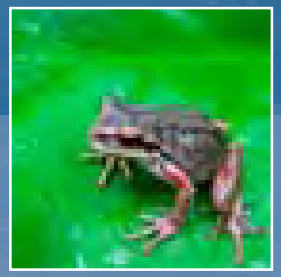
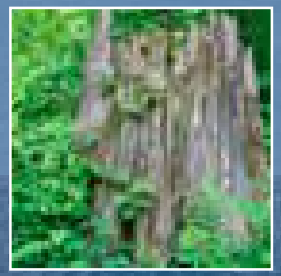
Strategic Directions for Biodiversity Conservation

IN THE METRO VANCOUVER REGION





WORKING TOGETHER
FOR THE
GEORGIA BASIN

DECEMBER 2008

The Biodiversity Conservation Strategy Partnership is an initiative under the Georgia Basin Action Plan involving Environment Canada, the British Columbia Ministry of Environment, the Burrard Inlet Environmental Action Program/Fraser River Estuary Management Program and Metro Vancouver, working in conjunction with municipalities, conservation organizations, stewardship groups and post-secondary institutions.

Cover images: Tree Frog, Melissa Blue Butterfly, Great Blue Heron.

November 2008

WORKING TOGETHER FOR THE GEORGIA BASIN

metro vancouver

Environment Canada | Environnement Canada

Canadian Wildlife Service | Service Canadien de la faune

BRITISH COLUMBIA The Best Place on Earth | Ministry of Environment

A region rich in natural diversity with a
network of habitats and healthy ecosystems
that are valued and conserved

Contents

1 Introduction

Douglas Squirrel

The Strategic Directions report provides a framework to better integrate biodiversity into land use policies, plans and programs. It supports regional collaboration and effective conservation efforts on the ground. The recommended strategic directions are based on research and analysis conducted by the Biodiversity Conservation Strategy Partnership (BCSP) since 2001. Initiated under the Georgia Basin Action Plan, this partnership of government agencies, municipalities and conservation groups has evaluated the state of biodiversity through regional mapping, and assessed the key issues impacting biodiversity conservation in the Metro Vancouver region.

Metro Vancouver is fortunate to have a diverse network of protected watersheds, parks and conservation areas, and designated agricultural lands as shown in figure 1. These lands comprise almost 200,000 hectares or two thirds of the region's land base. While these designations contribute significantly to biodiversity conservation, they are only one part of a strategy to conserve biodiversity.

Equally important are the widespread community efforts to protect natural areas and conserve biodiversity by conservation organizations, stewardship groups and concerned individuals. Dozens of stewardship groups volunteer to restore habitats and streams, remove invasive species and educate the public about nature. Conservation organizations, land trusts and governments secure and manage lands to protect our natural assets. Local governments are making smarter land use decisions to protect biodiversity in their official community plans and development processes. Even individual efforts to expand community gardens, plant trees and create backyard habitat contribute to protecting the region's natural assets.

II Why is Biodiversity Important?

*Biodiversity both sustains **natural systems** and provides **essential ecosystem services** for humanity.*

Nature Needs Biodiversity

Biodiversity is the variability within and among species and ecosystems that is essential to maintaining ecological health. Ecosystems are complex, having richly connected relationships between the living and non-living environment. When components of an ecosystem are compromised, other parts of the ecosystem become more susceptible to predators, disease and starvation. Maintaining ecosystem integrity increases nature's ability to withstand and recover from disruptive activities and stresses.

Biodiversity keeps our ecosystems healthy and functioning. Like a diversified stock portfolio, biodiversity helps keep our options open and provides returns despite fluctuating conditions.

We All Need Biodiversity

Healthy and diverse ecosystems provide a multitude of 'free' ecosystem services that provide the basics of life for all of us – clean air, clean water and healthy soils to produce food. Biodiversity is integral to the lives and well-being of Metro Vancouver's growing population. Natural areas, and the plants, animals and micro-organisms that inhabit them, moderate temperatures, purify our water and air, build soil for growing food, pollinate fruits and vegetables, reduce stormwater runoff and flooding risks, and capture carbon from the atmosphere. The cost to replace, replicate, or restore these ecosystem services far outweighs the cost of maintaining these functions today.

Biodiversity thrives in our parks, urban gardens, waterways, wetlands, farms and forests. Collectively, these areas contribute to our quality of life and the ecosystem services provided by nature.

Biodiversity **is the variability among living organisms which includes the diversity within species, between species and among ecosystems.**

Ecosystems **are dynamic complexes of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.**

Ecosystem services **are the 'free' benefits people obtain from ecosystems including provisional services (food, water), cultural services (recreation, aesthetics), regulating services (climate regulation, water purification, pollination) and supporting services (nutrient cycling, soil formation) that maintain the conditions for life on earth.**

Natural assets **are biological features and constituents that are essential for functioning ecosystems.**

III Biodiversity in Metro Vancouver

Great Blue Heron

Red Rock Crab

The Metro Vancouver region is remarkably productive and biologically diverse. The region's natural assets are unique, and many are provincially, nationally and even globally significant (Figure 1). The region's coastal location, topography and elevation range create conditions that contribute to a high diversity of species and ecosystems. The lower elevation, southwestern portion of Metro Vancouver is located in the Coastal Douglas-fir biogeoclimatic zone, the rarest zone in BC, which makes up less than one per cent of the provincial land base, and is considered 'imperilled.'

Biodiversity-Rich Ecosystems

Key components of natural ecosystems in the region include riparian areas, wetlands, intertidal areas and estuaries, alpine areas and forests[1]. Riparian areas are the lands adjacent to water bodies or wetlands that provide essential corridors for fish and wildlife movement and productive habitats. In addition, these areas filter sediment, stabilize banks and soils, store water, and help maintain water quality. The region's mightiest river, the Fraser, is the largest salmon-producing river in the world, with as many as 10 million salmon returning to the river system in some years. It supports six species of salmon and 29 other species of fish; more than 70 fish species live in the estuary.

Wetlands are significant contributors to biodiversity despite their limited size and extent in the region. They provide a wide range of ecosystem services including habitat, carbon storage and sequestration, and water flow regulation and purification. More than half of the region's wetlands have been converted to urban and other uses, and between 1989 and 1999, about 20 per cent of the wetlands in the Lower Fraser Valley were impacted by urbanization or agriculture. Wetlands, especially shallow and seasonal ones, are particularly vulnerable, because even small changes in hydrology can lead to significant changes in vegetation and habitat. Burns Bog is one of the largest raised bogs in coastal North and South America. More than 2,000 hectares of the bog is now protected as the Burns Bog Ecological Conservancy Area.

1: Taking Nature's Pulse provided the information base for this section.

Intertidal and estuarine areas are critical transition zones that link terrestrial, freshwater and marine habitats, and they too perform many essential ecosystem services. Boundary Bay provides internationally significant habitat for migrating birds along the Pacific Flyway with more than 2.3 million birds inhabiting or visiting each year. Intertidal areas and mudflats, such as Roberts and Sturgeon Banks also provide important feeding and resting grounds for shorebirds, waterfowl and raptors, especially in winter. These areas provide rich habitat, are nutrient sinks, and can also provide protection from climate change impacts such as erosion, coastal flooding, increased wave and storm activity and permanent inundation due to anticipated sea level rise.

Alpine and sub-alpine areas located in the North Shore Mountains are particularly vulnerable to climate change impacts as they are at elevations where small temperature changes would affect the tree line elevation and thus result in loss of habitat and an increase in the presence of invasive species.

The region's forests, both the large, contiguous reservoirs, and small, urban forests, provide habitat, store carbon, regulate water flow, remove pollutants from the air and provide natural air conditioning during hot weather.

Figure 1
Metro Vancouver – Geography of the Biodiversity Conservation Strategy Partnership

Purple Martin

Rough-Skinned Newt

Painted Turtle

The protected watersheds on the North Shore contain some of the region's last stands of old-growth temperate rainforest.

Agricultural lands represent about 20 per cent of the region's land base, and are protected from urban development through designation in the province's Agricultural Land Reserve. These areas not only provide food for humans, but they also can provide habitat for birds and other animals, regulate water, regenerate aquifers, and help to recycle nutrients and form soil. Urban agriculture also contributes to habitat and genetic diversity, especially for birds and native pollinators.

Beyond ecology, all these areas and ecological features contribute to the spectacular natural setting that inspires residents and attracts tourists. Our ecosystems and associated biodiversity are the foundation for abundant education, recreation, tourism, and health activities.

Species at Risk in Metro Vancouver

The greatest richness of species often occurs in areas of greatest human settlement – we all compete for great places to live. The Metro Vancouver region, for example, has more than 100 species that are provincially designated as Red or Blue species at risk. The list includes: 8 mammals, 24 birds, 3 amphibians, 1 reptile/turtle, 12 fish, 6 dragonfly/damselfly species, and 43 plant species. At a provincial scale, of the more than 50,000 species who make BC home, only 3,800 have been identified and assessed by scientists. Of those, 43 per cent are of conservation concern[2].

2: Taking Nature's Pulse 2008.

Threats to Metro Vancouver's Biodiversity

Many threats to biodiversity persist in this region. These threats are emphasized by the tension between the need and desire to protect the region's incredible and rich natural ecosystems and Metro Vancouver's continued urban growth.

Accommodating Growth

Metro Vancouver is an urban region anticipating a population of 3.4 million by 2040. The ongoing pressure to grow 'outward' where land prices are cheaper continues to have significant cumulative impacts on natural ecosystems. Our challenge is to develop a livable and sustainable region that ensures sufficient residential, commercial, industrial, agricultural and recreational capacity to accommodate that growth while protecting the region's natural assets and ecosystems.

Habitat Loss and Fragmentation

Competing interests on a limited land base continue to erode natural habitats from urban, industrial, agricultural and transportation developments. This has resulted in fewer and smaller places for native species to live, and diminished ecological functions and services. Less natural land cover (e.g. forests or open fields) decreases the capacity of the land to intercept rainfall, reduce stormwater and filter pollutants. Fragmentation reduces the ability of the remaining habitats to support wildlife and plant communities that need larger, interconnected habitats to complete their lifecycles. Fragmentation also makes individual species less adaptable to changes in water, food, or shelter availability.

Climate Change

The increasing effects of climate change on biodiversity in Metro Vancouver are difficult to isolate and measure, but changes to natural systems are occurring. Some predictions suggest increasingly warmer and drier summers, wetter winters, and flooding of low-lying coastal areas from rising sea levels. Of the many species and habitats in the region, some ecosystems may be more resilient to these changes while others may be extensively altered or displaced entirely.

Land Management Challenges

Many natural areas in Metro Vancouver have been significantly altered, reducing their ability to support diverse plant and animal communities. Agricultural intensification, recreational pressures, invasive species, and incompatible land uses even on 'protected' lands can all conflict with biodiversity conservation. Governments and conservation groups often acquire or designate land for environmental objectives. However, there is frequently inadequate follow-up management focusing on biodiversity. The opportunity to maintain, restore or enhance these protected lands is compromised if polices and plans do not specifically address biodiversity conservation.

Invasive Species

Invasive species are generally non-native species that colonize the landscape to such a degree that they replace or overwhelm the native species in an ecosystem and therefore cause havoc with ecological health. They threaten native species and natural ecosystems in all parts of the Metro Vancouver region. Particularly problematic invaders include reed canary grass, English ivy, purple loosestrife, Japanese knotweed, scotch broom, Himalayan blackberry, yellow flag iris, giant hogweed, policeman's helmet, Lamium and the American bullfrog.

Air, Water and Soil Pollution

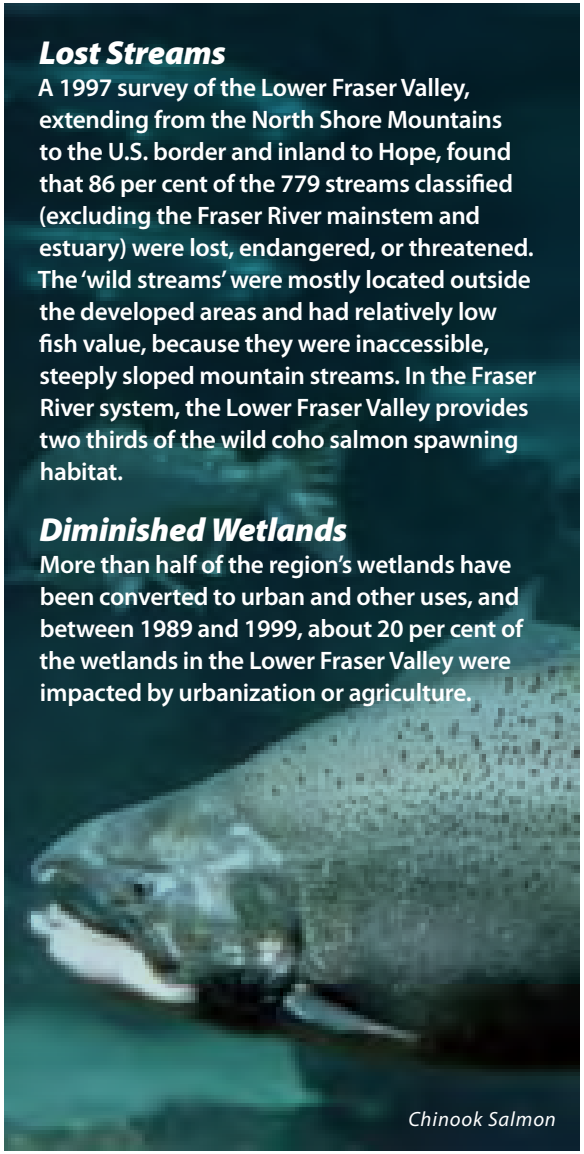
Pollutants impact ecological health. Sediments, metals, pesticides and other contaminants transported from stormwater runoff into waterways can reduce a species' ability to maintain biological functions (e.g., reproduction) in streams, wetlands and intertidal areas. Ground-level ozone known to impact humans can also have a detrimental effect on terrestrial species.

Lost Streams

A 1997 survey of the Lower Fraser Valley, extending from the North Shore Mountains to the U.S. border and inland to Hope, found that 86 per cent of the 779 streams classified (excluding the Fraser River mainstem and estuary) were lost, endangered, or threatened. The 'wild streams' were mostly located outside the developed areas and had relatively low fish value, because they were inaccessible, steeply sloped mountain streams. In the Fraser River system, the Lower Fraser Valley provides two thirds of the wild coho salmon spawning habitat.

Diminished Wetlands

More than half of the region's wetlands have been converted to urban and other uses, and between 1989 and 1999, about 20 per cent of the wetlands in the Lower Fraser Valley were impacted by urbanization or agriculture.



Chinook Salmon

IV Key Findings of the Biodiversity Conservation Strategy Partnership


Common Yellowthroat

Integration and Collaboration

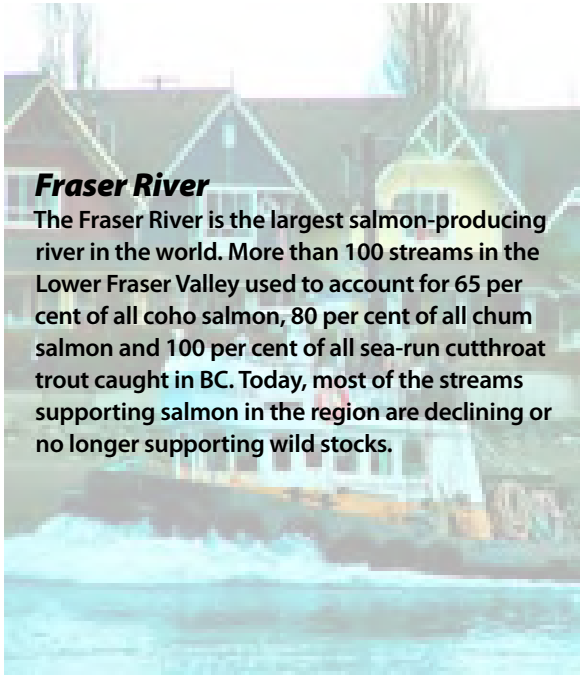
Early BCSP research focused on understanding the key challenges and opportunities facing governments and conservation organizations in conserving biodiversity in the region. It also identified their roles, responsibilities and successes in integrating biodiversity and ecosystem services into land use and development processes in an urban region experiencing significant growth. An inventory of initiatives related to biodiversity across the region identified a wide range of efforts, from regulatory mechanisms and policy and planning tools to research, education and on-the-ground stewardship. Most efforts focused on ecosystem components or specific habitats, rather than approaching biodiversity from a regional perspective.

Other research identified a number of significant challenges to improved integration of biodiversity values into land use decision making and development processes and the ability to practically implement biodiversity initiatives. These included: the continued lack of scientifically based data quantifying ecosystem services; ongoing barriers to protecting biodiversity on private lands; limited enforcement of existing regulations, and the need for further investigation and knowledge of economic tools and incentives that support biodiversity conservation. The research also identified that the biggest wins towards biodiversity conservation in the region would be: ensuring that a regional, or broader geographical and governance scale guides biodiversity conservation priorities, development of regional targets, indicators and performance measures, establishment of a solid monitoring program, and continued development of multi-agency partnerships and collaborative approaches.

Tree Cover

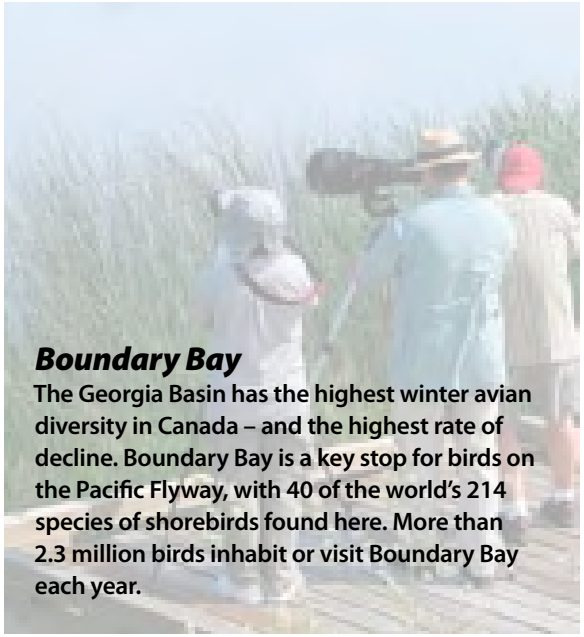
To help assess regional biodiversity, the BCSP used CITYgreen (a software package developed by American Forests) to quantify and compare some of the ecosystem services provided by trees in the region. Through orthophoto interpretation, it was determined that in 2002, about 45 per cent of the region was treed. Our protected watersheds, provincial Wildlife Management Areas and Ecological Reserves, and regional and provincial parks make up the majority of this tree canopy. It protects about 88 per cent of the region's old forests and 44 per cent of the region's young forests. An estimated 1,500 hectares of tree cover were lost between 1986 and 2002 in Metro Vancouver.

The value of tree cover in providing stormwater runoff reductions, improving air and water quality by removing pollutants, and in storing and sequestering carbon was evaluated in six watersheds that varied in tree coverage from 97 per cent to 12 per cent. Managing contaminant loadings was shown to be up to 10 times more effective in areas with extensive tree coverage than in those with minimal tree cover. An increase in roughly 25 per cent of tree cover was estimated to save more than $1.1 million in stormwater infrastructure costs. The loss of 1,500 hectares of tree cover can be translated into more than $254 million of extra infrastructure costs to manage the stormwater that was being controlled through natural processes. American Forests sets tree canopy targets for different types of land uses (ranging from low density residential at 50 per cent to central business districts at 15 per cent), and five of the six case study watersheds fell short of these targets.



Fraser River

The Fraser River is the largest salmon-producing river in the world. More than 100 streams in the Lower Fraser Valley used to account for 65 per cent of all coho salmon, 80 per cent of all chum salmon and 100 per cent of all sea-run cutthroat trout caught in BC. Today, most of the streams supporting salmon in the region are declining or no longer supporting wild stocks.



Boundary Bay

The Georgia Basin has the highest winter avian diversity in Canada – and the highest rate of decline. Boundary Bay is a key stop for birds on the Pacific Flyway, with 40 of the world's 214 species of shorebirds found here. More than 2.3 million birds inhabit or visit Boundary Bay each year.

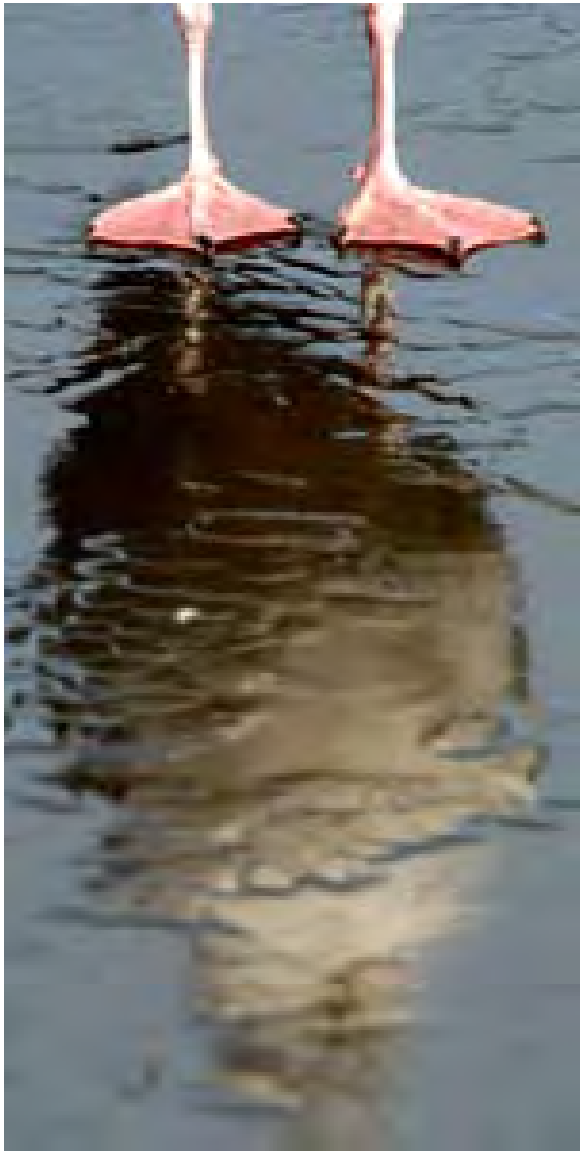
Biodiversity Mapping

The Regional Biodiversity Mapping Project, a milestone project completed in 2006 by the BCSP, confirmed the high biodiversity values of our region. The purpose of the project was to identify biodiversity 'hot spots' and create an overview to guide conservation efforts and assist agencies in integrating biodiversity into their policy development, land securement, management and stewardship activities. The maps categorized the region's habitats into 12 types, established the relative importance of those habitat types, and identified larger habitats and the connectivity among them. The maps were then combined to develop a composite 'Relative Biodiversity' map (Appendix 2).

The areas of high biodiversity shown on the maps were categorized into 'protected' and 'unprotected' areas. These areas provide tools to guide securing of priority lands and to improve land management practices to specifically include biodiversity conservation. The regional mapping, although a useful regionally scaled tool, requires ground-truthing at a site specific level. More work to refine the mapping is required to enhance its usability, accuracy and applicability at a variety of scales. Areas of greatest conservation concern continue to be wetlands, intertidal and coastal areas, stream corridors and steep slopes.

V Roles and Responsibilities

In Metro Vancouver, many agencies are responsible in some way for protecting and conserving biodiversity, making a complex jurisdictional environment. Although there is a wide range of regulatory and policy tools that impact biodiversity, none are explicitly biodiversity-focused. Biodiversity and natural systems are also complex in and of themselves, and do not adhere to administrative boundaries. Therefore, developing a clear picture of responsibilities has identified gaps in agencies' roles and in areas of concern for biodiversity conservation.



Federal Government

The federal government has exclusive jurisdiction over federally-owned lands and the power to regulate navigable waters. The Canadian Constitution also gives the federal government power to pass laws relating to fisheries, shipping, inter-provincial trade and commerce, and criminal law. Managing wildlife in Canada is a responsibility shared by the federal, provincial, and territorial governments. Federal responsibility includes protection and management of migratory birds as well as nationally significant wildlife habitat, and responsibilities for endangered species, control of international trade in endangered species, research on wildlife issues of national importance, and international wildlife treaties and issues.

In addition, the federal government has a mandate to protect and conserve almost all marine species, most anadromous species, habitat that falls under federal legislation (such as recognized fish habitat or habitat in national parks), National Marine Conservation Areas and National Wildlife Areas, and habitat in offshore areas (i.e., within the Exclusive Economic Zone seaward of recognized internal waters).

Banana Slug

Provincial Government

The provincial government is responsible for agriculture, forestry, mining and hydroelectric development, and has the authority to pass most environmental laws. Essentially, the province also 'owns' most natural resources. Generally, provincial and territorial wildlife agencies are responsible for conserving and managing wildlife populations and habitat within their borders, and for issuing licenses, permits and guidelines for fishing, game hunting and trapping.

Provincial legislation covers water pollution, air pollution and most wildlife conservation and management regulations, and the creation of ecological reserves and wilderness areas. Provinces also have the power to delegate responsibility for dealing with some environmental issues (e.g., pollution) to municipal and regional governments. Although the provincial government influences resource management on most of the provincial land base, and although many of the provincial statutes consider wetland management, there is no single comprehensive legislation that directly addresses biodiversity.

First Nations

Under the *Indian Act*, First Nations currently have reserve lands held collectively and set aside for the use and benefit of a band, with no individual ownership in the same way as off reserves. Biodiversity conservation objectives are currently achieved either through provisions of the *Indian Act* or the *Federal First Nations Land Management Act* (1999). The latter provides signatory First Nations with the authority to make laws in relation to reserve land and replaces the governing land management legislation contained in the *Indian Act*. Federal laws apply to all First Nations reserve lands, whereas provincial and other legislation are not automatically applicable on reserves. In the future, biodiversity conservation objectives may also be pursued in Final Agreements by treaty First Nations (e.g., Tsawwassen), who will have the powers to develop their own environmental laws or, alternatively, have federal and provincial environmental laws apply to treaty settlement lands.

Regional District

Metro Vancouver protects and conserves biodiversity as part of its corporate responsibilities for regional parks and greenways, growth management, liquid and solid waste management, drinking water provision and watershed management. The Parks and Greenways Plan aims to secure, enhance and manage regionally significant landscapes, critical habitats and conservation lands. The Livable Region Strategic Plan (the regional growth strategy) protects the Green Zone – comprising almost two thirds of the region's land base – from urban development. These lands include the region's protected watersheds, conservation areas, major parks and agricultural lands. Through its Liquid Waste Management Plan, Metro Vancouver is committed to managing wastewater and stormwater in a way that protects receiving waters. The Drinking Water Management Plan recognizes and protects the North Shore watersheds as natural assets.

Local Governments

Local governments are empowered to make land use planning decisions and can thus play an extremely important role in conserving biodiversity. Through official community plans and zoning bylaws, local governments can identify environmentally sensitive areas and designate lands for conservation, parks, or other uses compatible with maintaining and enhancing local and regional biodiversity. Through the *Community Charter, Vancouver Charter* and *Local Government Act*, municipalities can make bylaws to ensure watercourse protection, regulate tree removal, manage stormwater flows, and prevent harmful chemical inputs to the environment.

By working closely with the development community, local governments can help ensure that biodiversity conservation is considered at every stage of the land development process with an aim to maintaining natural areas and ecological processes, providing for habitat connectivity, and managing the environmental impacts of new construction. In addition to their regulatory roles, local governments can provide residential and business landowners with information about biodiversity, environmental protection and 'green' development.

Rufus Hummingbirds

Tree Swallow

Darner Dragonfly

Quasi-Government Organizations

Quasi-government organizations in Metro Vancouver include the Port Metro Vancouver and Vancouver International Airport Authority (YVR). These organizations liaise in various ways with surrounding local governments, the provincial government and the federal government. Both YVR and the Port Metro Vancouver have environmental advisory committees/staff and jurisdiction over some of the region's land with the highest biodiversity.

Conservation Organizations

There is a wide array of organizations and stewardship groups actively involved in biodiversity conservation. While the larger national and provincial organizations often focus on securing and managing land, lobbying for policy and regulatory reform and undertaking environmental litigation, local stewardship groups more often focus on landowner contact, education, habitat enhancement and restoration projects. Often these organizations become authorities in specialized disciplines such as conservation land management, nature interpretation or policy development. They also lead public education about the important connection between biodiversity and community well-being. Their advocacy and actions encourage governments to increase protection of natural assets, species at risk and conservation lands.

Conservation Partnerships

Alliances between government agencies and conservation organizations are one of the most effective ways to support biodiversity and protect wildlife habitat. There are a number of these multi-agency conservation partnerships in the region that focus on land securement or a defined geographic area. Examples of these partnerships include the Burrard Inlet Environmental Action Program, the Fraser River Estuary Management Program, the Wetland Stewardship Partnership, Invasive Plant Council of BC, Fraser Basin Council, Pacific Estuary Conservation Program, Pacific Coast Joint Venture, South Coast Conservation Program and Biodiversity BC.

VI Biodiversity Conservation Vision and Goals

Vision:

A region rich in ***natural diversity*** with a network of habitats and healthy ecosystems that are ***valued and conserved***

Goals:

1. A connected, biologically diverse network of habitats
2. Healthy, resilient ecosystems and ecosystem services across the region
3. Communities actively involved in caring for and conserving biodiversity

Saw-whet Owl

Guiding Principles

Ten key principles informed the development of the Strategic Directions Report. The ecological principles address physical conservation, while the process principles define how to approach biodiversity issues and work collaboratively toward solutions.

Ecological Principles

1 **Consider the Regional Context.** Metro Vancouver has unique natural assets including the Fraser River Estuary, Boundary Bay, the Coast Mountains, forest and watersheds, Burrard Inlet, and Maplewood mudflats with linkages to the Pacific Flyway and the Georgia Strait. The region lies within the larger Georgia Basin, and many ecosystems cross municipal and international boundaries. Local and regional land use decisions must consider the impacts and inter-relationships.

2 **Protect Core Habitat Areas.** Large contiguous natural areas, reservoirs and refuges are essential to species and ecological functions in our region.

3 **Maintain diversity of ecosystems, species and genetics.** Diversity in ecosystem types is important because it leads to higher species and genetic diversity. A single population of a particular species is vulnerable to disturbance or disease.

4 **Connect Habitat Areas.** Habitat areas that are connected are more sustainable. Watercourses, riparian areas, greenways and utility corridors offer good opportunities to link habitat, improve the viability and resilience of ecosystems and allow movement of species and genetic material.

5 **Benefit from Nature's Services.** People depend on ecosystems for invaluable, irreplaceable services. These ecosystem services include stormwater management, flood mitigation, water and air purification, climate moderation, soil generation, nutrient recycling, waste decomposition, pest control and pollination.

6 **Protect Environmental Health.** Ending environmental degradation and fragmentation, and improving water, air and soil quality are essential to sustaining human life, species and habitats.

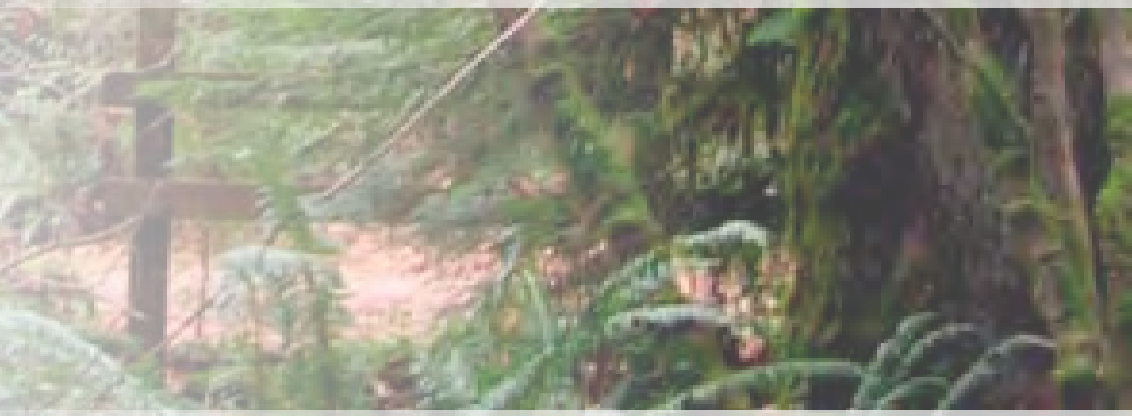
Process Principles

7 **Shared Responsibility.** To conserve and enhance the region's biodiversity, decision makers, landowners, communities and individuals must work collaboratively to identify problems, capitalize on opportunities, develop options and implement solutions.

8 **Ecosystem-based Approach.** Conserving biodiversity involves protecting ecosystem functioning as the first management priority. An ecosystem-based approach considers all ecosystem components, including humans and the environment, rather than managing one issue or resource in isolation.

9 **Adaptive Management.** A systematic and adaptive process should be used to continually improve management policies and practices and learn from program outcomes.

10 **Precautionary Decision Making.** Decisions and actions that conserve biodiversity should not be postponed or dismissed because of lack of knowledge, especially where there is a risk of significant or irreversible damage to ecosystems or species.



VII Strategic Directions: Identifying Opportunities and Focusing Efforts

In translating the vision and goals for biodiversity conservation into action, we need to build on biodiversity conservation successes and efforts already underway. We are making progress, but there is much more to do. The strategic directions below originated from a review of gaps in biodiversity conservation regionally, and are framed within ten subject areas. Opportunities for action are listed with each strategic direction to clarify and guide implementation.


Sandpipers

Institutional Arrangements

1 Build organizational capacity and develop champions within organizations

Opportunities for action

- Integrate biodiversity into organizational structures and mandates.
- Improve interagency collaboration and capitalize on partnership opportunities.
- Integrate biodiversity values into corporate decision making and culture.
- Define agency roles and actions for biodiversity conservation, clarifying roles for senior and local governments, areas of overlap and remaining gaps.
- Ensure consistent commitment and resources around biodiversity from federal, provincial and municipal levels.
- Strive for better and more consistent use of innovative policies and practices.
- Create more visible, engaged information sharing on data and best practices.

Legislation and Regulation

2 Develop flexible 'results-based' legislation that ensures accountability for achieving effective biodiversity conservation

Opportunities for action

- Make better use of existing legislation that addresses biodiversity components and their conservation.
- Allocate the required funding and resources for the enforcement and follow up implementation efforts associated with existing environmental regulations.
- Explore opportunities for broader environmental laws that encompass ecosystems beyond a single focus, such as fish or trees.
- Develop strong results-based biodiversity legislation with built in enforcement and achievable results.

Land Use Planning and Development Processes

3 Improve the incorporation of biodiversity conservation priorities into plans and policies

Opportunities for action

- Improve integration of biodiversity into the regional growth strategy, port plans, estuary management plans, official community plans, area and neighbourhood plans, integrated stormwater management plans, park plans, and watershed plans.
- Improve regional scientific data on environmentally sensitive areas and biodiversity to help planners identify appropriate zoning and policies within their jurisdictions.
- Collaborate to support better and more consistent uptake and use of innovative policies and practices in official community plans and other plans across the region.

4 Ensure that development processes integrate biodiversity values and environmental innovation

Opportunities for action

- Disseminate information about tools and incentives to promote protecting biodiversity on private lands.
- Make better use of existing tools and incentives (e.g., the Green Bylaws Toolkit) by improving local government understanding and uptake of opportunities to conserve biodiversity (such as environmental development permit areas, low impact design guidelines, sustainability checklists, tax incentives, density bonusing, development cost charge breaks and conservation covenants).
- Continue to identify regulatory, fiscal and other tools and incentives to specifically address biodiversity conservation.
- Explicitly integrate biodiversity goals and issues into development processes, rather than piggy-backing them on to existing processes or measures such as stream or tree bylaws.

Secure Land

5 Build on the existing regional park and Green Zone network including: habitats and corridors to protect ecosystem services and functions; unique and representative habitats; habitats for species at risk; and adequate buffers

Opportunities for action

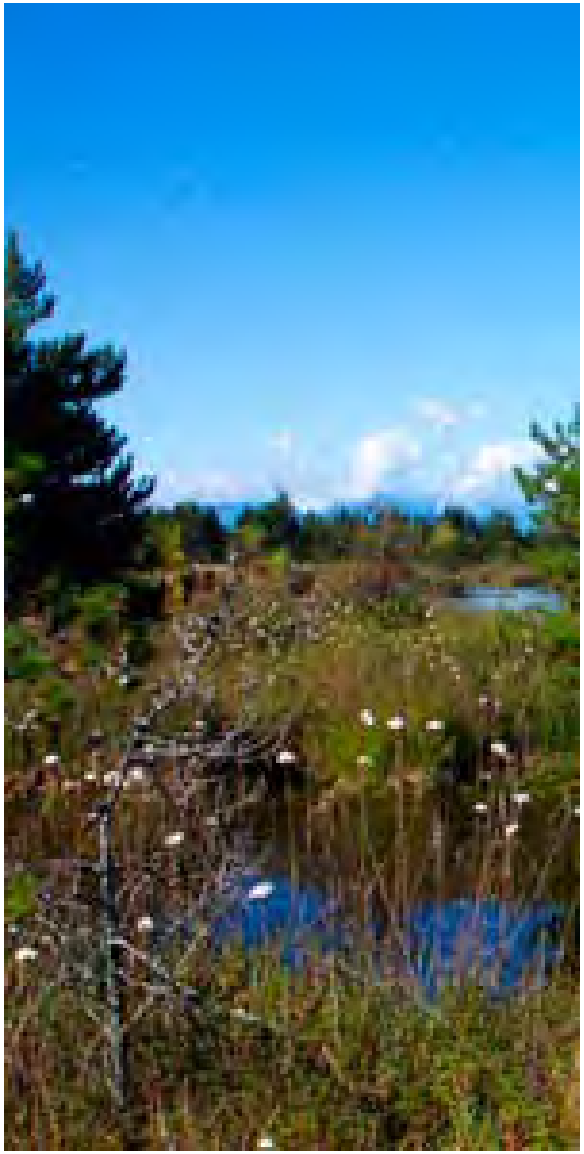
- Develop an updated, regionally focused parks and conservation land acquisition strategy that includes biodiversity as an important selection criterion.
- Update regional wetland inventory and status information.
- Use and expand on current opportunities, such as partnered acquisitions, conservation covenants and eco-gifting to improve the approach to land acquisition for biodiversity conservation.
- Use existing and emerging securement strategies and regional and local biodiversity mapping to guide actions, and focus on enhancing connectivity among habitats and protected areas.

Protected Areas Management

6 Manage, enhance and restore biodiversity and features of protected natural areas, habitats, and corridors

Opportunities for action

- Develop and regularly update management plans, and consciously integrate biodiversity conservation.
- Allocate more consistent and dedicated work to remove invasive species.
- Provide greater focus on ecosystem level planning.
- Provide consistent, dedicated resources for active land management to ensure that once a site is acquired or secured, the site's biodiversity is conserved.
- Design better buffering for protected lands.
- Minimize incompatible uses on lands within and adjacent to protected lands.



Private Land Stewardship

7 Develop and utilize incentives and education to encourage better uptake of existing programs and voluntary stewardship on private lands

Opportunities for action

- Increase private sector involvement in developing economic incentives, regulatatory measures, and key education messages. (Currently, incentives are limited, and existing tools are not sufficiently used to adequately protect ecologically sensitive areas on private lands.)
- Increase efforts to motivate property owners to conserve biodiversity on private lands.
- Bring together stewardship practitioners and program owners across the region to improve private land stewardship efforts, with specific focus on identified ecologically sensitive areas.

Map, Monitor, Research

8 Ensure sufficient biophysical information from a regional to a site specific scale to make scientifically defensible, measurable, ecosystem-based land use decisions

Opportunities for action

- Refine and build on regional ecological mapping based on existing regional biodiversity and environmentally sensitive areas mapping from all levels of government to improve policy development, land use decision making, and acquisition and management strategies and actions.
- Monitor habitat losses and gains in the region including changes in the conservation status of species and ecosystems.
- Encourage the use of provincial standards and methods for data collection and mapping to enable better sharing, evaluating and monitoring.
- Develop regional performance measures and indicators for biodiversity.
- Report on the region's state of biodiversity to measure progress towards goals.

Education / Communication

9 Promote better understanding of biodiversity, our region's natural assets, and habitats. Rekindle residents' connection to nature and encourage communities to to become actively involved in conserving and restoring biodiversity

Opportunities for action

- Develop more coherent messaging and consistent communication about biodiversity in Metro Vancouver.
- Create a regional communications working group to improve co-ordination and consistent messaging, and to ensure that existing biodiversity resources are available to local governments, conservation groups and landowners.
- Develop factual anecdotes about the region's importance in terms of biodiversity, beyond a focus on local or site specific issues.
- Raise the profile of terrestrial systems.
- Develop science-based analysis demonstrating the long-term economic values of ecosystem services.

Implementation

10 Confirm agencies or partnerships to undertake or champion the following priority actions

Priority actions

- Establish an administrative model to implement the strategic directions to provide opportunities for improved coordination, collaboration, information sharing and status monitoring.
- "Develop a regional ecological plan that addresses biodiversity within a broader ecological context.
- Refine existing regional biodiversity and environmentally sensitive areas mapping to improve policy development, land use decision making, and acquisition and management strategies and actions.
- Define regional scale biodiversity indicators and performance measures to track the state of biodiversity and conservation progress in the region.

Snow Geese

VIII Moving Forward

Implementing the Biodiversity Conservation Strategy is a shared responsibility. A critical step is engaging agencies and organizations to commit to specific actions that complement existing mandates and programs. The Strategic Directions for Biodiversity Conservation in the Metro Vancouver Region report provides a strong framework from which existing, proposed and future initiatives by multiple organizations can dovetail to better conserve biodiversity. The following points illustrate some key initiatives underway to conserve biodiversity in Metro Vancouver.

- As part of Canada's national strategy for the protection of species at risk, the federal government established the Habitat Stewardship Program (HSP) for Species at Risk in 2000. The HSP allocates up to $10 million anually to projects that conserve and protect species at risk and their habitats. In the Greater Vancouver region, HSP-funded projects include the Langley Environmental Partners restoration work for the Nooksack dace and Salish sucker, The Vancouver Aquarium cetacean and sea turtle sightings on the coast, the Fraser River Sturgeon Conservation Society for habitat inventory and survey work, and the Fraser Valley Conservancy for workshops aimed at promoting stewardship to land owners and municipal regulators.
- There are five main federal funding programs centred on the protection and recovery of species at risk being implemented by Environment Canada, Fisheries and Oceans Canada, and the Parks Canada Agency. They are the Habitat Stewardship Program, Interdepartmental Recovery Fund, the Endangered Species Recovery Fund, the Aboriginal Capacity Building Fund and the Aboriginal Critical Habitat Protection Fund.
- The Conservation Framework is the province's new approach for maintaining BC's rich biodiversity. The framework provides a set of science-based tools and actions to better protect species and ecosystems at risk. The Conservation Framework will help to coordinate and align conservation efforts across government and non-government sectors.
- *The Local Government* (Green Communities) *Status Amendment Act* (Bill 27) gives local governments powers to make changes regarding development cost charge exemptions, waivers and reductions, and expanded development permit area authority to reduce greenhouse gas (GHG) emissions and requires that official community plans and regional growth strategies include GHG targets.
- Biodiversity BC released a scientific assessment, Taking Nature's Pulse: The Status of Biodiversity in British Columbia, to help British Columbians make informed choices regarding biodiversity.
- Securing land to protect natural areas and their ecological value continues to be a priority for governments and conservation organizations, and collaborative acquisition is more frequent. Conservation groups such as the Nature Trust of BC, the Land Conservancy of BC and the Pacific Estuary Conservation Program play a key role.

Sandhill Crane

- The Burrard Inlet Environmental Action Program released an Environmental Indicators Report in 2008 measuring the status and trends of ecological health and biodiversity in the Burrard Inlet watershed.
- Metro Vancouver is updating the regional growth strategy to include policies that better protect natural assets both in the Green Zone and in urban areas, and is embarking on an ecological health plan in 2009. With regard to regional parks, Metro Vancouver integrated biodiversity as a criterion into acquisition planning, and in recent acquisitions, has focused on wetlands and conservation areas with high biodiversity values.
- Local governments are taking a leading role in conducting environmentally sensitive area and wildlife inventories, parks and land acquisition strategies, environmental bylaws, farmland and watercourse stewardship programs, development permitting, and integrated approaches to stormwater management. For example, in September 2008, the Township of Langley approved a Wildlife Habitat Conservation Strategy.
- A newer, active partnership in the region is the South Coast Conservation Program. It is a joint venture between the provincial and federal governments, Metro Vancouver Regional District, Fraser Valley Regional District, land trusts, BC Nature and Lower Mainland municipalities. It is a landscape-level conservation program with the primary objective of coordinating and facilitating the maintenance and recovery of species and ecosystems at risk in the Lower Mainland eco-region of the South Coast of British Columbia.
- Conservation organizations work in a complimentary role alongside regulators, land use authorities and land use decision makers. Their ability to take expedient action and form a voice of collective advocacy enables the development of flexible partnerships and innovative opportunities to conserve biodiversity. In the 2007 Biodiversity Action Profiles, 51 different projects, programs and community-based efforts were identified across the region that are actively effecting change in biodiversity conservation and awareness.
- In addition to many on-the-ground initiatives, the Fraser Basin Council (FBC) biannually issues a State of the Fraser Basin Report on more than 20 different indicators of environmental, ecological and economic health in the basin. FBC's Sustainability Snapshot 4 will be released in early 2009.

IX References

Adamah Consultants. 2007. *Biodiversity Action Profiles.* Biodiversity Conservation Strategy Partnership, Burnaby, BC.

Austin, M.A., D.A. Buffett, D.J. Nicolson, G.G.E. Scudder, and V. Stevens (eds.). 2008. *Taking Nature's Pulse: The Status of Biodiversity in British Columbia.* Biodiversity BC, Victoria, BC.

Axys Environmental Consulting. 2006. *Assessment of Regional Biodiversity and Development of a Spatial Framework for Biodiversity Conservation in the Greater Vancouver Region.* Biodiversity Conservation Strategy Partnership, Burnaby, BC.

Axys Environmental Consulting. 2005. *Still Creek Watershed Biodiversity Conservation Case Study Final Report.* Biodiversity Conservation Strategy Partnership, Burnaby, BC.

Axys Environmental Consulting. 2003. *Biodiversity Conservation in the Greater Vancouver Region: Issues and Strategic Directions Research. Phase I: Review of Key Biodiversity Conservation Issues, Roles and Responsibilities.* Biodiversity Conservation Strategy Partnership, Burnaby, BC.

Axys Environmental Consulting. 2003. *Biodiversity Conservation in the Greater Vancouver Region: Issues and Strategic Directions Research. Phase III: Priorities, Opportunities and Strategic Directions.* Biodiversity Conservation Strategy Partnership, Burnaby, BC.

C. A. Boyle, L. Lavkulich, H. Schreier, E. Kiss. 1997. *Changes in Land Cover and Subsequent Effects on Lower Fraser Basin Ecosystems from 1827 to 1990.* Environmental Management Vol. 21, No. 2, pp. 185–196.

Daily, Gretchen C., et al. 1997. *Ecosystem Services: Benefits Supplied to Human Societies by Natural Ecosystems.* Ecological Society of America. Ecology No. 2, Spring.

David Suzuki Foundation. 2007. *Rich Species, Poor Protection: The urgent need for strong legal protection of British Columbia's biodiversity.* Vancouver, BC.

Environmental Law Clinic, University of Victoria and Deborah Curran and Company 2008. *Green Bylaws Toolkit for Conserving Sensitive Ecosystems and Green Infrastructure.* Prepared for: Wetland Stewardship Partnership, Ducks Unlimited Canada, Grasslands Conservation Council of British Columbia, Environment Canada, and the Province of British Columbia. Part of the Stewardship Series. Available at The Stewardship Centre of BC. www.stewardshipcentre.bc.ca

Lee, N. and H. Rudd. 2003. *Conserving Biodiversity in Greater Vancouver: Indicator Species and Habitat Quality.* Vancouver, BC.

Lees and Associates. 2007. *Framework for Action: Conserving Biodiversity in the Greater Vancouver Region.* Biodiversity Conservation Strategy Partnership, Burnaby, BC.

Millennium Ecosystem Assessment. 2005. *Our Human Planet: Summary for Decision Makers.* Washington, DC, Island Press.

Moola, F., D. Page, M. Connolly, and L. Coulter. 2007. *Waiting For The Ark: the biodiversity crisis in British Columbia, Canada, and the need for a strong endangered species law.* Biodiversity, Volume 8, Issue 1.

West Coast Environmental Law. 1996. Biodiversity Law and Policy in BC. www.wcel.org/wcelpub/10986.html

Other supplementary information can be found at:
www.metrovancouver.org/planning/development/biodiversity

X Acknowledgements

Thanks to all who participated in the studies, workshops, forums, and meetings hosted by the Biodiversity Conservation Strategy Partnership and to the Working Group members who have supported the partnership over the years. Steering Committee members contributed significant time, commitment and resources and have been instrumental in the success of the partnership. Therefore special thanks go out to the following individuals:

Elaine Anderson
Ken Bennett
Zita Botelho
Ken Brock
Dianna Colnett
Lesley Douglas
Theresa Duynstee
Erin Embley
Lanny Englund
Michelle Gaudry
Stephen Godwin
Susan Haid
Jan Kirby
Rob Knight
Anna Mathewson
Ross Neuman
Marcy Sangret
Robyn Wark
Heather Wornell
Pamela Zevit

Photo Credits

We thank and acknowledge the following talented photographers who freely allowed their work to be displayed in this document.

Cover	Tree Frog	Jeremy Plotkin
	Melissa Blue Butterfly	Werner Eigelsreiter
Page 1	Sandpiper	Jason Puddifoot
Page 2	Douglas Squirrel	Jeannie Bespoyasny
	Family Walking	Sharon Doucette
Page 3	Evening Canoe	Vanessa Elton
Page 4	Great Blue Heron	Isabelle Groc
	Red Rock Crab	Isabelle Groc
Page 6	Purple Martins	Rick Leche
	Rough-skinned Newt	Vida Morkunas
	Painted Turtle	Chris Campbell
Page 7	Agricultural Lands	Evan Leeson
Page 8	Trees in Mist	L.A. Guenther
Page 9	Chinook Salmon	Jeff Kozlowski
Page 10	Common Yellowthroat	Jason Puddifoot
Page 11	Bald Eagle	Isabelle Groc
	Blackie Spit	Sharon Doucette
Page 12	Fraser River Tugboat	Mark Webber
	Boundary Bay Photographers	Stephen Rees
Page 13	Duck Reflection	Isabelle Groc
Page 14	Totem Pole	Craig Christensen
	Banana Slug	Bonnie Giovannetti
Page 15	Rufus Hummingbirds	Isabelle Groc
Page 16	Tree Swallow	Isabelle Groc
	Darner Dragonfly	Annette Colombini
Page 17	Saw-whet Owl	Sheila Linn
Page 18	Mossy Forest	Vida Morkunas
Page 19	Sandpipers	Tom Middleton
Page 21	Burns Bog	Marcy Sangret
Page 23	Snow Geese	Markus Merkens
Page 24	Jumping Salmon	Isabelle Groc
Page 25	Sandhill Crane	Jason Puddifoot
Page 31	Land Graphic	Jamie Vala

Appendix 1:

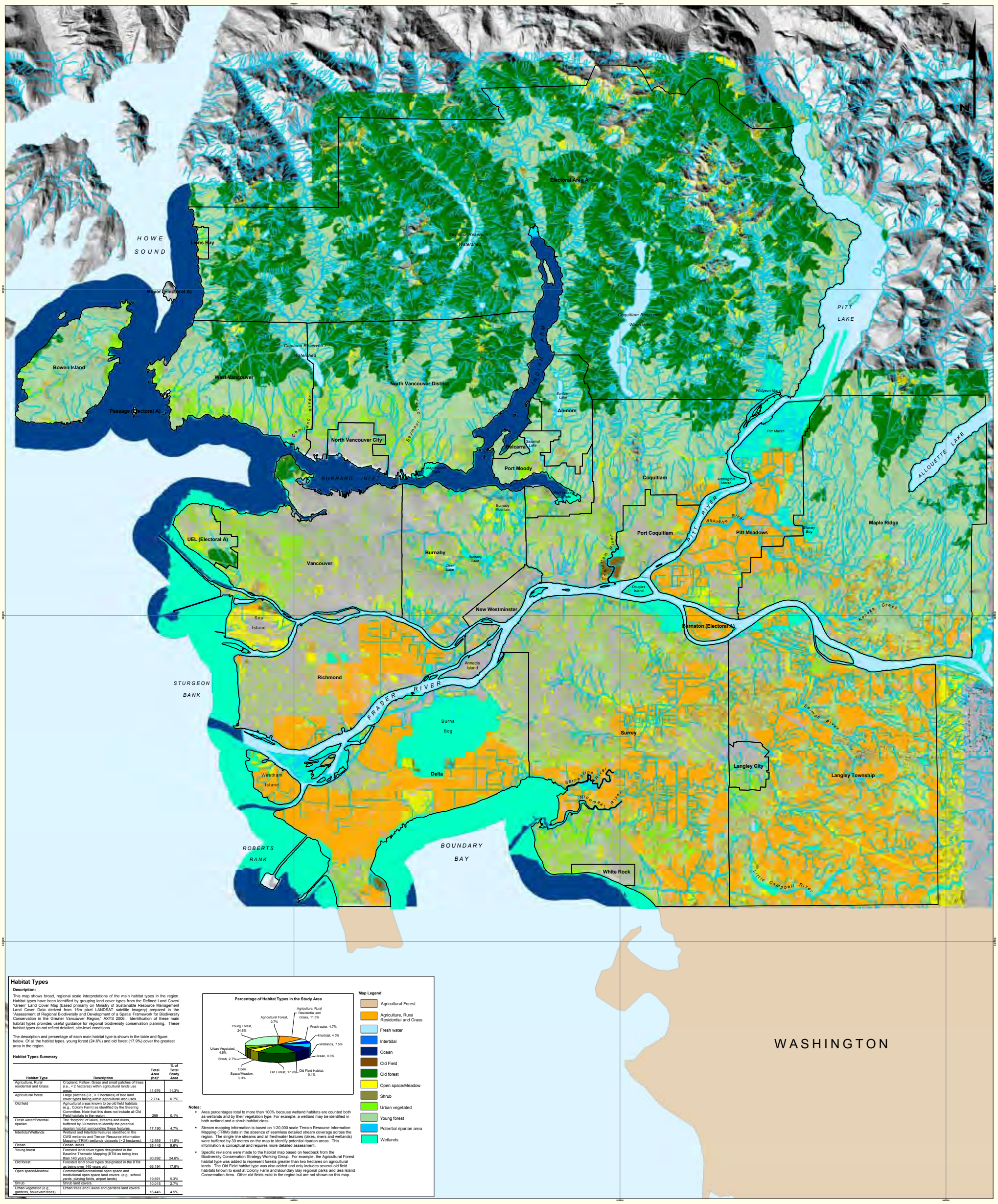
Legislative Tools for Biodiversity Conservation

	LEGISLATION	DESCRIPTION (how it relates to biodiversity conservation)
FEDERAL	Canadian Environmental Protection Act	Is an amalgam of several acts concerning environmental standards, protection, and penalties for violation. It deals primarily with regulation of pollution.
	Canadian Environmental Assessment Act	Ensures that a rigorous environmental assessment and public consultations are performed on projects carried out by the federal government or Crown corporations.
	Canada Marine Conservation Areas Act	Enables the establishment of marine conservation parks and a network of marine protected areas.
	Canada National Parks Act	Maintains and restores the ecological integrity of Canada's national parks.
	Canada Wildlife Act	Authorizes the acquisition of land by the federal government for creating National Wildlife Areas and protecting marine areas.
	Fisheries Act	Subsection 35(1) is a general prohibition of harmful alteration, disruption or destruction of fish habitat.
	Income Tax Act	Includes provisions for ecological gifts
	Migratory Birds Convention Act	Prevents the commercialization of migratory birds by hunting and trafficking, and allows the federal government to establish Migratory Bird Refuges.
	Oceans Act	Allows Canada to enforce its rights and responsibilities over exploration and exploitation of living and nonliving resources in the Exclusive Economic Zone (EEZ), which extends for 200 nautical miles off Canadian coasts.
	Species at Risk Act (SARA)	SARA provides for scientific assessment of the status of species through an organization (COSEWIC) and applies to all federal lands in Canada.

	LEGISLATION	DESCRIPTION (how it relates to biodiversity conservation)
PROVINCIAL	Agricultural Land Commission Act	Sets out processes for land use approvals including the inclusion or removal of land from the Agricultural Land Reserve, non-farm uses and subdivisions.
	Agricultural Land Reserve Use, Subdivision and Procedure Regulation	Details procedures for applications and defines permitted land uses and land subdivisions within the Agricultural Land Reserve.
	Drainage, Ditching and Diking Act	This Act establishes a comprehensive scheme for the regulation and authorization of ditches, watercourses, dikes and drainages throughout B.C.
	Drinking Water Protections Act	Covers all water systems other than single family dwellings and outlines water requirements for water supplies.
	Ecological Reserves Act	Provides for the establishment and administration of ecological reserves in the Province. New ecological reserves are created by regulation (order-in-council).
	Environmental Assessment Act	Proposed projects designated as reviewable projects as a result of prescribed type, size, scope or location are subject to an environmental assessment.
	Fish Protection Act	Prohibits dams, designates sensitive streams, limits Water Act approvals and licenses on sensitive streams, and allows the development of recovery plans and actions to protect fish habitat.
	Land Act	Governs the disposition, management and administration of Crown land and for base mapping and land information systems in B.C.
	Park Act	Prohibits any person from transporting garbage, refuse, domestic or industrial waste through, in, or over a park except with a permit for park use.
	Riparian Areas Regulation	Enacts sections 12, 13 and 37 of the Fish Protection Act. Establishes directives to protect riparian areas from development so that the areas can provide natural features, functions and conditions that support fish life processes.
	Waste Management Act	Prohibits the discharge of all wastes to the environment and pollution, unless the discharge is exempt or is made in accordance with a system of permits or approvals.
	Water Act	Legislation for managing the diversion and use of provincial water resources including: flow regulation; authorization of water use development; water supply, pollution control; and power development.
	Wildlife Act	Enables the listing of plant, animal and invertebrate species at risk and protection of the residence of a listed species through the designation of Wildlife Management Areas.
REGIONAL	Regional Growth Strategy	A shared commitment among member municipalities and the region that provides a long range vision and framework for land use policies.
LOCAL	Official Community Plans (OCP)	A statement of objectives and policies to guide decisions on planning and land use management, respecting the purposes of local government.

Appendix 2:

Maps



Habitat Types

Description:

This map shows broad, regional scale interpretations of the main habitat types in the region. Habitat types have been identified by grouping land cover types from the Refined Land Cover/ "Green" Land Cover Map (based primarily on Ministry of Sustainable Resource Management Land Cover Data derived from 15m pixel LANDSAT satellite imagery) prepared in the "Assessment of Regional Biodiversity and Development of a Spatial Framework for Biodiversity Conservation in the Greater Vancouver Region," AXYS 2006. Identification of these main habitat types provides useful guidance for regional biodiversity conservation planning. These habitat types do not reflect detailed, site-level conditions.

The description and percentage of each main habitat type is shown in the table and figure below. Of all the habitat types, young forest (24.6%) and old forest (17.9%) cover the greatest area in the region.

Habitat Types Summary

Habitat Type	Description	Total Area (ha)*	% of Total Study Area
Agriculture, Rural residential and Grass	Cropland, Fallow, Grass and small patches of trees (i.e., < 2 hectares) within agricultural lands use areas	41,676	11.3%
Agricultural forest	Large patches (i.e., > 2 hectares) of tree land cover types falling within agricultural land uses.	2,714	0.7%
Old field	Agricultural areas known to be old field habitats (e.g., Colony Farm) as identified by the Steering Committee. Note that this does not include all Old Field habitats in the region.	299	0.1%
Fresh water/Potential riparian	The 'footprint' of lakes, streams and rivers, buffered by 30 metres to identify the potential riparian habitat surrounding these features.	17,190	4.7%
Intertidal/Wetlands	Wetland and Intertidal features identified in the CWS wetlands and Terrain Resource Information Mapping (TRIM) wetlands datasets (> 2 hectares).	42,556	11.5%
Ocean	Ocean areas	35,446	9.6%
Young forest	Forested land cover types designated in the Baseline Thematic Mapping (BTM as being less than 140 years old.	90,892	24.6%
Old forest	Forested land cover types designated in the BTM as being over 140 years old.	66,194	17.9%
Open space/Meadow	Commercial/Recreational open space and Institutional open space land covers (e.g., school yards, playing fields, airport lands)	19,691	5.3%
Shrub	Shrub land covers.	10,015	2.7%
Urban vegetated (e.g., gardens, boulevard trees)	Urban trees and Lawns and gardens land covers.	16,446	4.5%

Notes:

- Area percentages total to more than 100% because wetland habitats are counted both as wetlands and by their vegetation type. For example, a wetland may be identified in both wetland and a shrub habitat class.
- Stream mapping information is based on 1:20,000 scale Terrain Resource Information Mapping (TRIM) data in the absence of seamless detailed stream coverage across the region. The single line streams and all freshwater features (lakes, rivers and wetlands) were buffered by 30 metres on the map to identify potential riparian areas. This information is conceptual and requires more detailed assessment.
- Specific revisions were made to the habitat map based on feedback from the Biodiversity Conservation Strategy Working Group. For example, the Agricultural Forest habitat type was added to represent forests greater than two hectares on agricultural lands. The Old Field habitat type was also added and only includes several old field habitats known to exist at Colony Farm and Boundary Bay regional parks and Sea Island Conservation Area. Other old fields exist in the region but are not shown on this map.

Map Legend

- Agricultural Forest
- Agriculture, Rural Residential and Grass
- Fresh water
- Intertidal
- Ocean
- Old Field
- Old forest
- Open space/Meadow
- Shrub
- Urban vegetated
- Young forest
- Potential riparian area
- Wetlands

Major Regional Habitat Types

0 4 8 12
Kilometres

Data Sources:
Greater Vancouver Regional District
Ministry of Sustainable Resource Management
Projection: Universal Transverse Mercator
Zone 10 NAD83

The Biodiversity Conservation Strategy for the Greater Vancouver Region is a joint project under the Georgia Basin Action Plan. Project partners include the Greater Vancouver Regional District, Environment Canada (through the Georgia Basin Action Plan's Coordination Office and Canadian Wildlife Service), Province of British Columbia (Ministry of Environment), and Burrard Inlet Environmental Action Program/Fraser River Estuary Management Program with input from GVRD member municipalities, Simon Fraser University (Resources and Environmental Management), Douglas College Institute of Urban Ecology, Langley Environmental Partners' Society, and the Como Watershed Group.

Map prepared by:
AXYS Environmental Consulting Ltd.
March, 2006

This map has been prepared as part of the study, Assessment of Regional Biodiversity and Development of a Spatial Framework for Biodiversity Conservation in the Greater Vancouver Region, by AXYS Environmental Consulting Ltd, 2006. Information on this map is at a broad, regional scale and is based on a variety of data sources. There are inaccuracies in the map and further assessment and ground-truthing are needed to augment this information in the development of the Biodiversity Conservation Strategy for the Greater Vancouver Region or for local biodiversity conservation strategies. Details on the methodology may be found in the above study available through the GVRD Policy and Planning Department.

Habitat Connectivity in the Greater Vancouver Region

Habitat Connectivity

Description:
Habitat connectivity is a qualitative term describing the degree to which natural ecosystems are linked to one another to form an interconnected network. The degree of interconnectedness and the characteristics of the linkages vary in natural landscapes based on topography and natural disturbance regime. Habitat connectivity is important for regional biodiversity because it facilitates the migration of species and genetic material and it enhances ecological functioning (e.g., streamflow). Breaking of these linkages results in ecosystem fragmentation and thus potentially reduces the biodiversity of a region as ecosystem functions may be impaired and species may not be able fulfill their needs for food, shelter and reproduction in their habitats.

Modelling Habitat Connectivity: To model the connectivity of habitat within the Greater Vancouver Region, a GIS 'neighbourhood analysis' was conducted to quantify the amount and quality of habitat within 500 metres of each pixel/ area. **The habitat value/ quality** for each pixel/ area is a function of the rating (of comparative biodiversity quality) for each habitat type that was determined by the Biodiversity Conservation Strategy Steering Committee through a 'pairwise comparison' of the main habitat types (see "Assessment of Regional Biodiversity and Development of a Spatial Framework for Biodiversity Conservation in the Greater Vancouver Region," AXYS 2006). This exercise rated the main habitat types in the region in terms of their comparative biodiversity value as follows (from highest to lowest):

Habitat Type	Habitat Ranking Based on Pairwise Comparison (for comparative biodiversity value/quality)	Habitat Ranking Score
Wetland, Old Forest (>140 years), Inter-tidal Areas	1	0.202
Ocean, Lakes, Rivers, Streams, Riparian Areas	2	0.123
Young Forest (<140 years)	3	0.071
Old Field	4	0.066
Agricultural Forest (>2 hectares)	5	0.042
Shrub	6	0.037
Agricultural lands and Rural Residential Grass Areas	7	0.025
Open Space/ Meadow (e.g. school yards, playing fields)	8	0.013
Urban Vegetated Areas (e.g. backyards)	9	0.017

The neighbourhood analysis was used as a measurement of habitat connectivity. Pixels/ areas surrounded by other pixels/ areas with high habitat ratings received a higher relative connectivity value/ score than those not adjacent to high value habitats as in the following example:

High connectivity

0.123	0.202	0.202
0.123	1.379	0.202
0.123	0.202	0.202

Low connectivity

0.017	0.017	0.123
0.0	0.157	0.0
0.0	0.0	0.0

The above figure simplifies the connectivity calculation for illustrative purposes: the 'neighbourhood' has been reduced to a 45m x 45m area assuming each cell represents one of the 15m x 15m land cover pixels. However, one can see that the high connectivity value results from a cell completely surrounded by other cells with relatively high habitat ratings (e.g., wetlands [0.202] and ocean [0.123] habitats), whereas the low connectivity cell might well be a park (e.g., open space [0.013]) bordering urban land uses with a habitat rating of 0.0.

Habitat Connectivity Map: The resulting map from the habitat connectivity analysis, identifies those habitats connected to significant habitat reservoirs (e.g., the North Shore mountains, Burns Bog) and refuges (e.g., agricultural lands). The important role of riparian corridors in habitat connectivity is illustrated. The map also identifies gaps in the network of biodiversity function and values across the region. This map could be used to help identify priority areas for protection, enhancement, or restoration if supplemented with local and site level information. Habitat corridors should be ground-truthed to determine if they are spatially and structurally sufficient for a diversity of wildlife or if enhancement is required.

Map Legend

- Very High Connectivity
- Moderate Connectivity
- Urbanized areas and areas outside study area

This map has been prepared as part of the study, Assessment of Regional Biodiversity and Development of a Spatial Framework for Biodiversity Conservation in the Greater Vancouver Region, by AXYS Environmental Consulting Ltd, 2006. Information on this map is at a broad, regional scale and is based on a variety of data sources. There are inaccuracies in the map and further assessment and ground-truthing are needed to augment this information in the development of the Biodiversity Conservation Strategy for the Greater Vancouver Region or for local biodiversity conservation strategies. Details on the methodology may be found in the above study available through the GVRD Policy and Planning Department.

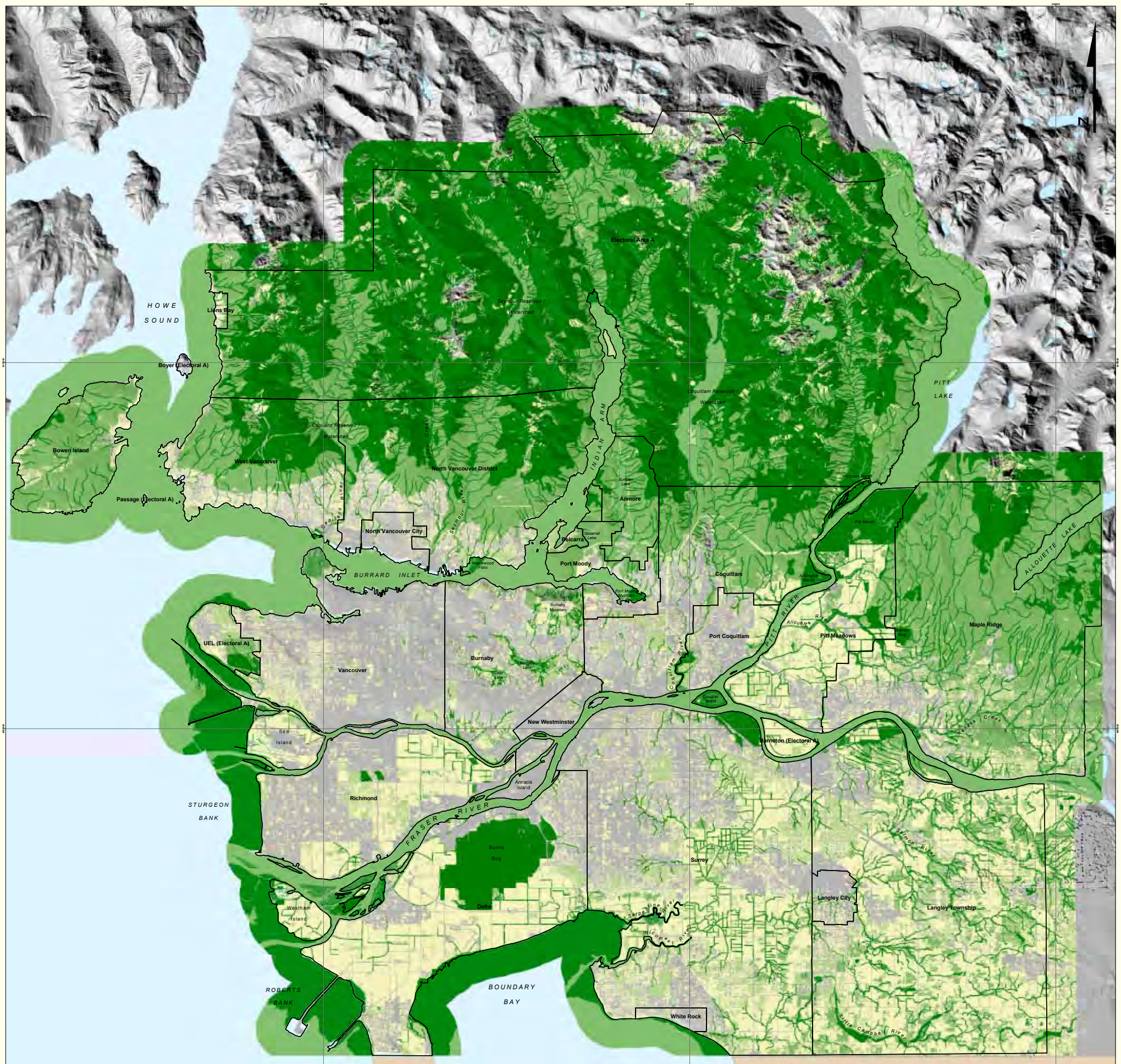
0 4 8 12
Kilometres

Data Sources:
Greater Vancouver Regional District
Ministry of Sustainable Resource Management
Projection: Universal Transverse Mercator
Zone 10 NAD83

The Biodiversity Conservation Strategy for the Greater Vancouver Region is a joint project under the Georgia Basin Action Plan. Project partners include the Greater Vancouver Regional District, Environment Canada (through the Georgia Basin Action Plan's Coordination Office and Canadian Wildlife Service), Province of British Columbia (Ministry of Environment), and Burrard Inlet Environmental Action Program/Fraser River Estuary Management Program with input from GVRD member municipalities, Simon Fraser University (Resources and Environmental Management), Douglas College Institute of Urban Ecology, Langley Environmental Partners' Society, and the Como Watershed Group.

Map prepared by:
AXYS Environmental Consulting Ltd.

March, 2006



Relative Biodiversity

Description:

This map provides a limited regional assessment of relative biodiversity based on the comparative evaluation of major habitat types in terms of their biodiversity quality/ values and their patch size.

An assessment and map of relative biodiversity in the region was developed as a composite of the Habitat Type value/ quality ratings and the Habitat Reservoir and Refuge coverage (see these large format maps and the "Assessment of Regional Biodiversity and Development of a Spatial Framework for Biodiversity Conservation in the Greater Vancouver Region," AXYS, 2006). This evaluation provides a tool to examine the main habitat types across the region relative to their broad ecological and biodiversity significance and the size of contiguous habitat. This approach to examine relative biodiversity is limited and should be used as a resource along with other information (e.g., local data, ground-truthing, consultation) to prepare the Biodiversity Conservation Strategy for the Greater Vancouver Region or local biodiversity conservation plans.

Habitat Ranking Values

Habitat Type	Habitat Ranking (based on comparative biodiversity value/ quality analysis)	Habitat Ranking Score
Wetland, Old Forest (>140 years), Inter-tidal Areas	1	0.202
Ocean, Lakes, Rivers, Streams, Riparian Areas	2	0.123
Young Forest (<140 years)	3	0.071
Old Field	4	0.066
Agricultural Forest (>2 hectares)	5	0.042
Shrub	6	0.037
Agricultural lands and Rural Residential Grass Areas	7	0.025
Open Space/ Meadow (e.g., school yards, playing fields)	8	0.013
Urban Vegetated Areas (e.g., backyards)	9	0.017

Habitat Patch Sizes for Habitat Reservoirs and Habitat Refuges

Habitat Patch Type	Patch size	Definitions
Major Habitat Reservoir	>200 ha	Area of relatively natural habitat that has sufficient size and ecological integrity to support a range of native species, including species that need interior habitats. The requisite size of the habitat reservoir depends on the species being managed.
Habitat Reservoir	30-200 ha	
Major Habitat Refuge	20-30 ha	Patch of habitat that provides food, shelter and/or other needs for wildlife. It may include human-modified ecosystems.
Habitat Refuge	2-20 ha	

The rated habitats were modified by patch size to refine the classification:

Habitat Patch Size Modifiers

Patch class	Area (ha)	Patch Size Weighting
Urban (not habitat)		0
Small patch	0 - 2	0.2
Habitat refuge	2 - 20	0.5
Major habitat refuge	20 - 30	0.8
Habitat reservoir	30 - 200	0.9
Major habitat reservoir	>200	1.0

Larger patches of habitat received a higher relative biodiversity value than smaller patches based on the following formula:

Weighted Habitat Rating x Patch Size Weighting = Relative Biodiversity

The following three examples illustrate how the relative biodiversity values are calculated for different habitat types with varying patch sizes:

1. A 250 hectare patch of Old Forest habitat
   Weighted Habitat Value (Old Forest) = 0.202
   Patch Size Weighting (Major habitat reservoir) = 1.0
   Relative Biodiversity = 0.202 x 1.0 = 0.202
2. A 13 hectare patch of Old Forest habitat
   Weighted Habitat Value (Old Forest) = 0.202
   Patch Size Weighting (Habitat refuge) = 0.5
   Relative Biodiversity = 0.202 x 0.5 = 0.101
3. A 22 hectare patch of Shrub
   Weighted Habitat Value (Shrub) = 0.037
   Patch Size Weighting (Major habitat refuge) = 0.8
   Relative Biodiversity = 0.037 x 0.8 = 0.030

Results:

The result of the analysis is presented in this Relative Biodiversity map. The analysis identifies a number of regionally significant areas including: the intertidal portions of the Fraser River Delta and Boundary Bay; Burns Bog; and the forested portions of the northern part of the GVRD. The table below summarizes the total area for each of the five biodiversity classes portrayed on the map.

Relative Biodiversity Summary

Map Legend Colour	Biodiversity Index	Area (ha)	% of Total Study Area
Colour			
	Very High	50,859	13.8%
		60,175	16.3%
	To	107,475	29.1%
		16,243	4.4%
	Moderate	67,390	18.2%
			81.8%

Relative Biodiversity in the Greater Vancouver Region

0 4 8 12
Kilometres

Data Sources:
Greater Vancouver Regional District
Ministry of Sustainable Resource Management
Projection: Universal Transverse Mercator
Zone 10 NAD83

The Biodiversity Conservation Strategy for the Greater Vancouver Region is a joint project under the Georgia Basin Action Plan. Project partners include the Greater Vancouver Regional District, Environment Canada (through the Georgia Basin Action Plan's Coordination Office and Canadian Wildlife Service), Province of British Columbia (Ministry of Environment), and Burrard Inlet Environmental Action Program/Fraser River Estuary Management Program with input from GVRD member municipalities, Simon Fraser University (Resources and Environmental Management), Douglas College Institute of Urban Ecology, Langley Environmental Partners' Society, and the Como Watershed Group.

Map prepared by:
AXYS Environmental Consulting Ltd.

March, 2006

This map has been prepared as part of the study, Assessment of Regional Biodiversity and Development of a Spatial Framework for Biodiversity Conservation in the Greater Vancouver Region, by AXYS Environmental Consulting Ltd, 2006. Information on this map is at a broad, regional scale and is based on a variety of data sources. There are inaccuracies in the map and further assessment and ground-truthing are needed to augment this information in the development of the Biodiversity Conservation Strategy for the Greater Vancouver Region or for local biodiversity conservation strategies. Details on the methodology may be found in the above study available through the GVRD Policy and Planning Department.

Environment Canada | Environnement Canada

Canadian Wildlife Service | Service Canadien de la faune

Ministry of Environment