2000, the population growth rate in Puget Sound was slightly less than the state-wide growth in Washington (16.9 per cent

compared to 17.9 per cent respectively). The Georgia Basin population had a marginally higher growth rate (21 per cent) than British Columbia's 20.5 per cent overall increase. The combined Georgia Basin-Puget Sound growth (18.65 per cent) was markedly greater than the national population increases of 11.6 per cent in the US and 9.7 per cent in Canada during this period.

What Is Being Done?

The continuing rapid growth in population and its demands on the ecosystem have resulted in a need for programs that can help decision-makers understand and address the environmental, social and economic implications of that growth.

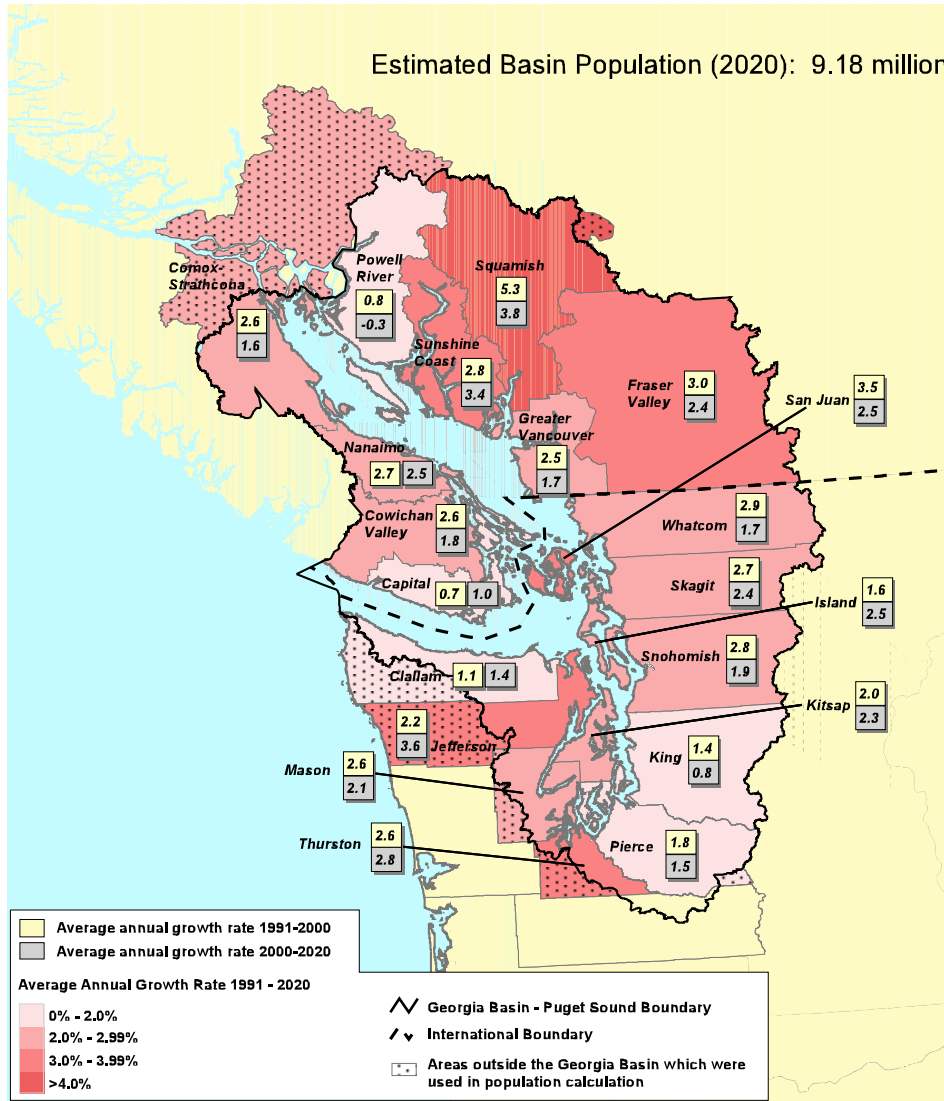
In Washington State, a number of strategies are helping to bound growth and minimize the impacts of sprawl while maintaining open space. These include the Growth Management Act, comprehensive county planning measures that involve defining urban growth areas and designating appropriate land uses outside of those areas, and critical area ordinances, which protect sensitive areas such as wetlands, slopes and aquifers. Collectively these laws help to minimize or even prevent unfettered suburban sprawl and the loss of contiguous natural areas.

Although different in some respects, British Columbia's regional growth strategy legislation is similar in scope, intent and effect to Washington's growth management legislation. In BC, regional districts and member municipalities prepare regional growth strategies to guide regional growth management and servicing programs



POPULATION *continued*

AVERAGE ANNUAL POPULATION GROWTH RATES BY REGIONAL DISTRICT AND COUNTY, 1991-2000 (WITH NUMERICAL RATES FOR 1991-2000 AND 2000-2020)



Average annual growth rates are shown by Regional Districts in Canada and Counties in the United States. The colour gradations represent the average annual growth rates 1991-2020 while the boxed numerical values represent the average annual growth rates up to 2000 and the projected average annual growth rates for 2000-2020, in that order.

Note: Comox-Strathcona consists of the sub area of that Regional District within the Georgia Basin, while Squamish is similarly a sub area of the Squamish-Lillooet Regional District. Data are for the Local Area Health Areas with populations primarily within those areas.

with reference to a comprehensive set of 14 goals. These goals address the future social, economic and environmental well being of present and future residents, as well as the region's natural systems. Official community plans, which must demonstrate how they mesh

with regional growth strategies, guide the development of communities.

In addition, the legislation provides for intergovernmental cooperation agreements. These agreements allow government organizations to use their various powers and programs to support

the mutually beneficial and cost-effective implementation of regional growth strategies. Of the nine regional districts in the Georgia Basin, two have adopted and two have prepared but have not yet adopted regional growth strategies. These four regional districts contain over 90 percent

of the current and forecast population of the Canadian portion of the Basin.

Inter-jurisdictional mechanisms such as the Georgia Basin Ecosystem Initiative in Canada complement and strengthen these programs by addressing common concerns about the protection of air, land and habitat resources and sustainable communities in the face of continued growth. The Fraser Basin Council is an innovative governance mechanism that facilitates governmental and non-governmental involvement in addressing sustainability issues in the major Canadian water basin draining into the Strait of Georgia. There are also agreements between Environment Canada and the US Environmental Protection Agency and under the British Columbia-Washington Environmental Cooperation Council to address these issues cooperatively across the international boundary.

While these governmental mechanisms will continue to be needed, concerted action by all basin organizations and citizens will also become increasingly important in addressing local and transboundary growth issues that affect the long-term sustainability of the Georgia Basin-Puget Sound ecosystem.



AIR QUALITY FROM INHALABLE PARTICULATES



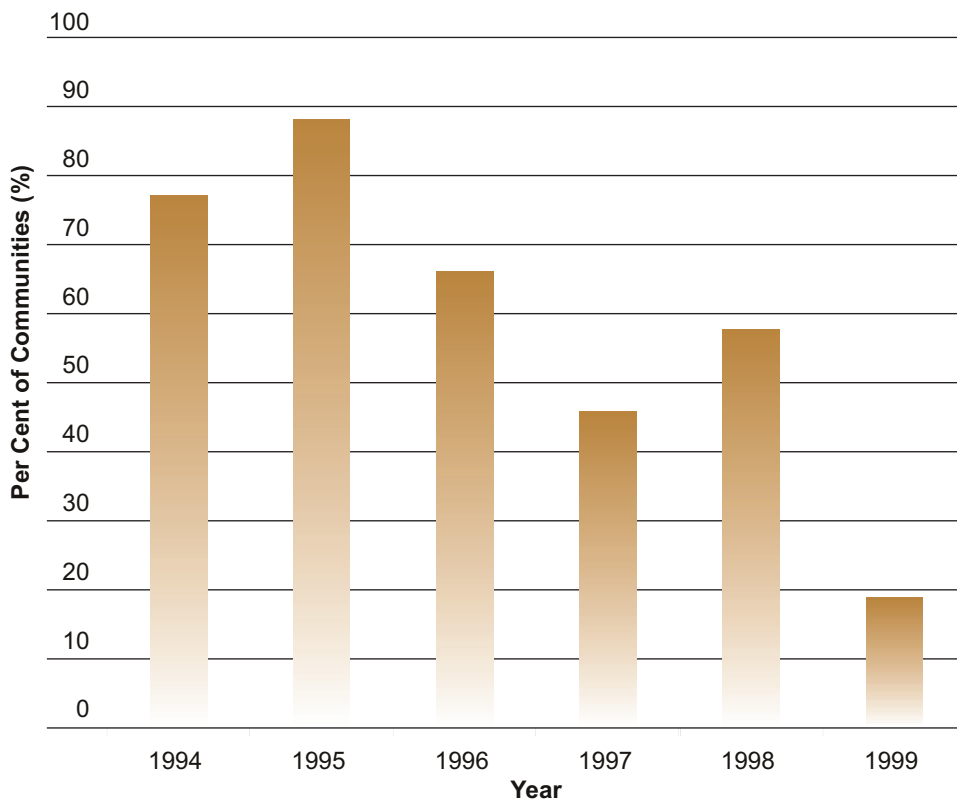
The Indicator

The air quality indicator examines trends in air quality related to concentrations of inhalable particulates in air, measured as PM₁₀ at various times and locations in the Georgia Basin - Puget Sound area.

PM₁₀ refers to airborne particulate matter 10 micrometres (µm) or less in diameter (about one eighth the width of a human hair). Particles of this size are only one aspect of general air quality, but they are known to pose a risk to human health. Air sampling stations are situated throughout the Georgia Basin-Puget Sound area to monitor PM₁₀ concentrations in air at regular intervals.

Particles 2.5 micrometres or less in diameter (PM_{2.5}, a subset of PM₁₀) pose the greatest health risks and throughout Georgia Basin-Puget Sound, monitoring is shifting to measure these finer particles. As more PM_{2.5} data become available, the PM₁₀ indicator may be modified or replaced in the future by an indicator showing trends in PM_{2.5} concentration.

PER CENT OF GEORGIA BASIN COMMUNITIES EXPOSED TO PM₁₀ CONCENTRATIONS GREATER THAN 25µg/m³ (MORE THAN 5% OF THE TIME)



What Is Happening?

The levels of PM₁₀ in the Georgia Basin-Puget Sound ecosystem have gradually decreased since the early 1990s. Although monitoring techniques and methods of data analysis differ somewhat between Washington State and British Columbia, the downward trend is apparent in both jurisdictions.

In the Georgia Basin, PM₁₀ levels have decreased among monitored communities since 1994. The British Columbia PM₁₀ indicator measures the percentage of monitored communities where PM₁₀ levels exceed 25 µg/m³ more than 5 per cent of the time annually, or 18 days per year. This threshold was used because scientific investigation has shown that PM₁₀ concentrations greater than 25 µg/m³ are associated with an increase in health effects. Effects at lower concentrations may also be occurring, but there is insufficient scientific evidence to draw conclusions.

In 1999, only three of 16 communities monitored in the Georgia Basin (19 per cent of the sampled communities)

exceeded PM₁₀ levels considered to be of concern (concentrations of 25 µg/m³ more than five per cent of the time annually). This is a marked improvement from seven of nine monitored communities that reached levels of concern (78 per cent of sampled communities) in 1994.

At least part of this significant improvement is attributable to weather conditions: rain removes particles from the air, while wind increases particle dispersal. During 1999, stronger winds and higher rainfall than average may have contributed to low airborne concentrations of PM₁₀.

In Puget Sound, PM₁₀ levels have also decreased since the early 1990s with fewer





AIR QUALITY FROM INHALABLE PARTICULATES

sample days exceeding 25 µg/m³ in 1999 than in previous years. The Washington State PM₁₀ indicator for the Puget Sound region measures the number of days PM₁₀ concentrations at sample stations in monitored communities fall into ranges of 0-24 µg/m³, 25-49 µg/m³, 50-74 µg/m³ and 75 µg/m³ and over.

In Puget Sound, levels of PM₁₀ have declined over the past six years and have not exceeded the US federal standard of 150 µg/m³. In 1999, 96 per cent of PM₁₀ readings were less than 50 µg/m³, reflecting an improvement compared to 1994 when 92 per cent of readings were less than 50 µg/m³. Further, of the readings in 1999 that were below 50 µg/m³, 72 per cent were less than 25 µg/m³ compared to 63 per cent in 1994.

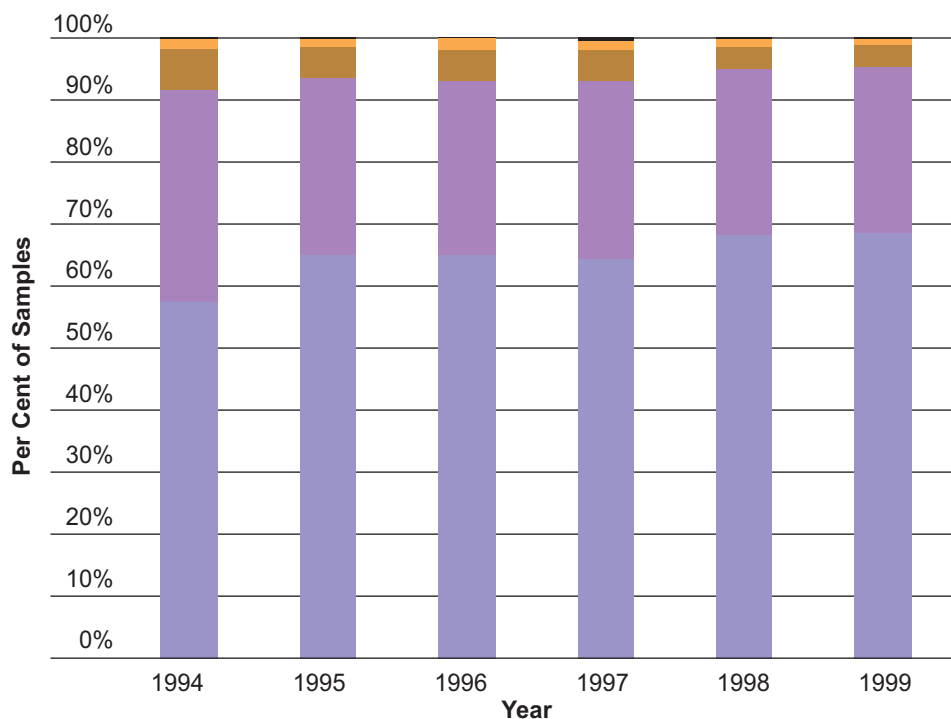
Why Is It Happening?

Multiple initiatives that have resulted in improvements to air quality are underway in the Georgia Basin-Puget Sound area. However, weather, climate and topography are additional factors that can contribute to significant seasonal and geographic fluctuations in levels of PM₁₀.

The primary sources of PM₁₀ in the Georgia Basin-Puget Sound region are mobile emissions (e.g., cars, large diesel fleets, marine vessels), permitted industrial emissions (e.g., oil refineries, bulk shipping terminals, and saw mills) and area sources (e.g., agriculture, construction, road dust, wood stoves and outdoor burning).

Particles are emitted directly from sources (known as primary particles) but can also form secondarily in the air through the chemical transfor-

PM₁₀ LEVELS IN PUGET SOUND, 1994-1999



mation of emitted gases such as sulphur dioxide, nitrogen oxides, various hydrocarbons and ammonia. Both primary and secondary particles and their precursor gases are a major air quality concern in the Georgia Basin-Puget Sound ecosystem. In 1999 in the Greater Vancouver Regional District, vehicles contributed 75 per cent of the estimated emissions of sulphur dioxide, nitrogen oxides, particulates, gaseous hydrocarbons, as well as a host of other air pollutants. In the Puget Sound region, 63 per cent of human-caused emissions are attributable to motor vehicles.

Why Is It Important?

Small airborne particles pose the greatest risks to human health. Inhalable particulates with diameters of 10 micrometres or less (PM₁₀) are

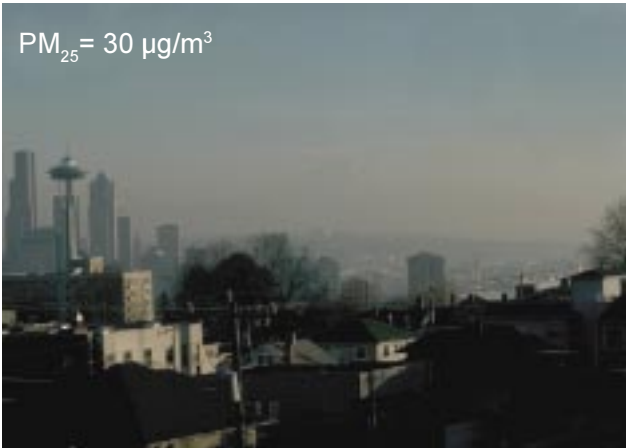
tiny enough to be inhaled deeply and penetrate the respiratory system. There they affect breathing, aggravate existing respiratory and cardiovascular disease, damage lung tissue and can contribute to premature death. Once these particles are lodged in the lower regions of the lung, they are difficult to remove through coughing or sneezing and are of particular concern for people with chronic heart and lung disease, as well as for children and the elderly.

Particulate matter is also a major component of haze and contributes to reduced visibility, which leads to negative impacts on transportation safety, aesthetics, business and tourism. The smaller particles that comprise PM_{2.5} contribute greatest to haze, as they are more efficient at scattering light than larger particles.

How Does It Compare?

Among monitored communities in British Columbia, those within the Georgia Basin are exposed less often to high concentrations of PM₁₀ than communities throughout the rest of the province. This finding highlights the fact that levels of airborne particulates are affected not only by settlement patterns, types of industries, and types of emissions, but also by topography, air circulation and weather.

PM₁₀ levels in Puget Sound tend to be comparable with other areas of Washington State, although the sources of particles vary. Average PM₁₀ values tend to



Mount Rainier from Seattle

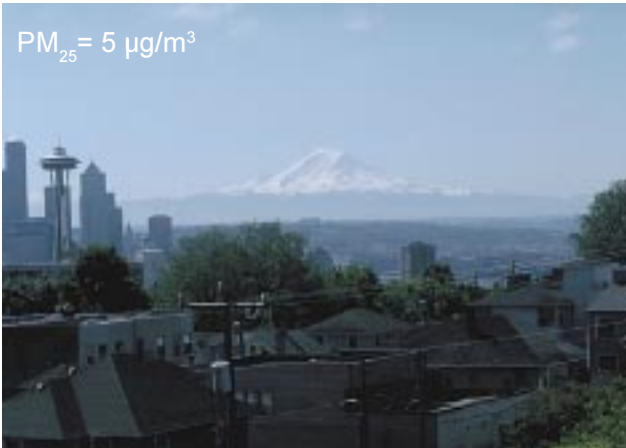
be higher in urban or industrialized areas. Communities east of the Cascade Mountains however, show periodic peaks of higher PM₁₀ concentrations resulting from large-scale agricultural burning or wind-blown dust (which are not significant sources in the Puget Sound).

What Is Being Done?

Air quality is a major concern to everyone, not just people who are sensitive to poor air quality. Emission control initiatives are being developed by all levels of government in the Georgia Basin and Puget Sound, as well

as programs sponsored by non-profit organizations that encourage individuals and businesses to make choices that will improve air quality.

Initiatives designed to reduce motor vehicle emissions include AirCare and a heavy vehicle-testing program in the Lower Fraser Valley as well as Washington State's vehicle emission check program in King, Pierce and Snohomish Counties. The Government of Canada has a series of measures planned over the next decade to reduce emissions from vehicles, engines and fuels. In Washing-



ton State alternatives to diesel fuels are also being researched by non-profit organizations and affiliates of the Puget Sound Clean Air Agency.

Environment Canada and the Environmental Protection Agency are working together with local and regional government agencies to develop a transboundary airshed management plan and characterize the air quality of the Georgia Basin-Puget Sound region. A portion of this work involves the application of computer models to assist with implementation of initiatives

such as the Regional Haze Rule, Canada Wide Standards and the Ozone Annex to the Canada/US Air Quality Agreement. If problems are identified, both countries can work together to find solutions.

Governments in both the Georgia Basin and Puget Sound are using a suite of regulatory controls to improve air quality, such as permitting to control industrial emissions, smoke control regulations and restrictions on open burning.

Current approaches are consolidated into Air Quality Management Plans in the Greater Vancouver and Fraser Valley Regional Districts of the Georgia Basin, and in central Puget Sound counties. In addition, air quality monitoring programs are being modernized with PM_{2.5} samplers to monitor for this subset of PM₁₀.

Outreach and education programs are raising awareness about sources of air pollution, its impacts and effective solutions. Information is also being shared to encourage alternative choices that can significantly improve air quality (e.g., chipping or composting yard waste or land clearing waste rather than burning).



Mount Baker from Fraser Valley

SOLID WASTE

The Indicator

This indicator examines the weight of solid waste disposed and recycled by individuals as well as businesses. The amount of solid waste disposed each year is known as a stress indicator, indicating the pressures placed on natural resources in the Georgia Basin-Puget Sound ecosystem. The amount of waste disposed and recycled each year in BC is tracked by regional districts and facility operators, and in Washington State by counties and recycling companies.

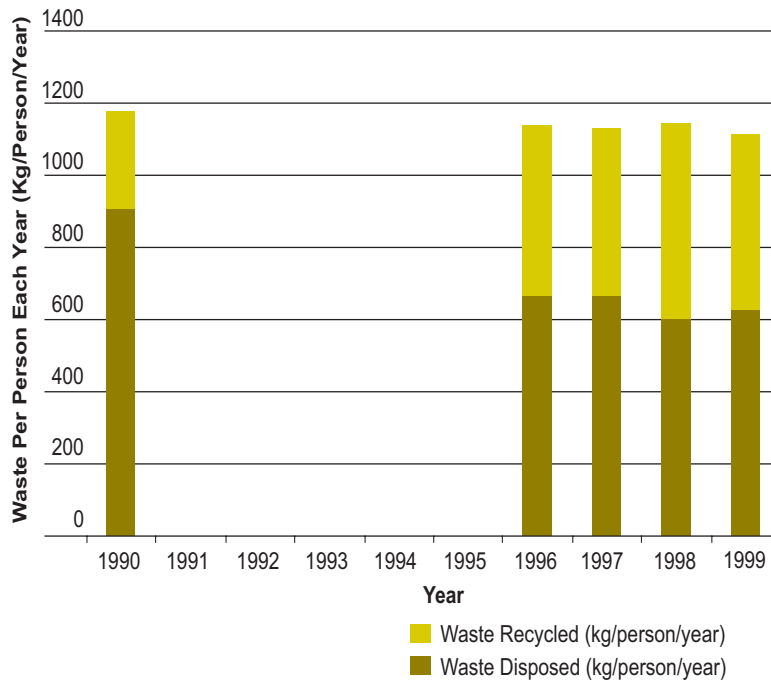
Solid waste is defined differently in each jurisdiction and includes a mix of residential, commercial and industrial waste. Please see the technical documents for specific definitions.

What Is Happening?

In 1999, 1,109 kg (2,449 lbs) of solid waste were generated per person in the Georgia Basin, of which 485 kg (1,078 lbs) were recycled. This represents a recycling rate of 43 per cent, resulting in a 32 per cent reduction in waste disposal overall since 1990. In comparison, 1,291 kg (2,840 lbs) of solid waste were generated per person in Puget Sound, of which 409 kg (900 lbs) were recycled. This is a recycling rate of 32 per cent, with this per capita rate fluctuating between a high of 39 per cent (1995) and 28 per cent (1997).

During the past decade, annual per capita waste

PER CAPITA SOLID WASTE DISPOSED AND RECYCLED IN THE GEORGIA BASIN IN 1990 AND FROM 1996 -1999



generation has remained relatively constant in both jurisdictions, although more waste is being recycled annually in the Georgia Basin than in Puget Sound.

Why Is It Happening?

The solid waste generation rate is associated with cultural tendencies that encourage material consumption, our habits driven by merchandising, aggressive marketing, and then exacerbated by many factors. These factors include the inefficient design of convenience products that are used once and then discarded; fast-paced lives which lead to more convenience-style purchases; the explosion of electronic goods; and a rapidly rising population that is generally affluent.

Partly offsetting this trend, almost one third of the solid waste generated in Puget Sound

and more than 40 per cent in the Georgia Basin is recycled annually. The recycling rate in Puget Sound-Georgia Basin is a direct result of several key efforts. Curbside recycling programs are established in many communities in the Georgia Basin. The Greater Vancouver Regional District (GVRD) and the Capital Regional District (CRD), with more than 78 per cent of the Georgia Basin population, have the most extensive recycling programs. Puget Sound counties have an excellent curbside recycling system, with some exceptions in more rural areas where drop box collection sites or depots are used instead.

Supported by effective collection programs and public education, people have shown a willingness to recycle. However, further reductions in the volume of waste disposed will have to come from a reduction in the

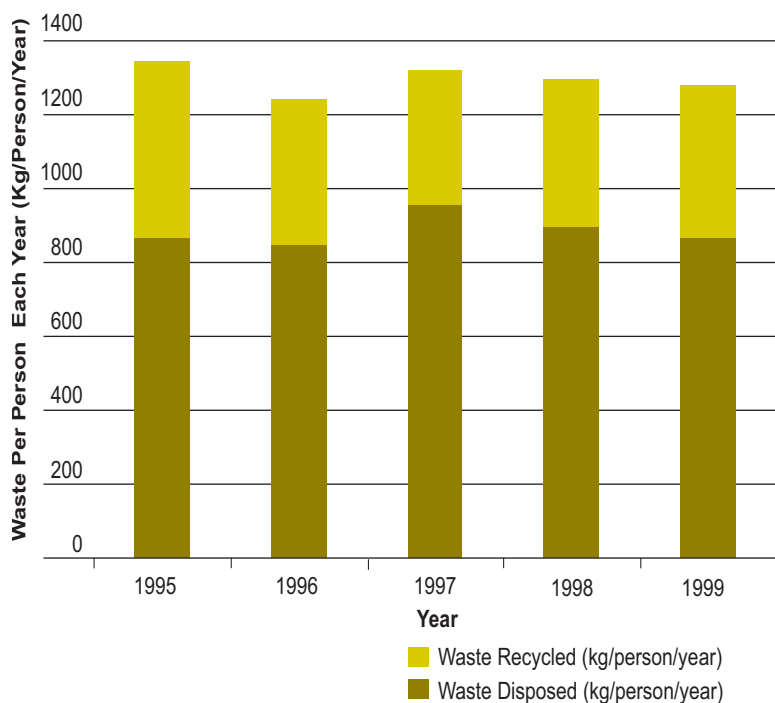
total amount of waste that people generate. This is much more difficult, as it requires fundamental changes in the way we define our 'quality of life'. Reductions in areas such as consumption and packaging of consumer goods and increases in product longevity are some of the areas that need to be addressed.

Why Is It Important?

In 1998, 8.3 billion kilograms (more than 18 billion pounds) of waste were produced in the Georgia Basin-Puget Sound area, of which 63 per cent was disposed in landfills or incinerated. Although landfills are managed to reduce adverse impacts on the environment, they are still a significant source of greenhouse gases, can contribute to surface and groundwater contamination, and require extensive and



PER CAPITA SOLID WASTE DISPOSED AND RECYCLED IN PUGET SOUND, 1995 - 1999



increasingly costly amounts of land. These factors make landfills unappealing to most communities and the task of siting new landfills is extremely difficult.

Although modern incinerators produce much lower levels of pollutants than older models, they still emit acid gases, carbon dioxide, toxic chemicals and fine particulates. These contaminants make their way into air, water and eventually into ecosystem food chains.

Ramifications of solid waste generation go far beyond landfill and incineration concerns and point toward the inefficient production of goods. Solid waste is a symptom of inefficiency because what eventually becomes “waste” could have been used during the manufacturing process or subsequently used to make a new product or create energy.

Every item that is thrown out as garbage involves a complex manufacturing, processing, transportation, use and disposal story called life cycle, and involves the extraction of natural substances and the creation of pollution. Accordingly, what we see in landfills or going into incinerators is just a glimpse of the overall impacts of waste generation.

How Does It Compare?

In 1999, 80 per cent of the solid waste generated in BC came from the Georgia Basin, where the majority of the provincial population is concentrated. A significantly higher percentage of waste is recycled in the Georgia Basin (44 per cent in 1999) than in the rest of British Columbia (26 per cent in 1999).

In Puget Sound, per capita waste disposal has decreased compared to the rest of Washington in recent years,

while recycling has slightly increased. For instance, in 1999, the recycling rate in Puget Sound was 1.12 kg/person/day (2.46 lbs/person/day) while the rest of the state had a rate of .93 kg/person/day (2.05 lbs/person/day).

What Is Being Done?

Residential and industry stewardship programs and the work of committed citizens and non-profit organizations,

coupled with government programs, ensure that the most hazardous components of solid waste are disposed of safely in both the Georgia Basin and Puget Sound regions. Existing programs encourage stewardship of lead-acid batteries, scrap tires, used lubricating oil, paint and solvents in both jurisdictions, and paint residuals, pharmaceuticals, flammables, pesticides, gasoline residuals, and beverage containers in the Georgia Basin.

The Washington State Department of Ecology, in conjunction with its partners, is developing the State’s Comprehensive Solid Waste Plan that will focus more vigorously on strategies that will lead the State towards a more sustainable “waste future.” Among the issues being discussed are product stewardship, green purchasing, developing a more accurate pricing structure for the solid waste system (in which external costs are internalized), and major advances in waste prevention, reuse, and substituting product services for purchases. In British Columbia, regional districts were required by the provincial government to design and implement Solid Waste Management Plans to address the generation, disposal and recycling of solid waste. Several districts are currently going through a 5-year review of their Plans.



Risa Smith, BC Ministry of Water, Land and Air Protection



PERSISTENT ORGANIC POLLUTANTS (POPs) IN

The Indicator

Harbour seals occupy a high position in the Georgia Basin-Puget Sound marine food web (feeding on a wide variety of fish and invertebrates) and, as a result, can be exposed to high concentrations of many persistent organic pollutants (POPs). Studying the level of these contaminants in harbour seals provides a valuable indicator of POP levels in the entire coastal environment over time and across the basin.

POPs are chemicals that dissolve easily in animal fat and do not break down readily, causing them to build up, or bioaccumulate, in the marine food web. PCBs (polychlorinated biphenyls), dioxins (polychlorinated-dibenzo-p-dioxins - PCDD) and furans (polychlorinated-dibenzofurans - PCDF) are examples of the POPs found in harbour seals.

LEVELS OF PCBs FOUND IN HARBOUR SEALS WITHIN THE GEORGIA BASIN - PUGET SOUND



Note: At all sites, blubber biopsy samples were taken from 4-6 week old free-ranging harbour seals pups in good condition.
 Note: Sample sites were pooled for Vancouver owing to limited sample size. As a result, the location reflects the site where most samples were obtained, while extra samples were collected in adjacent areas.

What Is Happening?

Harbour seals sampled in south Puget Sound showed drops in the levels of PCBs and DDT between 1972 and 1984, but have since stabilized.

The maps in this section show the levels of these substances measured in harbour seals at various locations in 1996, the latest year for which a

regional comparison is available. This analysis across Georgia Basin-Puget Sound suggests that harbour seals from Puget Sound are particularly contaminated with PCBs (18.1 mg/kg lipid), having concentrations 7-8 times higher than their counterparts in the Strait of Georgia (2.5 mg/kg lipid) (Ross et al. 2001, in preparation).

There were minor differences in concentrations of dioxins and furans in harbour seals among sites within the Strait of Georgia. However, levels of dioxins and furans were higher in Strait of Georgia harbour seals than measured in Puget Sound seals.

HARBOUR SEALS



LEVELS OF DIOXINS AND FURANS FOUND IN HARBOUR SEALS WITHIN THE GEORGIA BASIN - PUGET SOUND



Note: At all sites, blubber biopsy samples were taken from 4-6 week old free-ranging harbour seals pups in good condition.
 Note: Sample sites were pooled for Vancouver owing to limited sample size. As a result, the location reflects the site where most samples were obtained, while extra samples were collected in adjacent areas.

Why Is It Happening?

The decline in PCB and DDT levels through the 1970s reflects the impacts of widespread restrictions on their use in the early 1970s. The declines appear to have levelled off in the mid-1980s as contaminated land and sediments continued to release PCBs into the marine environment. A contributing factor to

the levelling off may be the introduction of contaminants into coastal BC and Washington through atmospheric transport from other regions of North America and the world.

The higher PCB levels in Puget Sound harbour seals indicate the ongoing presence of PCBs from past use as well as the slow rate at which sediment deposition buries contaminants

in Puget Sound waters. The elevated dioxin and furan concentrations in the Strait of Georgia are mainly a result of these chemicals being produced as by-products in the BC pulp and paper industry in the late 1980s and early 1990s. While no temporal trend information exists for dioxins and furans in BC harbour seals, data from Dungeness crab (Yunker *et al.*



1995; Yunker *et al.* 2001) and osprey (Elliott *et al.* 1998) suggest that substitution of chlorine in the bleaching processes at BC pulp mills has led to substantial declines in the levels of these contaminants in the Strait of Georgia over the past 10 years.

Why Is It Important?

The dangers associated with certain toxic chemicals became apparent when DDT (dichlorodiphenyltrichloroethane, an insecticide) caused eggshell thinning and the local extinction of many fish-eating birds across North America and Europe in the 1960s and 70s. As with DDT, PCBs, dioxins and furans are persistent, can biomagnify, or increase in concentration at each level in the marine food chain, and can affect the health of wildlife - particularly marine mammals at the high end of the food chain, and humans

Since harbour seals feed on a wide variety of prey, including fish and invertebrates, studying these mammals for POP levels provides useful information on the state of contamination of the environment in the coastal waters of BC and Washington. This information is important for monitoring the environment and evaluating the effectiveness of controls on these chemicals. Since many wildlife species such as sea otters, killer whales and



PERSISTENT ORGANIC POLLUTANTS (POPs) IN HARBOUR SEALS *continued*

bald eagles, and certain human consumer groups also consume large quantities of fish, POP levels in harbour seals can provide information on the health risks to these consumers as well.

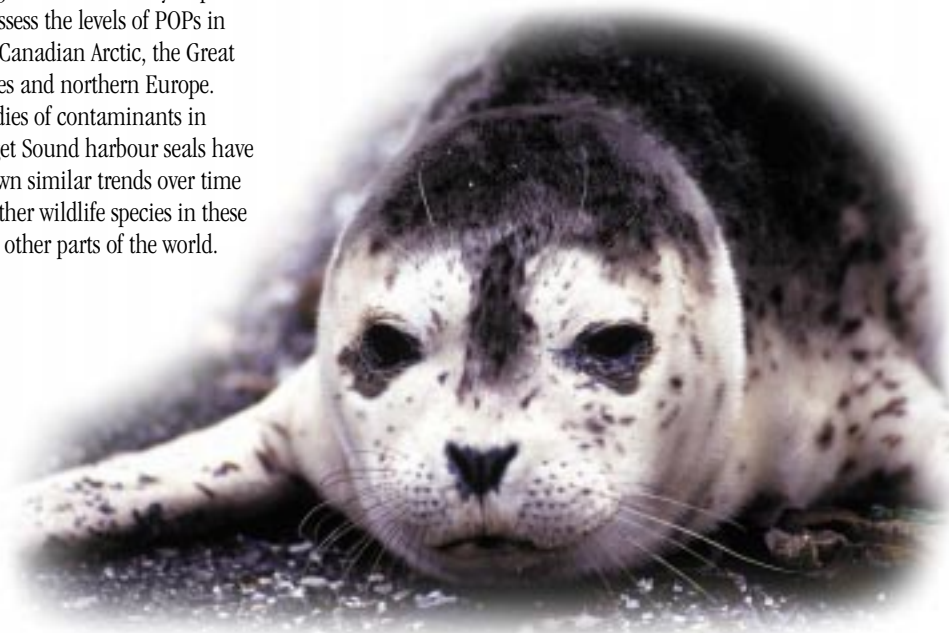
How Does It Compare?

Marine mammals, fish-eating birds and subsistence-oriented human consumer groups, including fishers and First Nations groups, have been shown to be particularly contaminated with POPs around the world. Monitoring programs are currently in place to assess the levels of POPs in the Canadian Arctic, the Great Lakes and northern Europe. Studies of contaminants in Puget Sound harbour seals have shown similar trends over time to other wildlife species in these and other parts of the world.

What Is Being Done?

Although PCBs and DDT have been banned from open use in Canada, the US and Western Europe since the mid 1970s, their use has continued in many developing nations. The United Nations Environment Program (UNEP) has coordinated a global treaty to phase out the production and/or use of the 12 priority POPs, including PCBs, DDT and dioxins. Pulp mills in BC and Washington have also implemented changes to their processes, greatly reducing the release of dioxins and furans into coastal waters.

A collaborative project underway between researchers in British Columbia, Fisheries and Oceans Canada (Institute of Ocean Sciences) and Washington (Washington Department of Fish and Wildlife; Cascadia Research Collective) is helping to monitor harbour seals in the shared waters of these two jurisdictions. In addition, federal US and Washington State laws provide the framework for sediment cleanup to keep historic contamination from reaching the marine food web.



SPECIES AT RISK

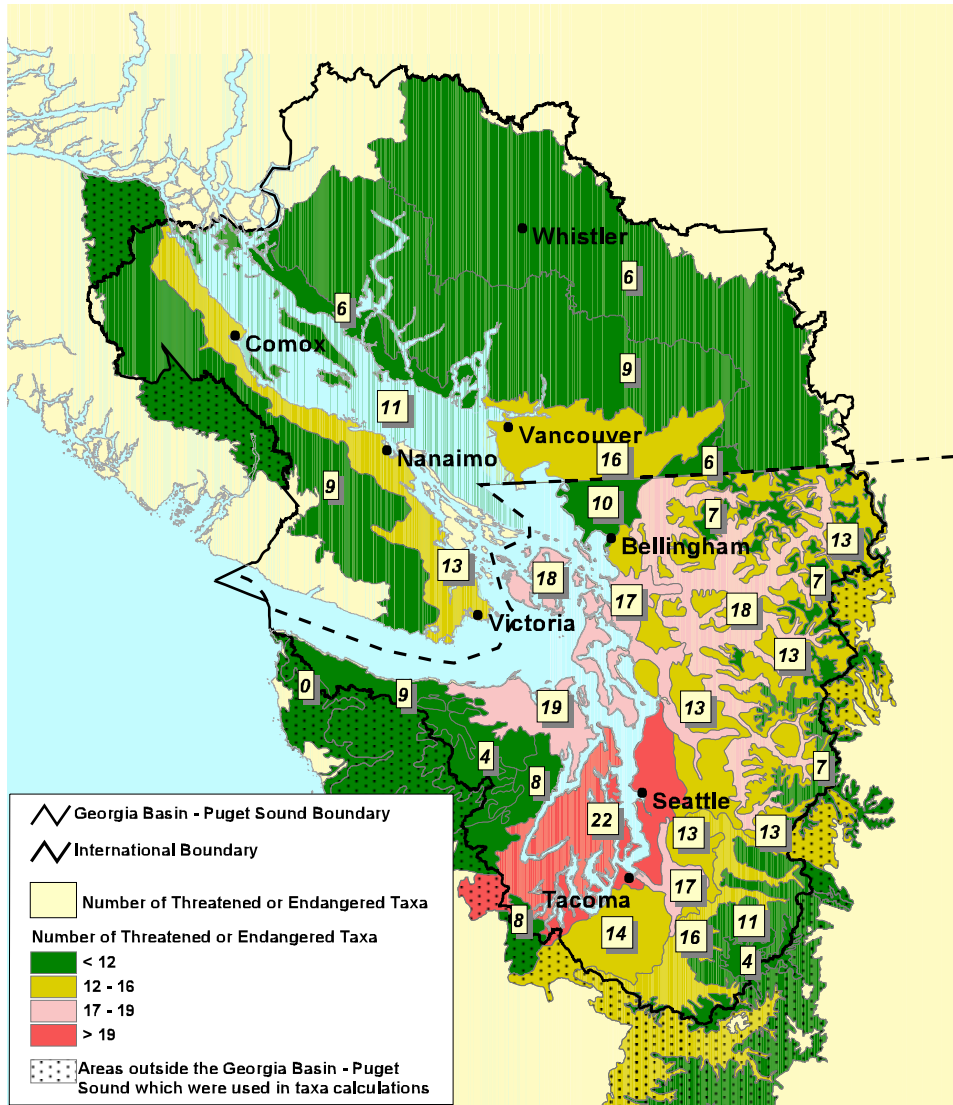


The Indicator

The Species at Risk indicator examines the number of species, by major taxa, in the Georgia Basin and Puget Sound that have been categorized as being vulnerable to extinction. The Association for Biodiversity Information, which includes a network of Conservation Data Centres across North America, uses a standardized method for assessing the conservation status of species. There are also national level conservation rankings. In Canada, these are assigned by the Committee for the Status of Endangered Wildlife (COSEWIC). In the U.S., formal at-risk species status reviews can be conducted through distinct state and/or federal administrative processes.

This indicator includes those native and breeding species that have been assessed in the most critical conservation categories developed by the Association for Biodiversity Information. In British Columbia, this corresponds to threatened or endangered status, while in Washington it corresponds to threatened, endangered, and candidate species status. The term species at risk is used throughout to refer collectively to species in these conservation categories.

SPECIES AT RISK IN THE GEORGIA BASIN - PUGET SOUND ECOSYSTEM



Sources: Washington Department of Fish and Wildlife, Ministry of Environment, Lands and Parks, Conservation Data Centre 2000.

Note: Map is based on the total number of threatened or endangered vertebrates species present in each ecoregion (Georgia Basin) or ecoregion (Puget Sound).

Note: Ecoregions that do not fall entirely within the Georgia Basin boundary were included unless the majority of the area lies outside the boundary.

Note: Marine mammals are not included in the numbers of threatened or endangered taxa on this map.



SPECIES AT RISK *continued*

What Is Happening?

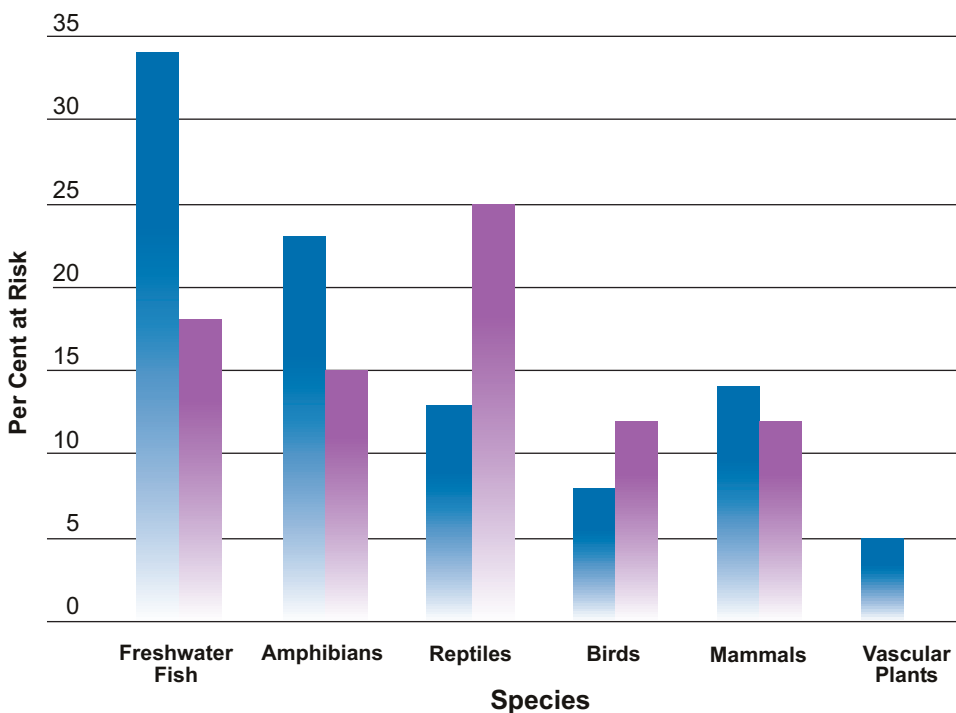
The indicator presents a status and reveals that while there are substantial numbers of species at risk across all major taxa groups, some taxa are more at risk than others. It is also evident that the number of at-risk species varies by ecoregion within the basin.

The total *at risk* species/native breeding species in each group is: freshwater fish, Georgia Basin 14/41, Puget Sound 9/49; amphibians, Georgia Basin 3/13, Puget Sound 3/20; mammals, Georgia Basin 10/72, Puget Sound 10/86; reptiles, Georgia Basin 1/8, Puget Sound 2/8; birds, Georgia Basin 13/163, Puget Sound 20/164; vascular plants, Georgia Basin 73/1367, Puget Sound n/a. Marine mammals are included in this analysis.

Vascular plants in Puget Sound are not included in this analysis because the total number of native breeding species has not been quantified.

Of the 298 native species of vertebrates in the Georgia Basin, 41 are either threatened, endangered, or candidates for these designations. These include the white sturgeon, marbled murrelet, Vancouver Island marmot, the Oregon spotted frog, and sharp-tailed snake, as well as recent additions such the double-crested cormorant and four other bird species (western bluebird, western meadowlark, sandhill crane and Lewis' woodpecker) with threatened or endangered populations in the Georgia Basin. Fourteen of the 41 species of freshwater fish in the Georgia Basin are at risk (34%), more than any other vertebrate species, and 10 mammal species are designated at risk (14%). An additional 30

SPECIES AT RISK IN THE GEORGIA BASIN AND PUGET SOUND (AS A PERCENTAGE OF NATIVE BREEDING SPECIES)



vertebrates, including the killer whale, are considered vulnerable.

Although killer whales in British Columbia are assessed as vulnerable by the B.C. Conservation Data Centre, there is great concern about the status of the Southern Resident Killer Whale population that resides in the Georgia Basin-Puget Sound region. Recent studies have revealed high persistent organic pollution levels in the tissues of this population. There is also concern about recent mortalities in the population, a reduction in food (prey) availability and increasing stress from whale watchers and boaters. COSEWIC has designated the southern resident population as Endangered in British Columbia. In Puget Sound, the same killer whale population is currently a threatened species candidate at the state level, while at the federal level, a petition is

underway to list the species as Endangered.

In Puget Sound, 64 species of vertebrates are considered at some risk of extinction within the basin. This includes 25% of native reptile species, such as the western pond turtle, and 18% of the freshwater fish species including the coastal cutthroat trout and Chinook salmon. Also at risk are 15% of all native amphibian species, including the Oregon spotted frog, 12% of all native mammal species, including the sea otter, killer whale, and lynx, and 12% of the native breeding bird species including the peregrine falcon, marbled murrelet, and spotted owl.

While it was not possible to quantify the percentage of at risk marine fish species in Puget Sound, the numbers of species at-risk within these taxa are significant and include at least 22 species of marine fish of

which three species are salmon. Comparable information on the status of marine fish is not yet available in British Columbia.

Of the 1,367 known native vascular plant species in the Georgia Basin, 73 are considered threatened or endangered while an additional 83 are listed as vulnerable. In the Puget Sound Basin, approximately 220 species of plants are considered at risk including some entire plant communities.

Why Is It Happening?

Loss of natural habitat as a result of population growth and urbanization is a constant threat to the birds, mammals, fish, reptiles, amphibians and invertebrates in the Georgia Basin-Puget Sound region. Streams, stream-sides, flood-plains, and wetlands are



particularly important habitats that support many species in the Georgia Basin-Puget Sound ecosystem.

In Puget Sound, the greatest numbers of species at risk are found in the lower elevation ecoregions (i.e. marine ecosystem, coastal lowlands, and lowland forests) and watersheds where there have been significant losses of aquatic, wetland, and riparian habitats. The San Juan Islands and the lowland forests of the major river valleys have both high species abundance and correspondingly high numbers of species at risk. The Puget Sound marine ecosystem has the highest total number of at risk vertebrate species, 31, many of which are fish species.

A similar pattern emerges in the Georgia Basin, where the highest numbers of threatened or endangered vertebrates occur in the Fraser Valley, in the lowlands of the east coast of Vancouver Island and in the Strait of Georgia. In the Lower Fraser Valley, 15% of streams have been lost and 71% are considered impaired because of such impacts as alterations to watersheds, streamside degradation, removal of streamside vegetation, propagation of introduced species, and water pollution resulting from urban development, agriculture and logging.

Why Is It Important?

The diverse array of habitats in the Georgia Basin-Puget Sound ecosystem supports a large number of vertebrate species that breed, winter, and make migratory stopovers in the basin. Although this indicator has focussed on species that breed in the basin, the area also provides critical winter habitat

for large numbers of other bird species.

Populations of native plants and animals are an important part of a healthy ecosystem, our legacy, and are key elements to long-term economic and social well-being. Without adequate conservation strategies and practices, significant numbers of bird, mammal, amphibian, fish, and plant species will continue to be vulnerable to extinction in the basin.

How Does It Compare?

Of all the native breeding vertebrate species and vascular plants in BC that are listed as threatened or endangered, almost half of the vertebrates and almost one-third of the vascular plants are found in the Georgia Basin. Compared to other Canadian provinces, BC has the highest biodiversity in terms of number of species and the second highest number of species that are at-risk in Canada. Ontario has the most and Prince Edward Island and Nunavut the fewest number of at-risk species. (Canadian Endangered Species Conservation Council, CESCC, 2001.)

What Is Being Done?

The Protected Areas System is the cornerstone of British Columbia's initiatives to protect species at risk. It sets aside important habitats, with conservation and recreation as management objectives. There are several successful partnerships and programs in the Georgia Basin such as the Lower Mainland Nature Legacy for conserving wildlife habitat through park designation, and the Pacific Coast Joint Venture for conserving waterfowl, shorebirds and other wetland

dependent wildlife species. There is also hope that Marine Protected Area strategies within the Georgia Basin will continue to be pursued.

In Washington State, the State Department of Fish and Wildlife and Natural Heritage Program help determine habitat protection needs through scientific data collection and analysis of existing native ecosystems and species. The Natural Heritage and GAP programs also help develop and recommend strategies for protection of the native ecosystems and species most threatened in Washington State. The Nature Conservancy (TNC/US), through its conservation

design initiatives, has recently launched a broad-based partnership to help establish both terrestrial and aquatic conservation objectives and strategies within the Puget Lowland and west slope Cascade Valley ecoregions (TNC, 2000). In addition, the Trust for Public Lands (TPL) has recently released an assessment of Conservation Priorities for freshwater salmon habitats in Puget Sound (TPL, 2000) for use in local planning and conservation activities. Marine Protected Areas are being discussed and initiated in Puget Sound, the Northwest Straits, and Georgia Basin.



Russ Haycock



BC Ministry of Water, Land and Air Protection

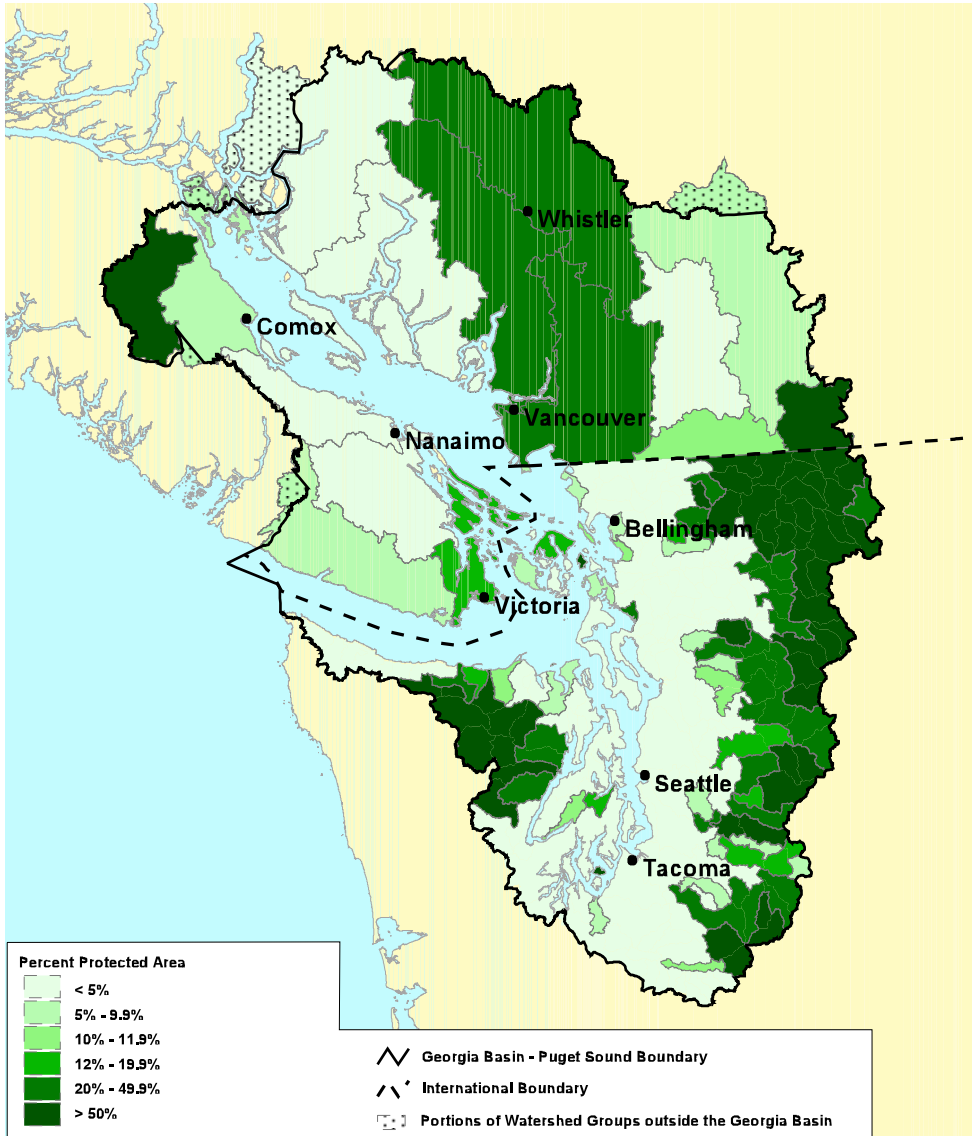
TERRESTRIAL PROTECTED AREAS

The Indicator

This indicator evaluates the percentage of land protected through legal mechanisms in the Georgia Basin-Puget Sound area. It includes areas that are managed primarily for the conservation of natural diversity and the maintenance of ecosystem integrity as defined by the World Conservation Union (IUCN) (Categories I to III).

In the Georgia Basin, the indicator includes land designated as Ecological Reserves, Parks (classes A and C), Recreation Areas, National Parks, Regional Parks, National Wildlife Areas and protected areas that fall under the BC Environment and Land Use Act, as well as private land holdings for conservation purposes. In Puget Sound, this includes National Parks, National Recreation Areas, National Wilderness Areas and Wildlife Refuges, State Natural Conservation and Preservation Areas, and other state and federal lands that have been legislatively protected.

PER CENT OF LAND PROTECTED IN THE GEORGIA BASIN - PUGET SOUND ECOSYSTEM



Note: Protected areas in Watershed Groups where more than 70% of the Watershed Group area falls outside the GB boundary have been omitted.

Sources: USEPA Seattle Regional Office, 2001
Land Use Coordination Office (LUCCO) and BC Parks 2000.



What Is Happening?

As of 2000, there were 254 areas with protected area status, comprising 700,000 hectares or 14.6 per cent of the land base in the Georgia Basin. Of the 15 watershed groups within the Georgia Basin, six had more than 12 per cent of their land in protected area status, with three having more than 20 per cent in protected area status and two having over 50 per cent. Despite this, many areas, particularly the east coast of Vancouver Island and the coastal areas along the mainland, are still underrepresented.

In the Puget Sound area, currently 900,000 hectares, or about 27 per cent of the land area, are considered protected. Some of the higher elevation watersheds or sub-basins have as much as 50 to 75 per cent of the area classified as protected. However, a very large percentage of these lands occur above 1,000 metres (about 3,300 feet) and represent largely mountain and alpine ecosystems. These relatively large areas are consolidated landscapes, often managed under a common federal or state land manager. In contrast, in the lower elevation and lower gradient sub-basins, as little as one per cent of the land is considered protected, and few sub-basins exceeding three per cent. The relative size of individual protected areas also decreases substantially in these low elevation areas.

Why is it Happening?

With the growing population in the Georgia Basin-Puget Sound ecosystem and continued expansion of urban centres, more land is being converted to

housing, industry, roads or secondary agriculture at the expense of natural habitat. This loss of habitat is a constant threat to the natural diversity and ecosystem integrity of the Georgia Basin-Puget Sound area.

The designation of protected areas helps to preserve lands as natural habitat, maintaining their ecological integrity and biological diversity. The World Commission on Environment and Development (WCED - the Brundtland Commission) suggested in 1987 that as a general guideline, 12 per cent of the land-base should be protected. Since then, both the Georgia Basin (through the BC Protected Areas Strategy), and Puget Sound (through the general protection of public lands as legacy ecosystems) have surpassed this target. The BC Protected Areas Strategy has resulted in the protection of more than 12 per cent of the provincial land base.

This is an important foundation for a long-term strategy to protect our ecological and cultural heritage. Several regional districts in the Georgia Basin including the Greater Vancouver Regional District and the Capital Regional District have substantial park acquisition strategies that have contributed to the network of protected areas in the Georgia Basin. Growing concern, awareness and action by non-profit groups have made a difference, including raising private funds for land purchases in both countries.

Why Is It Important?

Protected areas contribute to the maintenance of ecosystems, species and genetic resources

while also contributing to outdoor recreation opportunities. It is important that the portfolio of protected lands represents the broad diversity of species and ecosystems. Currently, low elevation areas, particularly those containing critical floodplain and nearshore habitats, are significantly under-represented in the overall conservation holdings within the basin. These low gradient, low elevation, and nearshore ecosystems provide critical habitat for a great number of species, particularly aquatic and riparian dependent species.

Connecting habitats across larger landscapes is critical in protecting both ecosystem processes (e.g. river and floodplain corridors) and critical habitats for wildlife range and migration. The 'network' of protected areas in the Puget Sound-Georgia Basin ecosystem includes a north-south corridor along the Cascade ridge. However, river corridors from this ridge down to the floodplains and estuaries are not well protected.

How Does it Compare?

With 14.6 per cent of its land base in protected area status, the Georgia Basin has passed the provincial goal of 12 per cent. As of September 2001, approximately 13 per cent of British Columbia's land base was protected.

Puget Sound is a relatively well-protected basin, with 27 per cent of its terrestrial land base considered protected. However, even in the Puget Sound region, the lower elevation ecotypes and the marine and freshwater habitats are still greatly under-represented.

What Is Being Done?

The British Columbia Protected Areas Strategy was initiated in the early 1990s, to protect representative areas of biological and cultural diversity, provide habitat protection for wildlife, protect recreational resources, and provide opportunities for scientific research and education. Non-government land conservancy organizations (including the Nature Conservancy, the Land Conservancy, Trust for Public Lands, local land banks and others) continue to play a key role in identifying and acquiring protected areas in the Georgia Basin-Puget Sound region.

Two land use planning processes have been concluded in the Georgia Basin - the Vancouver Island Land Use Plan and the Lower Mainland Protected Areas Strategy process. Both resulted in a substantial number of new protected areas, greatly increasing the representation of a number of ecosystems and affording protection to a range of special natural, cultural and recreational features. These land use planning processes have been complemented by four nature legacy initiatives, each resulting in a number of new protected areas in the Georgia Basin.

In the Georgia Basin, the Pacific Marine Heritage Legacy (PMHL), a five-year federal/provincial program, was established to protect coastal and marine areas in the Southern Gulf Islands. It has resulted in the acquisition of 19 coastal properties. In the spring of 2001, an agreement was reached through the PMHL to establish a 1,200-hectare National Park Reserve spread over 12 Southern Gulf Islands



TERRESTRIAL PROTECTED AREAS *continued*



by 2003. As part of this agreement, British Columbia will purchase additional lands on Saltspring, Valdes and Galiano Islands, and the federal and provincial governments have agreed to purchase Burns Bog, a unique ecosystem in the Fraser River Delta. There will also be a feasibility study for the creation of a national marine conservation area reserve in the Strait of Georgia.

In Puget Sound, the identification and establishment of a network of coastal and marine protected areas is actively being discussed and set in motion through the activities of community councils, non-governmental entities, resource managers, and other local, state, and federal agencies. In addition, many local governments are developing plans and programs to protect some of the most critical habitats in local watersheds. While lands in land trust arrangements and lands under private conservation commitments are not currently included in this assessment, these lands also provide a very important contribution to the existing network of protected areas. This is also the case for public lands that are being managed under long-term conservation plans, but do not meet the higher criteria of protection used in this initial indicator. These other lands should be regarded as part of an overall ecosystem protection strategy and considered in future revisions of this indicator.



Adrian Dorst

WHAT CAN I DO?

These indicators tell a story about the state of our relationship with the natural environment in and around Puget Sound and the Georgia Basin. They are intended to inform readers about trends in the health of this ecosystem based on the latest science and available knowledge. As individuals, we often ask ourselves “What can I do?” These resources are designed to nurture your involvement in protecting the natural legacy that belongs to us all: the rich, diverse and stunningly beautiful Georgia Basin-Puget Sound ecosystem.

Below, you will find information and contacts that can help you make personal choices that will reduce the collective impact we are placing on this ecosystem. Daily choices — driving alone to work, using disposable coffee cups, using cosmetic lawn products — may not individually appear to impact the quality of this shared ecosystem, but collectively the impact is profound when one contemplates the combined choices of seven million people!

The resources below can provide you, as the citizen, consumer, commuter, employee or manager, with access to information on how you can help conserve the health of the Georgia Basin-Puget Sound ecosystem for future generations. Smart choices now can help us restore, maintain and even improve the quality of life for all the natural and human inhabitants of this region.

The views represented in the resource materials provided do not necessarily reflect those of the government agencies sponsoring this report. They are listed to give readers a range of information to inform their decisions.

Just a few of the resources available to you

At Home:

Live sustainably. If you are making a decision about where and how to live, you might explore the idea of “SmartGrowth”. This includes planning and designing for sustainable, healthy communities. Contact SmartGrowth BC at www.smartgrowth.bc.ca (604-915-5234); SmartGrowth America at www.smartgrowthamerica.com (202-974-5132); or 1000 Friends of Washington at www.1000friends.org/resource.htm (206-343-0681). A transboundary organization also working in this area is Northwest Environment Watch at www.northwestwatch.org (206-447-1880).

Keep your landscape beautiful and safe for both your family and the environment. Run-off from pesticide applications, household chemical use, and car washing can enter salmon-bearing streams and percolate into the aquifers that people depend on for drinking water.

Landowners, developers, volunteers, professionals, local governments and agencies can share experiences through case studies examined in *The Naturescape Series*, as well as the *Stream Stewardship and Agricultural Stewardship Guidebooks*. You will find these at the Stewardship Centre Online, www.stewardshipcentre.org. For

Washington-specific information, contact Seattle Public Utilities at www.ci.seattle.wa.us/util/AboutUs.htm (206-684-3000) and Minnesota’s Garden Campaign at www.moea.state.mn.us/campaign/garden/index.html (800-632-3299).

Protect your waterways. For suggestions on how you can best protect your shoreline, check out the Living By Water Project in British Columbia at www.livingbywater.bc.ca/ (250-832-7405). In Washington, consult the *Puget Sound Shoreline Stewardship Guide Book* from the Puget Sound Water Quality Action Team (360-407-7300 or 1-800-54-SOUND).

Put your land in trust or get involved with land conservation. Reduce your taxes by placing conservation covenants on your land or by contributing to land trusts that purchase private lands. Check out the Nature Conservancy in BC at www.bc.natureconservancy.ca (250-479-3191) and in Washington at www.tncwashington.org (206-343-4345).

Buy consciously. Some products are more environmentally friendly than others. You can help reduce impacts through green purchasing — it’s easy! Check out the following resources for suggestions that will help you buy smart and make things last longer: the California Integrated Waste Management Board at www.ciwmb.ca.gov/RCP/ and the National Waste Prevention Coalition, which has lots of great tips on how to deal with junk mail, computer recovery,

waste reduction, and toxic chemicals at www.metrokc.gov/nwpc or (206) 296-4481. You can also try Coop America’s Green Pages On-Line at <http://www.greenpages.org>.

For information on Guidelines, Standards, and Certification Services, Green Products and Services and Information on Purchasing and the Environment on both sides of the border, visit the Buy Green WebSite www.buygreen.com/main/ or the Recycling Council of British Columbia at www.rcbc.bc.ca/.

Pay attention to the common cleaners you buy as their use can adversely affect the environment and your health. There are effective and safe alternatives available. You can find out about these at www.westp2net.org/Janitorial/jp4.htm (415-744-2150) or call the City of Seattle’s Office of Sustainability and Environment to find out more about what they’re buying at (206-615-0817). In British Columbia, contact the Georgia Strait Alliance at www.georgiastrait.org. (250-753-3459).

Buy only certified wood stoves and fireplaces. Good stoves make good neighbours! A certified wood stove can use one-third less wood and produce one-fifth as much pollution as a certified model. Find out how: www.ecy.wa.gov/programs/air/91-053.html#stovelist.

Respect paper — one-third of all trees harvested are used for paper production. Recycling and improvements to pulp mill processes are helping to reduce our impact, but your participation can help even more.





Check out the Resource Conservation Alliance at [www.rca-info.org\(202/387-8030\)](http://www.rca-info.org(202/387-8030)), Re-think Paper at [www.rethinkpaper.org\(415/788-3666\)](http://www.rethinkpaper.org(415/788-3666)) and the Chlorine Free Products Association at [www.chlorinefreeproducts.org\(847/658-6104\)](http://www.chlorinefreeproducts.org(847/658-6104)). In British Columbia check out the “Reach for Unbleached” initiative at [www.rfu.org\(604-879-2992\)](http://www.rfu.org(604-879-2992)).

At Work:

Develop a green purchasing policy. The life cycle impacts of products can have consequences to both the environment and your own operating costs. Help protect the environment and save money by being an informed consumer. To see examples of green procurement policies online, check out the details from the City of Seattle at <http://www.ci.seattle.wa.us/environment/GreenPurchasing.htm>, King County at <http://www.metrokc.gov/procure/green/>, the Province of Manitoba at <http://iisd1.iisd.ca/business/gprocurement.htm>, the United States Environmental Protection Agency at <http://www.epa.gov/opptintr/epp/linksgreen.htm>, the Pacific Northwest Pollution Prevention Resource Center at <http://www.pprc.org/pprc/pubs/topics/envpurch.html> and Environment Canada at http://www2.ec.gc.ca/eog-oeg/greener_procurement/Greener_Procurement.htm.

Make sure everyone has a durable coffee mug. A large number of paper, plastic and styrofoam cups are thrown away each year. Save money and the environment with one simple purchase.

Institute a green travel policy. You can dramatically reduce the environmental footprint of your business by using conference centres, hotels and services that follow sustainable practices. Contact the Coalition of Environmentally Responsible Economies Green Travel page at www.ceres.org/programs/GHI and EPA’s Green Conference Program at www.opptintr/epp/conference.htm. The CERES site also has information on the TripleE flight plan that implements carbon sequestration projects for each mile flown. In Canada, Oceans Blue leads “Blue Tourism” programs for protecting the coastal environment, www.oceansblue.com/bluetourism/chartacourse/index.html.

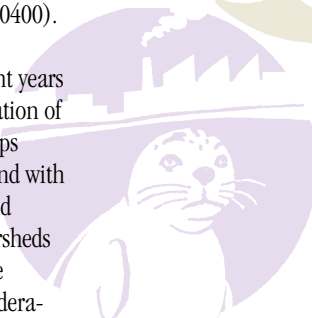
Commute to work using environmentally friendly means: bus, train, walk, cycle or surf. Using commuting alternatives to your car can improve the sustainability of the Puget Sound – Georgia Basin ecosystem. Let someone else do the driving! In British Columbia contact Better Environmentally Sound Transportation at [www.best.bc.ca\(604-669-2860\)](http://www.best.bc.ca(604-669-2860)). In Washington, contact: The Climate Change program at <http://ci.seattle.wa.us/light/conserve/business> or call (206) 684-3254; FlexCare (carsharing) at [www.flexcar.com\(206\)323-FLEX](http://www.flexcar.com(206)323-FLEX); the Bicycle Alliance at

www.bicyclealliance.org and (206) 224-9252. Check out the Green Car Buying Guide at <http://greencars.com/indexplus.html> or call the American Council for an Energy Efficient Economy at (202) 429-0063.

At Play:

Volunteer! Working with people on projects that have a positive impact on the Puget Sound – Georgia Basin ecosystem can provide benefits for you, too. In British Columbia, contact The British Columbia Environmental Network at [www.bcen.bc.ca\(604-879-2279\)](http://www.bcen.bc.ca(604-879-2279)) for groups that need volunteers. In Washington, contact the Washington Green Pages at www.wolfenet.com/~greenway/mwalpha.htm and the Earth Legacy Program at [www.metrokc.gov/earthlegacy/programs.htm\(206-296-0400\)](http://www.metrokc.gov/earthlegacy/programs.htm(206-296-0400)).

Get involved! In recent years there has been a proliferation of Stream Stewardship groups working independently and with government to protect and restore streams and watersheds in the Georgia Basin. The Pacific Streamkeepers Federation helps streamkeepers take action through support, education and building partnerships. Check them out at www.pskf.ca.



SOURCES AND REFERENCES

Population

Graph: *Total Population in the Georgia Basin-Puget Sound (in millions)*. Sources: BC Stats and Washington State Office of Financial Management.

Map: *Percentage of Georgia Basin-Puget Sound Population by Regional District & County, 2000*. Sources: BC Stats and Washington State Office of Financial Management.

Map: *Average Annual Population Growth Rates by Regional District & County, 1991-2020*. Sources: BC Stats and Washington State Office of Financial Management.

Other Sources:

Actual Census figures are used for the US 1990 and 2000, and Canadian 1991 and 1996 data years. Population estimates are used for intervening years and projections to the year 2020 based on comparable but somewhat different methodologies for developing those estimates in each country. Projections can be expected to be modified following analysis of the US 2000 and Canadian 2001 Censuses.

Inter-censal estimates and projections for population in the Georgia Basin and Puget Sound to 2020 were developed by BC Stats and the Washington State Office of Financial Management, respectively.

Migration data for BC and the Georgia Basin were obtained from the BCStats, Georgia Basin Statistical Profile.

Air Quality

Graph: *Per Cent of Georgia Basin Communities Exposed to PM₁₀ Concentrations Greater Than 25 µg (More than 5 per cent of the Time) 1994-1999*. Source: BC Ministry of Environment, Lands and Parks, 2000, *Air Resources Branch*.

Graph: *PM₁₀ Levels in Puget Sound, 1994-1990*. Source: Washington State Department of Ecology, 2001.

Other Sources:

Greater Vancouver Regional District. Air – Air Pollutants. <http://www.gvrd.bc.ca/services/air/pollution/pollution.html>

BC Ministry of Environment, Lands and Parks, (2000) State of the Environment Reporting. Air Quality Impacts from Fine Particulates Indicator; www.elp.gov.bc.ca/sppl/soerpt/

Solid Waste

Graph: *Per Capita Solid Waste Disposed and Recycled in the Georgia Basin, 1990-1999*. Source: BC Ministry of Environment, Lands and Parks, 2001. Pollution Prevention and Remediation Branch. BC Municipal Solid Waste Tracking Report 1997-98; BC Municipal Solid Waste Tracking Report 1999. **Notes:** Estimates for recycled and disposed wastes were derived from municipal surveys conducted across British Columbia. Survey methodology was improved in 1996, increasing the reliability of the data. Volumes of recycled waste are likely underestimated as private

recycling facilities and recyclables collected by industry stewardship agencies are not included.

Graph: *Per Capita Domestic Solid Waste Disposed and Recycled in Puget Sound, 1995-1999*. Source: Washington State Department of Ecology, 2001.

Contaminants from Harbour Seals

Map: *Levels of PBCs Found in Harbour Seals within the Georgia Basin-Puget Sound in 1996*. Sources: see below.

Map: *Levels of Dioxins and Furans in Harbour Seals within the Georgia Basin-Puget Sound in 1996*. Sources: see below.

Source: Peter S. Ross: rosspe@pac.dfo-mpo.gc.ca

Other Sources

Calambokidis, J., Jeffries, S.J., Ross, P.S., and Ikonomou, M.G. 1999. Final Report: Temporal trends in contaminants in Puget Sound harbor seals. USEPA and Puget Sound Water Quality Action Team, Olympia.

Elliott, J.E., Machmer, M.M., Henny, C.J., Wilson, L.K., and Norstrom, R.J. 1998. Contaminants in ospreys from the Pacific Northwest: I. Trends and patterns in polychlorinated dibenzo-p-dioxins and -dibenzofurans in eggs and plasma. *Arch. Environ. Contam. Toxicol.* **35**: 620-631.

Ross, P.S., Jeffries, S., Yunker, M., Ikonomou, M., and Calambokidis, J. 2001. Levels

and patterns of congener-specific PCBs, PCDDs and PCDFs in young, healthy harbour seals (*Phoca vitulina*) from coastal British Columbia, Canada, and Washington State, USA. *Manuscript in preparation*.

Simms, W., Jeffries, S.J., Ikonomou, M.G., and Ross, P.S. 2000. Contaminant-related disruption of vitamin A dynamics in free-ranging harbour seal (*Phoca vitulina*) pups from British Columbia, Canada and Washington State, USA. *Environ. Toxicol. Chem.* **19**(11): 2844-2849.

Yunker, M. B. and Cretney, W. J. 1995. Chlorinated dioxin trends between 1987 and 1993 for samples of crab hepatopancreas from pulp and paper mill and harbour sites in British Columbia. Fisheries and Oceans Canada. Canadian Technical Report of Fisheries and Aquatic Sciences No. 2082.

Yunker, M.B., Cretney, W.J., and Ikonomou, M.G. 2001. Assessment of chlorinated dibenzo-p-dioxin and dibenzofuran trends in sediment and crab hepatopancreas from pulp mill and harbour sites using multivariate and index-based approaches. *Manuscript in preparation*.

Species at Risk

Graph: *Species At Risk in the Georgia Basin and Puget Sound (as a percentage of native breeding species)*: Ministry of Environment, Lands and Parks, BC Conservation Data Centre, 2000 and Washington State Department of Fish and Wildlife, 2001.





Other Sources:

State and local habitat protection and restoration efforts in Puget Sound are described or further referenced in the Puget Sound Water Quality Management Plan (PSWQMP, 2000).

Fraser River Action Plan, Fisheries and Oceans Canada. 1998. *Wild, threatened, endangered and lost streams of the Lower Fraser Valley. Summary Report. 1997.*

Prepared by Precision Identification Biological Consultants, Vancouver, BC 27pp.

Terrestrial Protected Areas

Map: *Percent of Protected Lands in the Georgia Basin-Puget Sound Ecosystem.*

Sources: US Environmental Protection Agency, 2001; Land Use Coordination Office (LUCO) and BC Parks 2000.

Other Sources:

See separate Protected Areas Technical document for more information.

Note:

As of June 5 2001, the BC Ministry of Environment, Lands and Parks ceased to exist and was succeeded by the Ministry of Sustainable Resource Management and the creation of the Ministry of Water, Land and Air Protection.



Environment Canada

For more information about Georgia Basin-Puget Sound ecosystem indicators, please contact the following organizations:

Environment Canada
Phone: (604) 664-9100
WebSite:<http://www.pyr.ec.gc.ca/GeorgiaBasin/>

BC Ministry of Water, Land and Air Protection
Phone: (250) 356-2191
WebSite:<http://wlapwww.gov.bc.ca/soerpt/>

Puget Sound Water Quality Action Team
Phone: (360) 407 7300
Toll free: 1 800 54 SOUND (Washington only)
WebSite:http://www.wa.gov/puget_sound

US Environmental Protection Agency
Phone: (800) 424-4EPA
WebSite:<http://www.epa.gov> and <http://www.epa.gov/region10>

Washington State Department of Ecology
Phone: (360) 407-6000
WebSite:<http://www.ecy.wa.gov/>

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