Canada's 5th National Report

to the Convention on Biological Diversity

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Executive Summary

This report was prepared further to Canada's commitments as a Party to the *Convention on Biological Diversity* (CBD). Canada was the first developed country to ratify the Convention and has been the proud host of the Convention's Secretariat since it was established in 1996.

Biodiversity in Canada

The national *Ecosystem Status and Trends 2010* assessment report identified 22 key findings related to the health of ecosystems in Canada. These are summarized in Figure 1 on the following page and detailed further in Chapter I. Additional, recent information highlighted in Chapter I includes:

- Changes in Canada's Arctic ecosystems include changes in the extent of Arctic summer sea ice, affecting species such as polar bears that depend on sea ice as habitat, and greening of Arctic tundra ecosystems. A greening trend is also occurring along the northern treeline.
- Over the last two decades, the annual rate of deforestation in Canada has declined. This trend is expected to continue but at a slower pace.
- Between 1990 and 2008, about 1,000 square kilometres (km^2) of land was converted from non-forest land (such as abandoned cropland) to forest.
- Lake acidification remains an issue in parts of Canada. Although sulphate levels in Ontario Lakes declined following action by Canada and the United States to reduce air emissions, the recovery of lake pH levels has been slow and less widespread, and calcium levels in many lakes are below or approaching the threshold needed to keep lake ecosystems healthy.
- There are about 70,000 known species in Canada and likely tens of thousands more which have not yet been identified. Most (77%) of the nearly 12,000 species assessed in Canada in 2010 are considered "Secure", but 12% are considered to be "at Risk" or "May be at Risk", while the remaining 11% are "Sensitive".
- Over 400 bird species breed in Canada each year. Since the 1970s, breeding bird populations have decreased on average by 12%. Some birds (such as grassland birds and shorebirds) have decreased dramatically, while others (such as waterfowl) have increased.
- Trends in populations of sub Arctic terrestrial birds increased between 1970 and 1994 and then decreased before returning to 1970 levels in 2007.
- Improved understanding of the population status of boreal caribou and Peary caribou is supporting recovery planning and management, including under the federal *Species at Risk Act*.
- Since 2007, the levels of contaminants such as persistent organic pollutants and mercury have generally declined or remained stable in seabirds and lake trout.
- Marine litter is posing a growing threat to seabirds, as well as other marine species.
- Focused efforts to better understand the genetic diversity of wildlife species such as the american black bear and native forest tree species are helping inform wildlife and resource management.
- The emergence of White Nose Syndrome is endangering several of Canada's bat species.

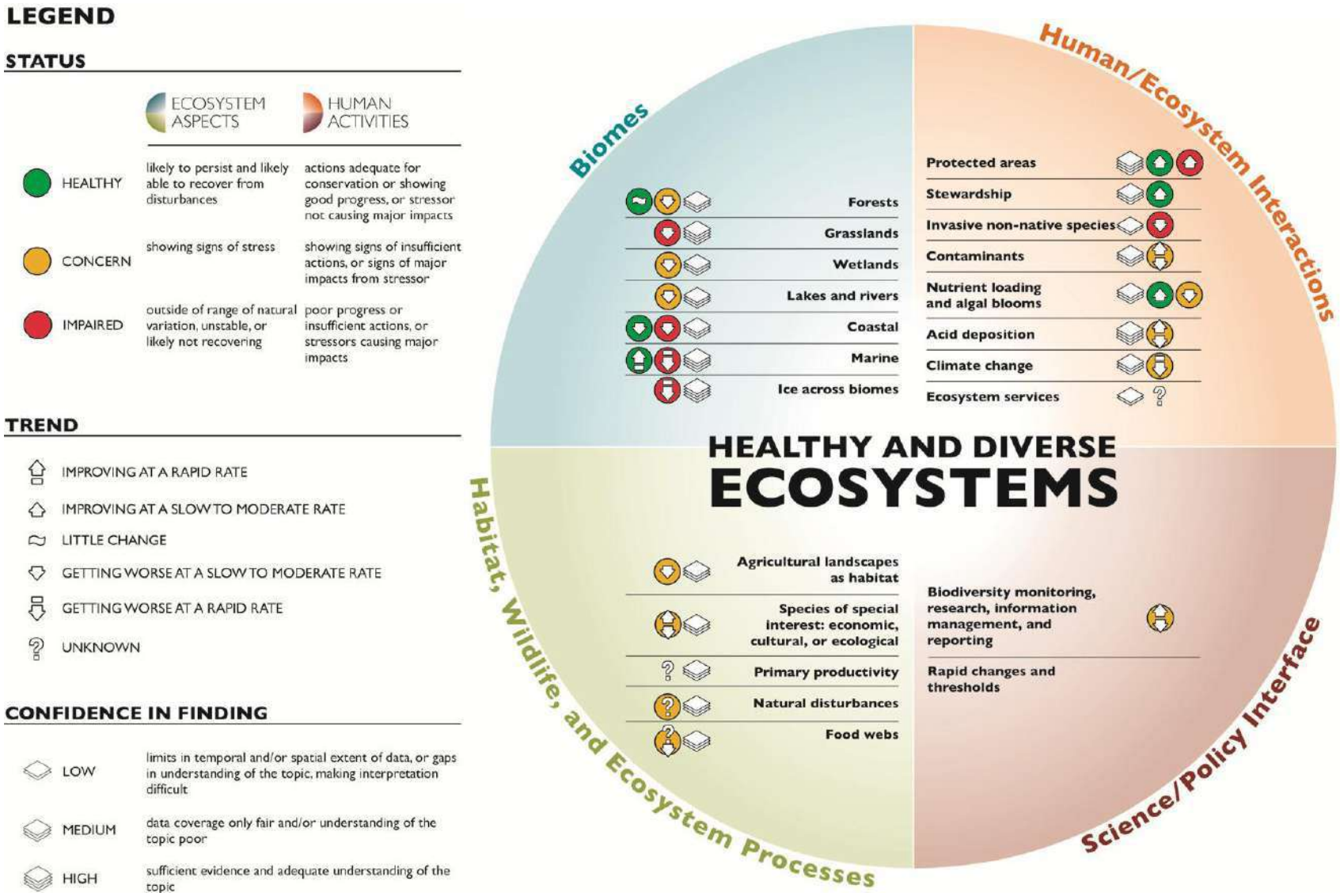


Figure 1: Synthesis of key findings of *Canadian Biodiversity: Ecosystem Status and Trends 2010* (Federal, Provincial and Territorial Governments of Canada, 2010). There may be two circle or arrow combinations beside some topics. This is to represent a range or a dichotomy in the status and trend information.

- Of the 155 major wild fish stocks assessed in 2012, 148 (95%) were harvested at levels considered to be sustainable.
- Across the country, timber is being harvested at rates more than 30% below the wood supply considered to mark the sustainable limit.
- Built-up areas in and around cities and towns in southern Canada increased over the past decade as a result of the transformation of cropland and forests to built-up areas.
- More than 150 invasive plants were introduced and established in Canada between 1800 and 1900; since the 1900s, introduction rates have slowed to about one species every two years.
- Recent data indicate that glacier mass continues to decrease and permafrost temperatures in Canada's North continue to increase.
- The first bloom day of Alberta plants advanced by about two days per decade between 1939 and 2006.
- Ecosystem services assessment is a rapidly growing and evolving field in Canada, with many reports released in recent years by both government and non-government researchers. Accounting for how changes in ecosystem services affect socio-economic well-being is the purpose of many assessments. Canadian researchers are currently working to clarify practical approaches for assessing the cultural implications of changes to ecosystem services.

Implementation and Mainstreaming of Biodiversity Conservation

Chapter II provides an overview of recent actions in Canada to support biodiversity conservation and sustainable use. The *Canadian Biodiversity Strategy* and the complementary *Biodiversity Outcomes Framework* still guide the implementation of the Convention in Canada. In response to the *2011-2020 Strategic Plan,* proposed biodiversity goals and targets for Canada have been drafted and, once adopted, will further focus action and help track progress.

Since 2009, the Provinces of Ontario and Quebec have introduced biodiversity strategies, and the Province of Alberta is currently finalizing a biodiversity policy. Manitoba integrated biodiversity-related commitments into its latest strategic plan for the province. At the federal level, the *2013-16 Federal Sustainable Development Strategy* details actions for protecting nature, and a proposed *National Conservation Plan* will further support results.

Canada's protected areas system grew by over 87,000 km^2 between 2009 and 2013. Investments in partnerships like the Natural Areas Conservation Program enabled the protection of over 3,690 km^2 of ecologically significant land in southern Canada between 2007 and 2012. Canadian governments and conservation organizations are collaborating to develop guidance on identifying and reporting on "other effective area-based conservation measures". Integrated planning at the landscape level and in the marine context is also advancing in several regions of Canada.

Work continues at all levels to assess the status of wild species and recover species at risk. Several jurisdictions, including the Northwest Territories, New Brunswick, Manitoba, and British Columbia have strengthened or updated legislation and policies for protecting wildlife and recovering species at risk. Governments are applying an ecosystem approach to species recovery through joint federal-provincial stewardship initiatives in areas like the South of the Divide in southwestern Saskatchewan. The federal

government and several provincial governments, including Ontario, continue to offer funding support to local, community and Aboriginal organizations to enable stewardship actions.

Numerous efforts to conserve and enhance Canada's wetlands are underway. Over 80,000 km^2 of wetlands have been retained in Canada through the *North American Waterfowl Management Plan* (NAWMP), including nearly 10,000 km^2 between 2009 and 2012; another 238,046 km^2 of wetlands were managed or restored under the plan during the same period. At the sub-national level, the Province of Alberta recently introduced a wetlands policy, which provides the strategic direction and tools to support informed wetland management decisions.

Nationally, since 2009, governments and stakeholders have undertaken numerous assessments of the vulnerability of ecological systems and biodiversity to climate change in sectors and regions across Canada. This includes collaborative work by federal-provincial-territorial governments on tools and assessments for adaptation planning related to parks and protected areas, water resources management and the forest sector.

Canada's farmers are implementing practices that increase diversity on their farms such as planting shelterbelts and windbreaks, installing and managing riparian buffers, and integrating practices like crop rotation, strip cropping and agroforestry. In 2011, 35% of Canadian farms had a formal *Environmental Farm Plans* (compared to 27% in 2006) and 2% indicated they were in the process of developing one.

Significant investments have been made to protect and restore key bodies including the Great Lakes, Lake Winnipeg and Lake Simcoe, and progress is being made to reduce nutrient loads to these areas. Three Canadian Areas of Concern in the Great Lakes are fully restored and two more areas are in recovery.

The *National Aquaculture Strategic Action Plan Initiative* provides a comprehensive strategic vision for the sector, identifying actions for federal, provincial and territorial governments and industry from 2011 to 2015. Canada is also taking steps to ensure long-term sustainability of nationally managed fisheries by developing and implementing comprehensive fishery management plans supported by new policies and tools, including those developed under the *Sustainable Fisheries Framework*, the best available science advice, and compliance and enforcement activities. Of 155 major fish stocks assessed in 2012, 75 stocks (48%) were classified as "healthy" and 15 stocks (10%) were classified as "critical"; this represents an improvement since 2011.

Since 2009, at least 47 intervention or management plans have been developed by governments to address the threat of invasive alien species (IAS), often in partnership with non-government organizations. IAS councils and committees, established in most provinces and territories, play an important role in identifying regional priorities and leveraging local actions to address IAS. In 2013 the Canadian Council on Invasive Species was formed and works collaboratively across jurisdictional boundaries.

Recognizing the benefits both for biodiversity and business sustainability, Canadian companies, particularly in the natural resource sectors, are introducing new initiatives and standards in support of biodiversity outcomes. The Canadian Business and Biodiversity Council tracks and promotes best practices and facilitates information sharing amongst leading businesses and those who are interested in improving their corporate biodiversity performance.

The customary use of biological resources, including such activities as hunting, fishing, trapping and gathering, is an important element of the intimate cultural relationship many Aboriginal peoples in Canada have with nature. Through negotiated cooperative agreements, Aboriginal peoples are assuming increased responsibility for the management of biological resources. While some challenges for

Aboriginal peoples to engage in customary use of biological resources remain, there are also many positive examples that can be built upon.

Since 2009, national initiatives such as the *Ecosystem Status and Trends Report* series, the *Value of Nature to Canadians Study*, and the federal Measuring Ecosystem Goods and Services project have advanced the science and knowledge base for biodiversity and ecosystems services in Canada. University- and museum-based researchers, as well as non-government organizations, are also enhancing understanding of Canada's biodiversity. In addition, there have been ongoing improvements to the extent and accessibility of taxonomic information and geospatial data to support decision-making.

Aboriginal traditional knowledge (ATK) makes important contributions to conservation planning and decision-making. A number of mechanisms exist to promote and consider ATK in biodiversity-related work, such as species assessment and recovery, park planning and management, research and capacity building, and impact assessment.

Statistics Canada is pursuing opportunities to improve measure of natural capital related to biodiversity and ecosystem services to help ensure the diverse values of biodiversity can be fully reflected in, for example, environmental statistics and national wealth accounts, indices of well-being, land use and resource management plans and development plans.

Provinces and territories integrate some aspects of biodiversity into their formal education systems, often supported through complementary initiatives by non-government organizations. Initiatives such as the *Ontario Children's Outdoor Charter* are working to get more Canadians out into nature. Countless efforts to engage Canadians in biodiversity conservation are underway across the country, particularly at the local and regional level, through local environmental organizations and volunteer programs, and through government-run conservation programs. Canadians are also contributing to our understanding of species through a variety of citizen-science programs.

Contributing to progress towards the Aichi Biodiversity Targets

Chapter III cross-references the global Aichi targets with the proposed 2020 biodiversity goals and targets for Canada, and associated domestic indicators. It also provides additional information related to other CBD and global priorities.

Chapter I - An Update on Biodiversity in Canada: Status, Trends and Threats, and Links to Human Well-Being

Introduction

The survival, security and well-being of Canadians are directly dependent upon the health, resilience and productive capacity of natural systems. Beyond providing the necessities of life, Canada's natural wealth is a cornerstone of the Canadian economy, the foundation for Canada's natural resource sectors, and the key to continued growth in sectors such as agriculture, ecotourism and recreation. Biodiversity also serves as the basis for the emerging bio-based economy, including the genomics, biotechnology and pharmaceutical industries. Many Aboriginal communities, particularly in the North, depend on the sustainable harvesting of biological resources from intact ecosystems for their livelihoods, food, cultural and ceremonial needs. These communities also have interests and are involved in the commercial uses of biodiversity and the emerging bio-based economy. Biodiversity is the foundation of the spiritual and cultural connection that many Canadians have with nature.

While Canada still has large, relatively undisturbed natural areas, there are increasing pressures on terrestrial and aquatic ecosystems, spurred by rapid economic development across the country and intensified by a changing climate. Habitat is being lost and degraded, largely due to urban development, agricultural and other industrial activities. Invasive alien species (IAS), pollutants, acid deposition, nutrient loading and climate change are also compromising the integrity of ecosystems and threatening species.

The following section provides an overview of the current state of biodiversity in Canada. Much of the information was taken from the *Ecosystem Status and Trends 2010* assessment (Canada, 2010), a collaborative project of Canada's federal, provincial and territorial governments that synthesized contributions from hundreds of experts across Canada. Other sources include newly released scientific studies and recent biodiversity assessments by Canadian governments, including collaborative work under the Arctic Council's Conservation of Arctic Flora and Fauna Working Group.

This section updates or complements indicators and information provided in *Canada's 4th National Report to the United Nations Convention on Biological Diversity*. As with the 4th Report, the information is arranged by the four outcomes under Canada's *Biodiversity Outcomes Framework*, described further in Chapter II: healthy and diverse ecosystems; viable populations of species; genetic resources and adaptive potential; and sustainable use of biological resources.

Outcome 1: Healthy and Diverse Ecosystems

Healthy and diverse ecosystems in Canada means reducing human impacts and restoring damaged ecosystems to enhance the productivity and resilience of our ecosystems, and preserve the goods and services essential to our well-being.

The 2010 *Ecosystem Status and Trends Report* (Canada, 2010) was prepared under the guidance of a steering committee of federal, provincial, and territorial government representatives. Over 500 experts participated in the preparation of foundational technical reports. This series of reports assesses progress towards the goal of "Healthy and Diverse Ecosystems" laid out in Canada's *Biodiversity Outcomes Framework* (2006). Twenty-two recurring key findings emerged from the technical information and are presented in the table below, organized under four interrelated themes: biomes; human/ecosystem interactions; habitat, wildlife, and ecosystem processes; and science/policy interface. See Figure 1 for a graphic representation of this information.

Key Findings from Canadian Biodiversity: Ecosystem Status and Trends 2010 (Canada, 2010)

Topic	**Key Finding**
THEME: BIOMES *A biome is a large community of plants and animals that occupies a distinct type of environment.*	
Forests	At a national level, the extent of forests has changed little since 1990; at a regional level, loss of forest extent is significant in some places. The structure of some Canadian forests, including species composition, age classes, and size of intact patches of forest, has changed over longer time frames.
Grasslands	Native grasslands have been reduced to a fraction of their original extent. Although at a slower pace, declines continue in some areas. The health of many existing grasslands has also been compromised by a variety of stressors.
Wetlands	High loss of wetlands has occurred in southern Canada; loss and degradation continue due to a wide range of stressors. Some wetlands have been or are being restored.
Lakes and Rivers	Trends over the past 40 years influencing biodiversity in lakes and rivers include seasonal changes in magnitude of stream flows, increases in river and lake temperatures, decreases in lake levels, and habitat loss and fragmentation.
Coastal	Coastal ecosystems, such as estuaries, salt marshes, and mud flats, are believed to be healthy in less- developed coastal areas, although there are exceptions. In developed areas, extent and quality of coastal ecosystems are declining as a result of habitat modification, erosion, and sea-level rise.
Marine	Observed changes in marine biodiversity over the past 50 years have been driven by a combination of physical factors and human activities, such as oceanographic and climate variability, and overexploitation. While certain marine mammals have recovered from past overharvesting, many commercial fisheries have not.

Topic	Key Finding
Ice Across Biomes	Declining extent and thickness of sea ice, warming and thawing of permafrost, accelerating loss of glacier mass, and shortening of lake ice seasons are detected across Canada's biomes. Impacts, apparent now in some areas and likely to spread, include effects on species and food webs.
THEME: HUMAN/ECOSYSTEM INTERACTIONS	
Protected Areas	Both the extent and representativeness of the protected areas network have increased in recent years. In many places, the area protected is well above the [2010] United Nations 10% target[1]. It is below the target in highly developed areas and the oceans.
Stewardship	Stewardship activity in Canada is increasing, both in number and types of initiatives and in participation rates. The overall effectiveness of these activities in conserving and improving biodiversity and ecosystem health has not been fully assessed.
Invasion of Non-Native Species	Invasive non-native species are a significant stressor on ecosystem functions, processes, and structure in terrestrial, freshwater, and marine environments. This impact is increasing as numbers of invasive non-native species continue to rise and their distributions continue to expand.
Contaminants	Concentrations of legacy contaminants in terrestrial, freshwater, and marine systems have generally declined over the past 10 to 40 years. Concentrations of many emerging contaminants are increasing in wildlife; mercury is increasing in some wildlife in some areas.
Nutrient Loading and Algal Blooms	Inputs of nutrients to both freshwater and marine systems, particularly in urban and agriculture-dominated landscapes, have led to algal blooms that may be a nuisance and/or may be harmful. Nutrient inputs have been increasing in some places and decreasing in others.
Acid Deposition	Thresholds related to ecological impact of acid deposition, including acid rain, are exceeded in some areas, acidifying emissions are increasing in some areas, and biological recovery has not kept pace with emission reductions in other areas.
Climate Change	Rising temperatures across Canada, along with changes in other climatic variables over the past 50 years, have had both direct and indirect impacts on biodiversity in terrestrial, freshwater, and marine systems.
Ecosystem Services	Canada is well endowed with a natural environment that provides ecosystem services upon which our quality of life depends. In some areas where stressors have impaired ecosystem function, the cost of maintaining ecosystem services is high and deterioration in quantity, quality, and access to ecosystem services is evident.
THEME: HABITAT, WILDLIFE AND ECOSYSTEM SERVICES	

[1] The 2010 target has since been replaced by Aichi Target 11: 17% of terrestrial and inland water and 10% of coastal and marine areas

Topic	Key Finding
Agriculture Landscapes and Habitat	The potential capacity of agricultural landscapes to support wildlife in Canada has declined over the past 20 years, largely due to the intensification of agriculture and the loss of natural and semi-natural land cover.
Species of Special Interest: Economic, Cultural or Ecological	Many species of amphibians, fish, birds, and large mammals are of special economic, cultural, or ecological interest to Canadians. Some of these are declining in number and distribution, some are stable, and others are healthy or recovering.
Primary Productivity	Primary productivity has increased on more than 20% of the vegetated land area of Canada over the past 20 years, as well as in some freshwater systems. The magnitude and timing of primary productivity are changing throughout the marine system.
Natural Disturbances	The dynamics of natural disturbance regimes, such as fire and native insect outbreaks, are changing and this is reshaping the landscape. The direction and degree of change vary.
Food Webs	Fundamental changes in relationships among species have been observed in marine, freshwater, and terrestrial environments. The loss or reduction of important components of food webs has greatly altered some ecosystems.
THEME: SCIENCE AND POLICY INTERFACE	
Biodiversity Monitoring, Research, Information Management and Reporting	Long-term, standardized, spatially complete, and readily accessible monitoring information, complemented by ecosystem research, provides the most useful findings for policy-relevant assessments of status and trends. The lack of this type of information in many areas has hindered development of this assessment.
Rapid Changes and Thresholds	Growing understanding of rapid and unexpected changes, interactions, and thresholds, especially in relation to climate change, points to a need for policy that responds and adapts quickly to signals of environmental change in order to avert major and irreversible biodiversity losses.

Below is additional, current information related to a select number of ecosystem components, processes and interactions.

Changes in Arctic Ecosystems

Decline in Arctic Sea Ice Ecosystems

Sea ice supports a unique Arctic ecosystem and many Arctic species have evolved specialized survival mechanisms that rely on the presence of sea ice. Changes in the timing of spring break-up, fall freeze-up and the distribution of ice cover can affect marine conditions such as underwater light availability, water temperatures and salinity. These in turn affect algae populations that form the base of the Arctic marine food web. Coastal Arctic ecosystems may also experience higher erosion from increased wave energy as summer sea ice cover declines (McGillivray *et al.*, 1993). Sea ice changes are driven by increases in air

temperatures: Arctic air temperatures are increasing at twice the global rate as a result of global climate change (Eamer *et al.,* 2013).

Arctic sea ice extent has been measured using satellite technology since 1979. During the summer of 2012, sea ice extent dropped to 3.6 million square kilometres (km²), the lowest recorded extent since monitoring began (Figure 2). This is 48% lower than the average value of sea ice extent between 1979 and 2000 of 7.0 million km². In 2013, the sea ice extent increased to 5.4 million km², highlighting the variability that exists between years. However, between 1979-2013, summer sea ice was lost at about 50,000 km²per year. The last six years (2007-2013) have the lowest summer ice cover since measurements began in 1979.

Extent of Arctic Summer Sea Ice (1979-2013)

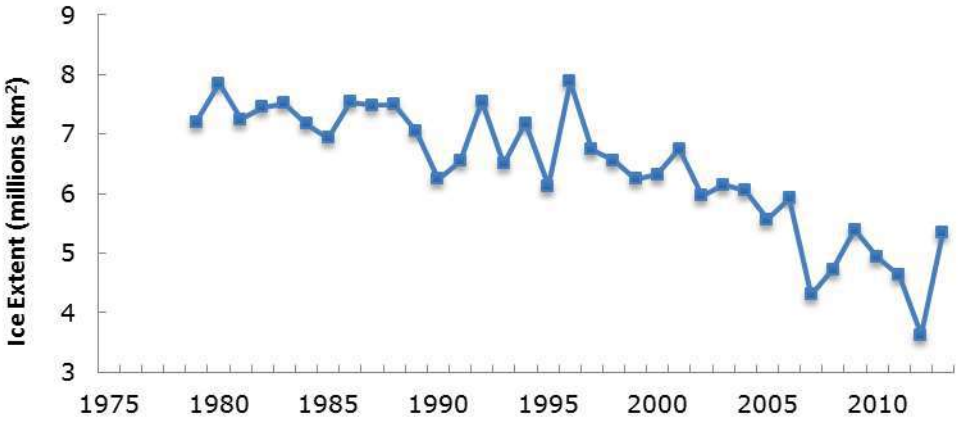


Figure 2: September extent of Arctic sea ice. Ice extent is monitored from space using passive microwave instruments installed on satellites. Sea ice extent is the areal total of sea ice covering the ocean.
Source: Sea Ice Index, National Snow and Ice Data Center, 2013.
Data downloaded from: nsidc.org/data/seaice_index/archives.html

Of the many species that depend on sea ice as habitat, probably the most well-known example is the polar bear (*Ursus maritimus*) that relies on Arctic ice as a platform from which to hunt seals (Stirling and Derocher, 2012). Earlier spring break-up and later autumn freeze-up means that polar bears spend longer periods without access to seals, which they rely upon to gain adequate body mass to ensure survival. As a result, the fall body mass of polar bears in western Hudson Bay has declined (Figure 3). The body condition of polar bears captured from the Baffin Bay subpopulation between 1991 and 2006 has also declined (Rode *et al.*, 2012) as have polar bears captured from the southern Hudson Bay subpopulation between 1984 and 2005 (Obbard *et al.*, 2006).

Fall Weight of Female Polar Bears (1980-2007)

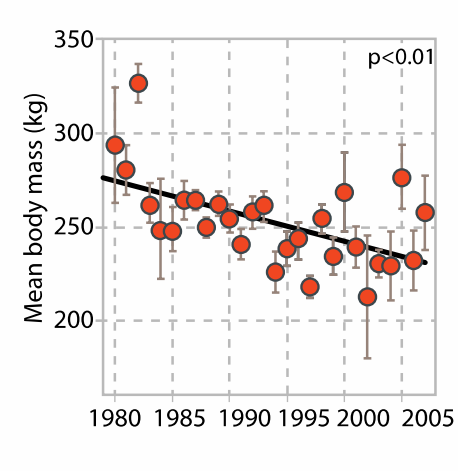


Figure 3: Fall weight of female polar bears, western Hudson Bay, 1980 to 2007.
Source: Stirling and Derocher, 2012.

Greening of Arctic Tundra Ecosystems

Increased summer temperatures and longer growing seasons have led to increases in primary productivity, causing an overall 'greening' in the Arctic tundra (CAFF, 2010). For example, high Arctic tundra on Ellesmere Island has become more productive, with a 50% increase in standing biomass over 13 years (Figure 4). A review of recent studies of Arctic vegetation reveals an increase in willow shrubs (*Salix spp.*) in the Canadian western and high Arctic and an increase in dwarf birch (*Betula nana*) in the eastern Canadian Arctic (Myers-Smith *et al.*, 2011).

Increases in Evergreen Shrubs and Mosses, Ellesmere Island, Nunavut (1995 to 2007)

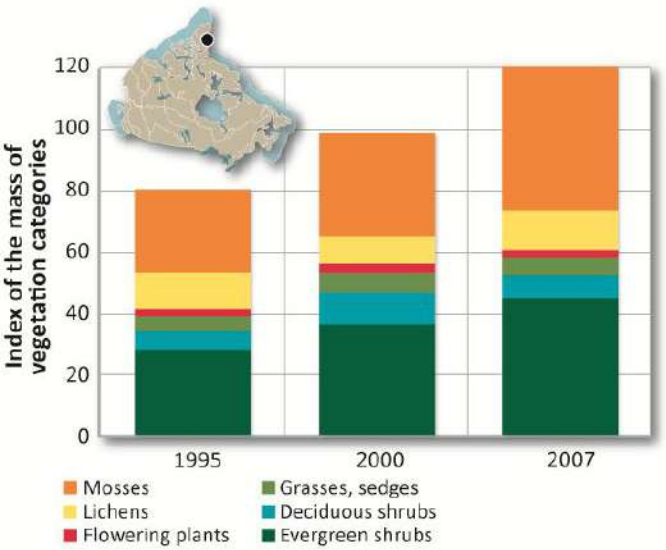


Figure 4: Increases in the mass of different vegetation categories on Ellesmere Island, 1995 to 2007.
Source: Adapted from Hudson and Henry, 2009.

A greening trend is also occurring along the northern treeline. The treeline is not a narrow zone but a gradual thinning of trees from northern boreal forest, through a sparsely treed area known as the taiga, and finally to true tundra with no trees. Remote sensing over 22 years detected an increase in shrubs (15%), herbs (12%), and conifer tree cover (0.5%), and a decrease in bare ground (9%) and lichen (4%) (Figure 5) (Olthof and Pouliot, 2010).

Increases in shrubs in the tundra and taiga ecosystems are expected to affect species diversity and food webs, change land cover types and influence global biogeochemical cycles (Anisimov *et al.*, 2007). For example, a taller, denser shrub canopy may outcompete shorter, shade intolerant species such as lichen. Lichen are an important forage species for caribou (*Rangifer tarandus*), a species whose populations are declining throughout Canada (Environment Canada, 2012). Increased shrub cover could also alter soil temperatures and rates of litter decomposition by reducing the biomass of moss, a soil insulator (Myers-Smith *et al.*, 2011).

Vegetation Changes in the Treeline Zone of Western Canada (1985 to 2006)

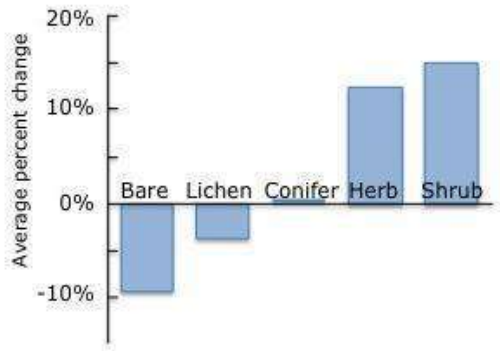


Figure 5: Average change in vegetation cover of the northern treeline zone of western Canada, 1985 to 2006. Analysis is based on over 22 years of early spring and summer satellite images.
Source: Data from Olthof and Pouliot, 2010.

Changes in Forest Ecosystems

Canada has approximately 3.48 million km^2 of forest – representing 38% of the country's total land area and 10% of the world's forest cover – as well as another 409 thousand km^2 of other wooded land and 85 thousand km^2 of other land with tree cover (Natural Resources Canada, 2013a). Of this total, about 2 million km^2 are under management planning, with some fire and insect management occurring in additional areas for an overall managed forest area of 2.29 million km^2. When combined with lakes, wetlands, and other non-vegetated surfaces within forest-dominated ecosystems, these ecosystems comprise approximately 60% of Canada (Wulder *et al.*, 2008). The area of forest in Canada is relatively stable.

Changes in Forest Area

Deforestation (the conversion of forest to non-forest land uses due to human activity) resulted in the loss of about 12,100 km^2 (1,210,000 hectares (ha)) of forested land between 1990 and 2012 (Figure 7) or about 0.33% of Canada's total forest area. An average of 485 km^2 (48,500 ha) was lost annually between 2008 and 2012, compared to about 640 km^2 in 1990. Forest lands are converted to various uses such as

cropland, transport infrastructure, transmission lines, oil, gas and mining developments, urban expansion and flooding for new hydro reservoirs.

Over the last two decades, the annual rate of deforestation in Canada has declined. This trend is expected to continue but at a slower pace. Conversion of forest to agricultural land uses will likely remain the largest factor (Figure 6). Although the rate of deforestation for agriculture is expected to decrease, it is possible that economic or policy changes within the agricultural sector could increase deforestation rates. Only the oil and gas sector is currently experiencing an increase in deforestation rates. Over the next decade these rates are expected to stabilize or increase, although that will depend on how economic conditions affect oil and gas activity.

Estimated area (hectares) of deforestation in Canada, by industrial sector, 1990–2010

Sector	Year[a]				
	1990	1995	2000	2005	2010
Agriculture	42,100	22,200	20,500	19,100	18,900
Forestry[b]	3,700	3,300	3,600	3,800	3,800
Hydroelectric infrastructure[c]	2,700	1,500	900	1,100	600
Industry and transportation[d]					
Industry	900	900	900	900	900
Mining	2,800	2,700	2,900	2,700	2,500
Oil and gas	4,400	5,400	7,900	11,300	11,100
Transportation	2,000	1,700	3,000	2,800	2,700
Municipal[e]	3,900	3,700	4,300	4,700	4,700
Peat mining	900	700	500	100	100
Recreation[f]	600	700	700	600	600
Total[g]	**64,000**	**42,600**	**45,000**	**47,200**	**45,900**

a Values reported are for listed year.
b Resulting from the creation of permanent forest access roads.
c Excludes reservoirs.
d Includes mines, gravel pits, oil and gas projects and highway construction.
e Includes urban development.
f Includes ski hills and golf courses.
g Totals adjusted for rounding.

Sources: Canadian Forest Service, Deforestation Monitoring Group; and Environment Canada, *National Inventory Report 2013*

Figure 6: Estimated area (hectares) of deforestation in Canada, by industrial sector, 1990 – 2010.

Afforestation is the conversion of non-forest land to forest through active management. It does not include post-harvest tree planting or natural succession on abandoned land. Between 1990 and 2008, about 1,000 km^2 (100,000 ha) of land was afforested. Most afforestation activities occurred in eastern Canada on abandoned cropland (Environment Canada, 2013a). Tracking of afforestation at the national level has received less emphasis in recent years, and there are no national data on afforestation activities since 2008.

Deforestation (1990-2012) and Afforestation (1990-2008)

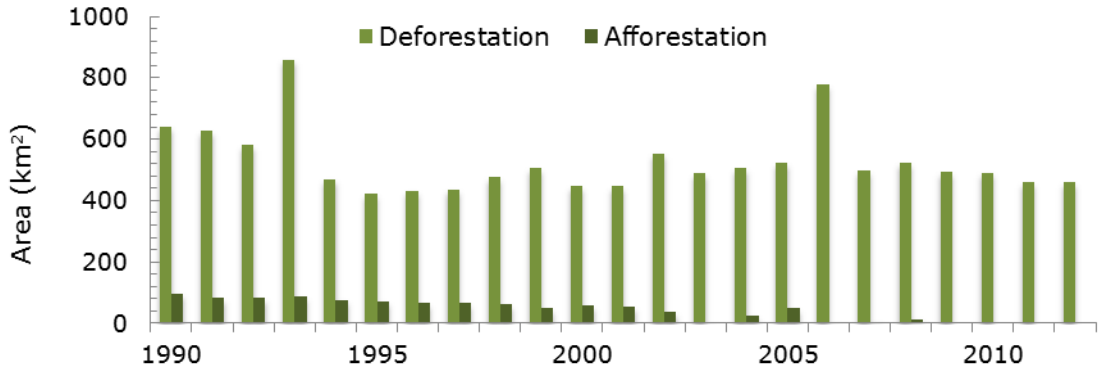


Figure 7: Area of land that is known to have been deforested and afforested since 1990.
Sources: Canada's National Deforestation Monitoring System (NDMS), Environment Canada, 2013a.

Forest Fragmentation

Forest fragmentation occurs when continuous forests are broken up into smaller patches. It can result from human activities such as clearing forests for agriculture, urbanization, oil and gas exploration, and roads, as well as from natural disturbances. The drivers of fragmentation differ at the regional level (Wulder *et al.*, 2011).

Within the managed forest, harvesting and access infrastructure can fragment forests. However, harvest-related fragmentation is ephemeral due to provincial and territorial replanting and regeneration programs, and with forest practices designed to mimic natural disturbances. In more northern un-managed forests, wild fire is the main agent of change. Many northern ecosystems continue to function with limited anthropogenic influence (Andrew *et al.*, 2014).

The impact of forest fragmentation depends on which species and spatial scale are considered. Impacts can include: declines in neotropical migrant and resident birds requiring interior forest habitat (Schmiegelow *et al.*, 1997); declines in species with large area requirements such as caribou; increases in species that prefer to browse along forest edges, such as moose (*Alces alces*); increased exposure of interior forest species to predators and parasites; disruption of social structure (Jalkotzy *et al.*, 1997) and barriers to dispersal (Fleishman and Mac Nally, 2007).

The relationships between species populations and habitat quality and fragmentation are complex. Nielsen *et al.* (2004) have reported that tree harvesting is not detrimental to grizzly bear (*Ursus arctos* ssp.) populations, with recently harvested area providing sources for desired foods. For some species in the human interface zones, it is the access (resulting in hunting pressure and inadvertent collisions with vehicles), not habitat change, that results in negative impacts on populations.

Protected Areas

As of 2012, the proportion of area protected within Canada's ecological regions varies from less than 1% to around 20%. Terrestrial ecozones[2] with a high proportion of protected area tend to be remote or prized for recreation. This is in contrast to regions with high levels of urbanization and development. For example, ecozones+ in the Rocky Mountains have 15% or more of their area protected, but the Mixedwood Plain, in southern Ontario and along the St. Lawrence River, has only 1.6% of its area protected. Marine areas have not benefited from such a long tradition of protection, and consequently smaller proportions are currently protected, ranging from 0.02% to 5.3%. Approximately 12% of the area of the Great Lakes that is within Canada is protected.

Percentage of Ecological Regions Protected, Canada (2012)

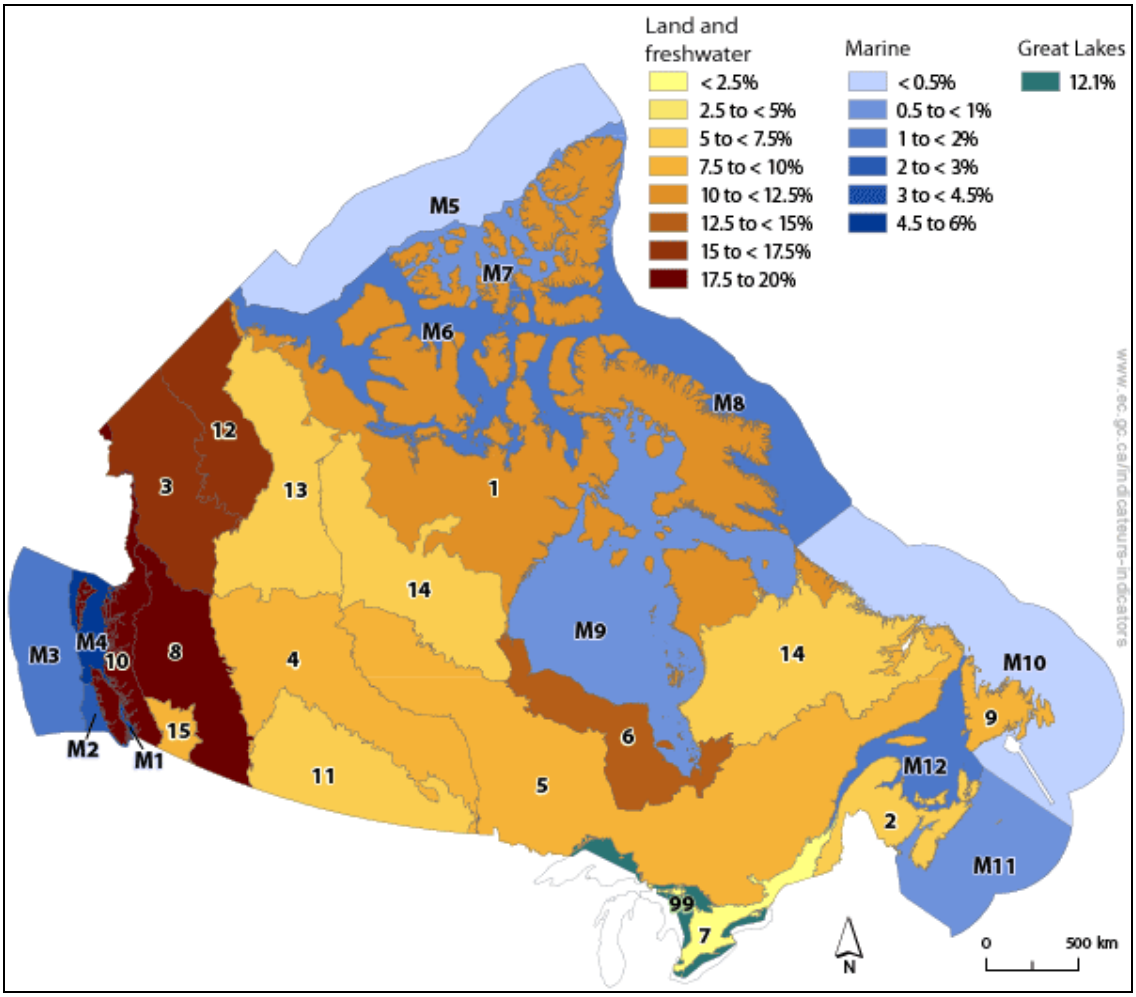


Figure 8: Percentage of ecological regions protected, Canada, 2012.
Note: Only areas recognized as protected under international standards are included. Terrestrial ecozones+ and the protected areas therein, include both land and freshwater.

[2] A provisional adaptation ("Ecozones+") of the National Ecological Framework of Canada was used as a spatial framework. Marine bioregions are similar to ocean ecozones, but are broader in scale and consider additional factors.

Source: Environment Canada, 2013b.
Data: For Canada except Quebec: Canadian Council on Ecological Areas (CCEA) (2013) Conservation Areas Reporting and Tracking System (CARTS). For Quebec: Ministère du Développement durable, de l'Environnement, de la Faune et des Parcs (2013) Base de données du Registre des aires protégées au Québec. Data are current as of 31 December, 2012. The Ecozone+ framework is from Federal, provincial and territorial governments of Canada (2010) *Canadian Biodiversity: Ecosystem Status and Trends 2010*. Marine bioregions are from Fisheries and Oceans Canada.

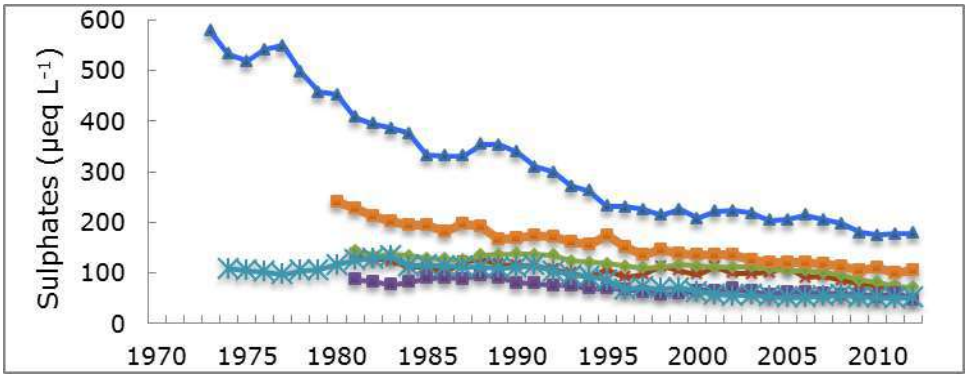
Each ecozone and bioregion is unique and varied, meaning that protection needs to be carefully planned to include areas representative of different parts of the ecozone and to capture sites of special value. It is much more challenging to establish protected areas in areas that are already developed for other uses, such as where cities, agriculture, fishing or industry are present. For terrestrial areas, this is in part because there is less ecologically intact land remaining, and the existing land has often been fragmented into many small parcels.

Lake Acidification

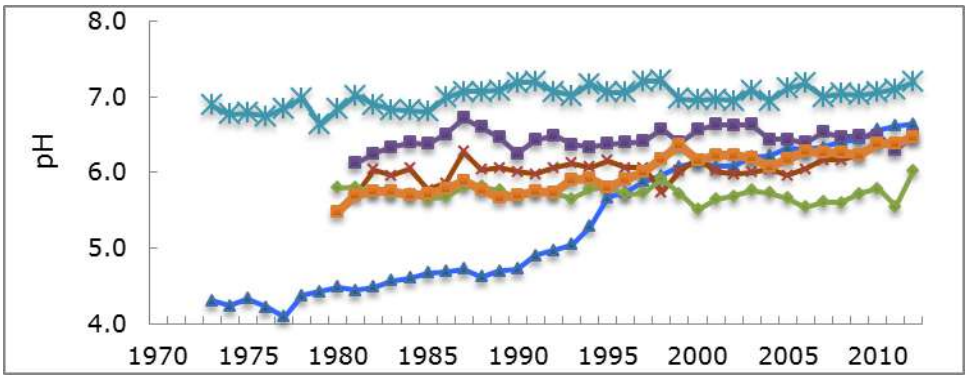
Acid deposition, sometimes referred to as acid rain, is produced when sulphur and nitrogen-based pollutants react with water in the atmosphere and are deposited on the Earth's surface. From 1980 to 2006, sulphur dioxide emissions in Canada and the United States (U.S.) declined by about 45% and emissions of nitrogen oxides declined by about 19% (Canada and United States, 2008). This reduction was in part the result of the Canada-United States Air Quality Agreement signed in 1991 (Canada and United States, 2008). Although significant declines in lake sulphates followed closely behind emission reductions (Figure 9a) (Jeffries *et al.*, 2003; Weeber *et al.*, 2005; Canada and United States, 2008), the recovery of lake pH has been slow and less widespread (Figure 9b).

Changes in pH, Sulphates and Calcium Concentrations in Ontario Lakes (1973-2012)

a)



b)



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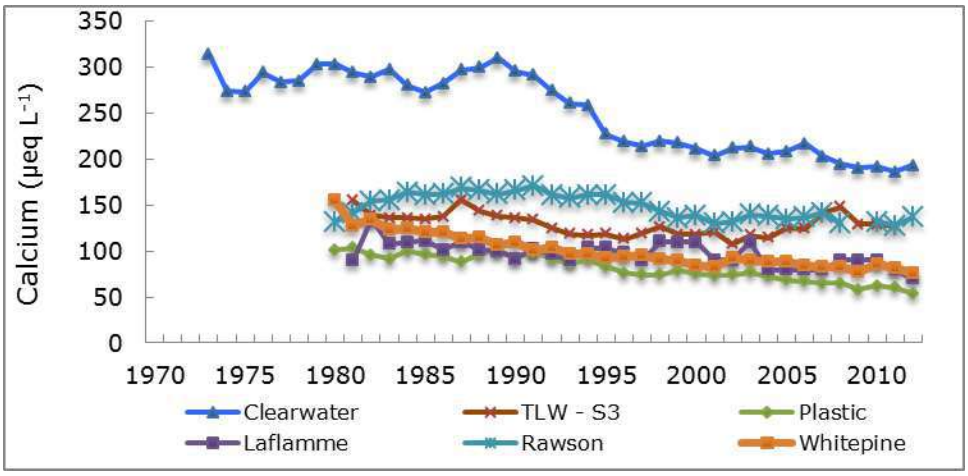


Figure 9: Changes in sulphates (a), pH (b) and calcium (c) concentrations in Ontario lakes, 1973–2012.
Source: Adapted from Jeffries *et al.*, 2003; Keller *et al.*, 2007; and Monk & Baird, 2010.

Lack of recovery is related in part to declines in dissolved calcium (Figure 9c), a buffering mechanism that has been reduced due to acid deposition (Canada and United States, 2008).

In addition to acid rain, other factors such as repeated forest harvesting can also lead to calcium depletion in watersheds (Watmough *et al.*, 2003). Calcium is an essential element for *Daphnia* species, a water flea that acts as a keystone species because it links primary producers and fish. *Daphnia* reproduction is compromised when calcium concentrations are lower than 1.5 mg/L (Ashforth and Yan, 2008). Approximately 35% of lakes in Ontario had a calcium concentration below 1.5 mg/L and an additional 27% were approaching this threshold with levels between 1.5–2.0 mg/L (Jeziorski *et al.*, 2008). A loss of *Daphnia* from freshwater lakes would impact lake food webs and lead to increases in algal biomass (Korosi *et al.*, 2012).

Outcome 2: Viable Populations of Species

Maintaining the structure and function of ecosystems requires the full complement of native species. Conservation at the ecosystem level sustains most species, but special efforts are needed for some. An outcome of viable populations of species also means: improved status of species at risk; no new species extinctions due to human activity; and species assemblages maintained in their ecological regions.

Species Status

There are about 70,000 known species in Canada and likely tens of thousands more which have not yet been identified. Every five years, Canada conducts an assessment of wild species. The 2010 assessment covered all of Canada's vascular plants, mosses, macro-lichens, freshwater mussels, several insect groups, and all vertebrate species except for fishes. In 2010, 11,950 species were assessed, about 45% more than the 7,732 species assessed in 2005 (Canadian Endangered Species Conservation Council, 2011). Information on the status of other species groups, such as fungi, is limited so far, but work is ongoing to continue to expand the number and range of species assessed.

Most species assessed in Canada are considered “Secure” (77%), but 12% are considered to be “at Risk” or “May be at Risk”, while the remaining 11% are “Sensitive”. Reptiles (43%), freshwater mussels (36%) and amphibians (20%) have the greatest proportion of species that are “at Risk” or “May be at Risk” (10). Major threats to these groups include habitat fragmentation and destruction. Road mortality can also be a major threat to reptiles if a high survival rate of adults is necessary to sustain a population. Freshwater mussels and amphibians are threatened from land use activities that affect water quality and quantity.

General Status of Species (2010)

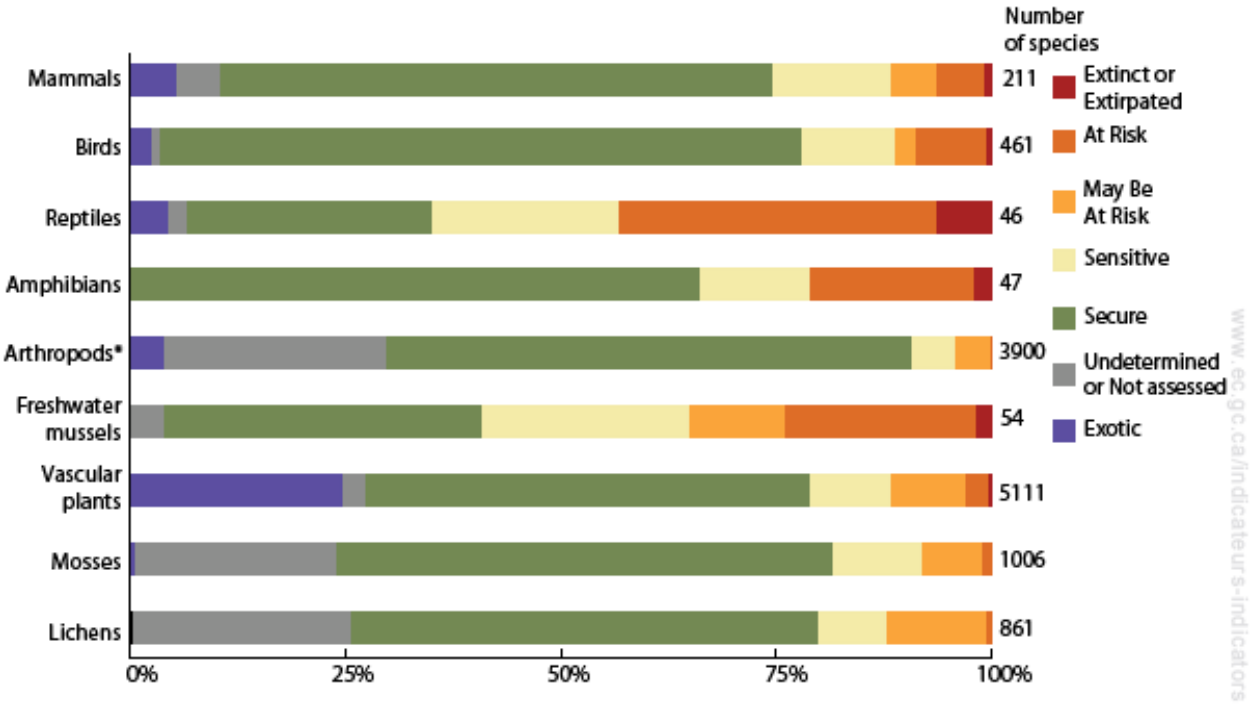


Figure 10: General Status of Species in Canada in 2010, by group of species. For each group, all species found in Canada have been ranked with the exception of the arthropod group, which contains at least several tens of thousands of species. This figure also excludes species ranked as Accidental (n = 253).
Source: Canadian Endangered Species Conservation Council, 2011.

Breeding Birds in Canada

Over 400 bird species breed in Canada each year (Calvert *et al.*, 2013). Each year, bird population abundance is tracked by volunteer and professional ornithologists through programs such as the North American Breeding Bird Survey. As a result, data are more available for southern regions of Canada where more people live (North American Bird Conservation Initiative Canada, 2012).

Since the 1970s, breeding bird populations have decreased on average by 12% (Figure 11). Some birds such as aerial insectivores (-64%), grassland birds (-45%) and shorebirds (-42%) have decreased dramatically. Raptors ($^{+}$70%) and waterfowl ($^{+}$46%) have increased likely due to targeted management of these species including the banning of dichlorodiphenyltrichloroethane (DDT) and wetland conservation. Forest birds (-3%) and other water birds (-10%) have experienced smaller decreases.

Trends in Canada's Breeding Birds (1970-2010)

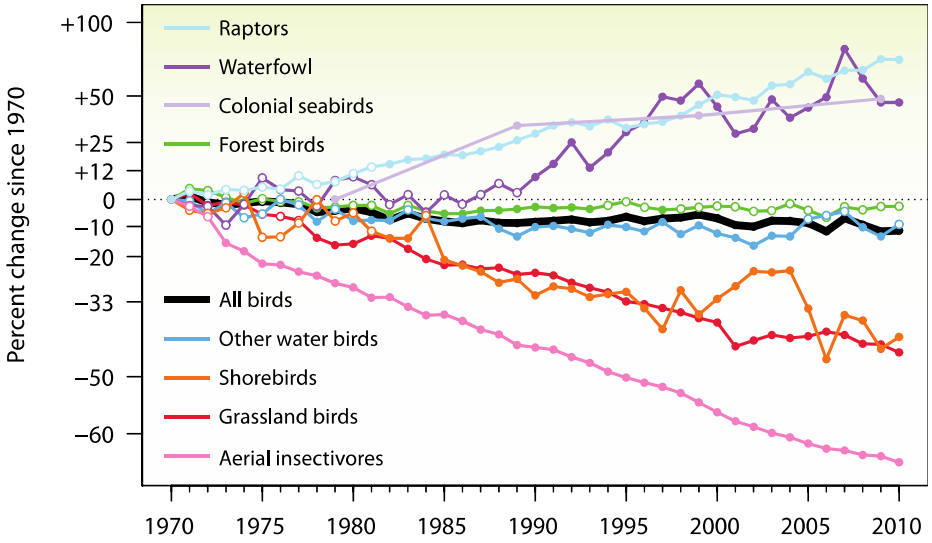


Figure 11: National trends for all regionally occurring native bird species groups in Canada from 1970 to 2010. Source: North American Bird Conservation Initiative Canada, 2012.

Aerial insectivores depend entirely on flying insects for food. Of the 26 species that breed in Canada, 22 are declining. Some previously very common species such as barn swallows (*Hirundo rustica*) and chimney swifts (*Chaetura pelagica*) have population sizes of about a quarter of what they were in the 1970s. It is not clear why this group of species has declined (Nebel *et al.*, 2010) but the use of pesticides in Canada and along international migration routes may have reduced food availability (Nocera *et al.*, 2012).

A recent series of studies examined the relative and absolute importance of various sources of human related bird mortality (Calvert *et al.*, 2013). Domestic and feral cats kill an estimated 100 million birds each year in Canada, while collisions with power transmission lines, houses and road vehicles result in additional mortality of 43 million birds per year. The impact of this mortality on population trends varies among species. Although songbirds experience some of the highest human-caused mortality, they are also the most abundant birds in Canada. In contrast, mortality sources such as fisheries bycatch impact relatively small numbers of individuals, but have major impacts on populations of some rare species. For example fisheries bycatch results in additional mortality of 4% of the Canadian population of black-footed albatross, and 7% of the Nova Scotia breeding population of the common eider (Calvert *et al.*, 2013).

Status of Sub Arctic Species

The Arctic ecozone supports, for at least part of the year, a substantial amount of the Earth's populations of fish, birds and mammals (McRae *et al.,* 2010). Climate change and the resulting decrease in snow cover, changes in precipitation, and encroachment of southern species, are expected to lead to dramatic changes in Arctic habitat and native biodiversity (CAFF International Secretariat, 2010). Climate change and other stressors such as increases in industrial development and resource extraction are predicted to cause changes in the distribution and abundance of species and habitats; changes in

genetic diversity; and changes in the behavior of migratory species (CAFF International Secretariat, 2010).

The trend index for sub Arctic terrestrial birds (Figure 12) increased from 1970 to 1994 and then decreased between 1994 and 2006 but returned to 1970 levels in 2007. This is similar to the results for all Sub Arctic vertebrates as reflected in the Arctic Species Trend Index reported on by the Conservation of Arctic Flora and Fauna (CAFF), a working group of the Arctic Council (McRae *et al.*, 2010). The sub Arctic region, as defined by CAFF, is forested tundra or taiga ecosystems that form the northernmost part of the boreal forest. Compared with other Arctic regions, the sub Arctic has experienced the greatest amount of land use change due to resource extraction. Habitat shifts are also occurring as species' ranges shift northwards and melting permafrost causes changes in surface hydrology, both impacts of global climate change (CAFF International Secretariat, 2010).

Trend Index for Sub Arctic Terrestrial Birds (1970-2007)

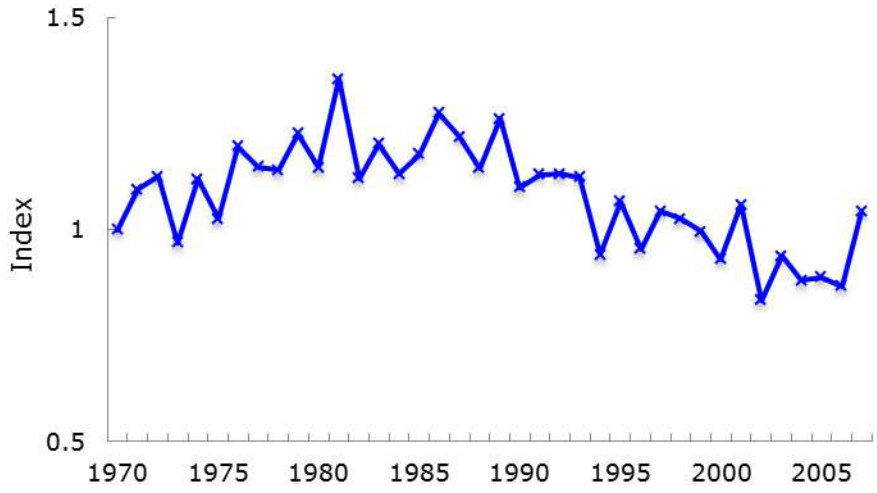


Figure 12: Trend index for sub Arctic terrestrial birds, 1970-2007.
Note: Index is standardized to 1 for the year 1970. Index calculated following the Living Planet Index methodology described in Loh *et al.*, 2005. Sixty-seven bird populations were used to calculate the index.
Source: Data supplied by the Conservation of Arctic Flora and Fauna, 2014.

Changes in Population Status of Boreal Caribou

In North America there are four extant subspecies of caribou (Peary, barren-ground, Grant's and woodland), occupying ranges from close to the 49th parallel to the high Arctic Islands. Historically, caribou were found in all 13 Canadian provinces and territories compared to 10 today[3].

Boreal woodland caribou, one of six populations of woodland caribou (*Rangifer tarandus caribou*) in Canada, are forest dwelling, sedentary caribou found only in Canada. They were assessed as threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) in 2002 and listed as such under the federal *Species at Risk Act* (SARA). Their total population is approximately 34,000, distributed

[3] The classification of caribou used in this report follows the current SARA classification system. In 2011, COSEWIC adopted 12 designatable units for caribou in Canada that will be used in caribou assessments and subsequent listing decisions under SARA beginning in 2014.

widely across the boreal forest from the northeast corner of Yukon across to Labrador and as far south as Lake Superior. Since the 1900s their range has been progressively receding in a northward. In terms of the population trends of each of the 51 local populations of boreal caribou, 1 is increasing, 14 are declining, 17 are stable and the trend of 19 is unknown (Environment Canada, 2012).

Integrated Risk Assessment for Boreal Caribou Ranges in Canada (2012)

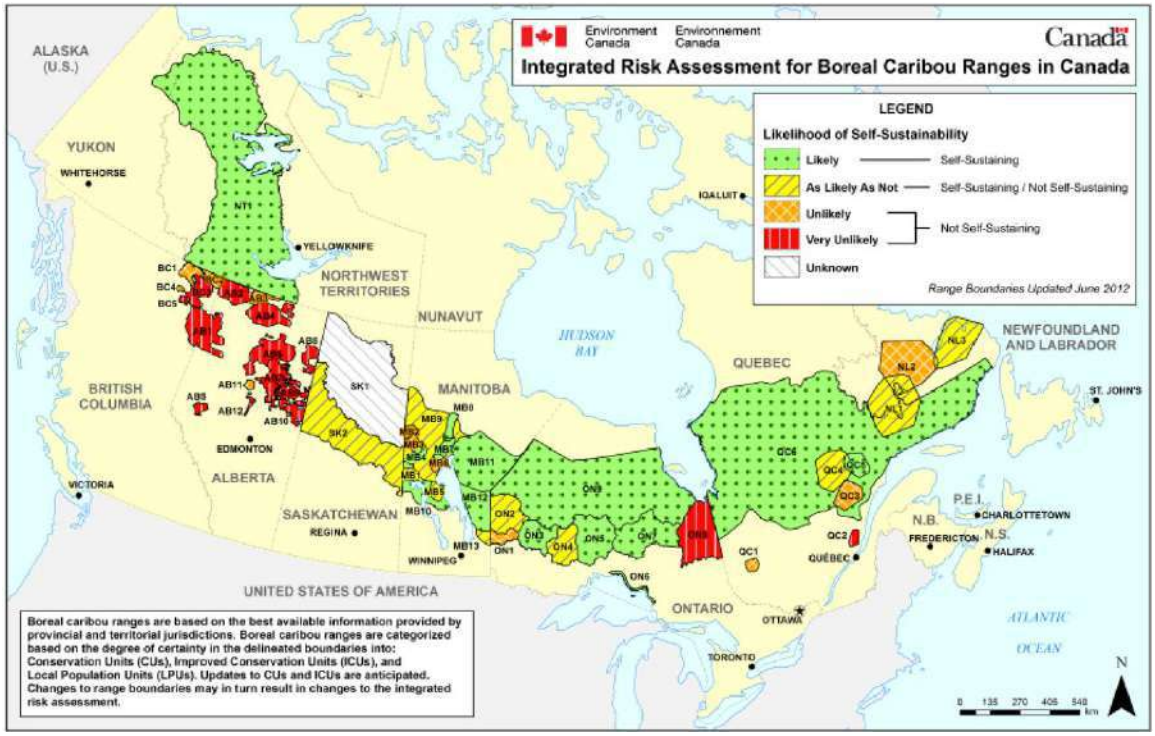


Figure 13: Integrated risk assessment for boreal caribou ranges in Canada, 2012.
Source: Environment Canada, 2012.

Figure 13 shows the results of an integrated risk assessment to determine the likelihood that the local populations are self-sustaining. This was conducted using three lines of evidence: population trend, population size and habitat condition, as defined by amount of total disturbance (Environment Canada, 2011). Of 51 boreal caribou local populations, 14 are “self-sustaining”, 26 are “not self-sustaining”, 10 are “as likely as not self-sustaining”, and one is “unknown”.

Habitat alteration (i.e. habitat loss, degradation, and fragmentation) from both anthropogenic and natural sources, and increased predation as a result of habitat alteration have led to local population declines. Some local populations of boreal caribou are at risk because of other factors, mainly over-harvest (Environment Canada, 2012).

Changes in Status of Peary Caribou

Peary caribou (*Rangifer tarandus pearyi*) occur in the Canadian Arctic Archipelago and are the most northerly group of caribou in North America. Small groups of Peary caribou are found on the high Arctic and mid Arctic islands as well as the northern extension of the mainland (Figure 14). Their range covers approximately 520,000 km^2 of Arctic tundra and they are uniquely adapted to this polar desert environment.

Global Distribution of Peary Caribou (2013)

Figure 14: Global distribution of Peary caribou, 2013.
Source: Data supplied by Environment Canada, 2013.

Peary caribou were assessed in Canada by the COSEWIC and In February 2011, were listed as endangered under the federal SARA. Since the 1960s, Peary caribou numbers have declined in the Northwest Territories and Nunavut. Given their vast range in Canada, the rate of decline has varied between different islands in the Canadian Archipelago over time. Severe declines were documented since the 1960s and now numbers appear to have been stable at low levels with some populations showing increases in recent years. The current global population estimate is 12,000.

The Canadian Archipelago and its wildlife, including Peary caribou, are sensitive to the effects of changing climate and sea ice patterns. Catastrophic die-offs are due mainly to severe icing episodes, where ice covers the vegetation and the caribou starve. Pressures from mineral and energy resource exploration and development are also increasing within their range.

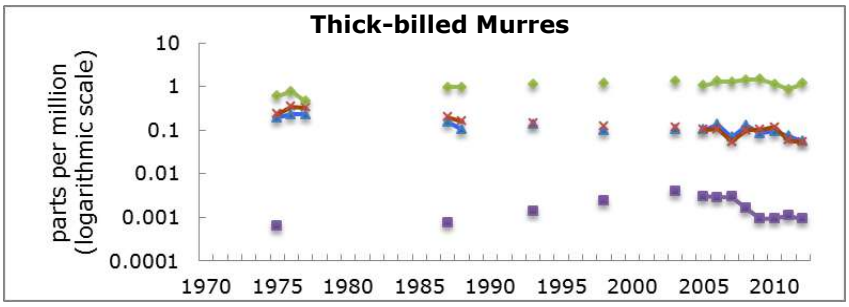
Peary caribou play a very important role in the culture and economy of Inuit and Inuvialuit in the Northwest Territories and Nunavut. Peary caribou are an actively managed resource through the land claim co-management system in the Nunavut and Northwest Territories, where management authorities work to set harvest levels that are sustainable. Harvesting is under strict quotas as the subspecies is sensitive to overharvesting.

Contaminants in Wildlife

Persistent organic pollutants (POPs) and mercury (Hg) tend to accumulate in aquatic ecosystems more than in terrestrial ones. Contaminant levels are magnified as they move up the food web. This means that the highest levels of these contaminants are found in top predators – especially marine mammals and fish-eating birds.

Contaminant Trends in Seabirds (1973-2012)

a)



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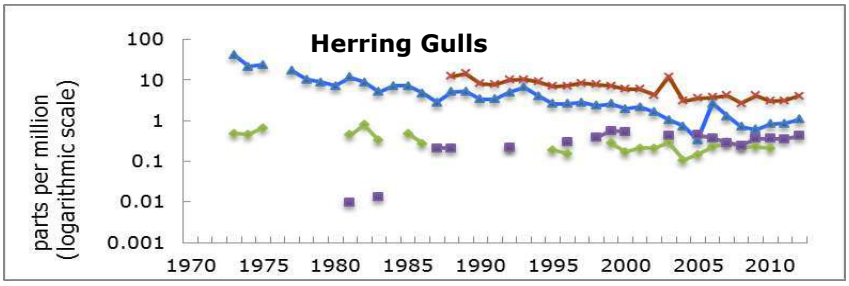

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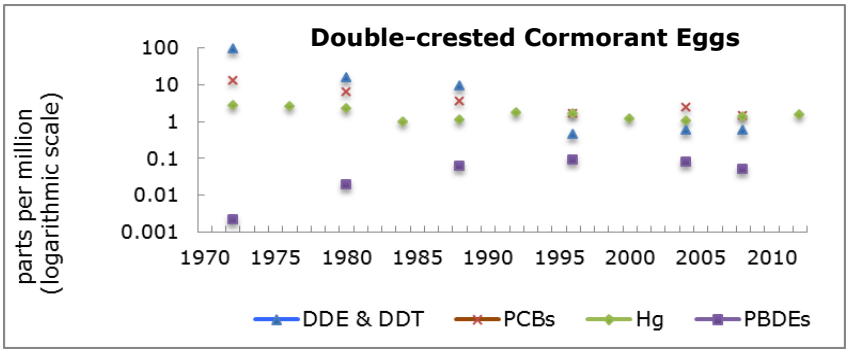


Figure 15: Trends in persistent organic pollutants and mercury in a) thick-billed murres from Prince Leopold Island in the Canadian Arctic, b) herring gulls from Lake Ontario and c) double-crested cormorant eggs in the St. Lawrence Estuary. Annual concentrations are the sum of individual congeners and are standardized to wet weight, except for Hg that is standardized to dry weight.
Note: DDE is a breakdown product of DDT.
Source: Data supplied by Environment Canada, 2013.

POPs and mercury from urban and industrial sources are transported to the Arctic by air and ocean currents. Since being banned in the 1970s, legacy contaminants such as DDT and polychlorinated biphenyls (PCBs) have been declining in thick-billed murres (*Uria lomvia*) in the Arctic (Figure 15a, Braune, 2007). The use of polybrominated diphenyl ethers (PBDEs) as a flame retardant in plastics, textiles and other materials, has been voluntarily phased out by some industries and is subject to restriction. PBDEs have also declined in seabirds since 2007 (Figure 15a).

In contrast, mercury concentrations almost doubled in thick-billed murres from 0.6 ppm in 1975 to 1.18 ppm in 2012 (Figure 15a). Anthropogenic sources of mercury include the burning of fossil fuels, non-ferrous metal production and waste incineration (Arctic Monitoring and Assessment Programme (AMAP), 2011). Large scale hydro-electric developments can also increase methyl-mercury in the food chain (Rosenberg *et al.*, 1997). As these activities increase globally, Arctic concentrations of mercury have also increased.

Concentrations of DDT and PCBs in herring gulls (*Larus argentatus*) from Lake Ontario (Figure 15b) and double-crested cormorants (*Phalacrocorax auritus*) from the St. Lawrence Estuary (Figure 15c) declined between 1973, when sampling began, until the late 1990s. Since then concentrations leveled out, which is evidence of the long life of these pollutants (Environment Canada, 2013). Since 2000, concentrations of PBDEs have stabilized in herring gulls and decreased in the eggs of double-crested cormorants. Mercury concentrations have declined slightly in both seabirds since sampling began. However, mercury deposition continues in the Great Lakes Basin and St. Lawrence River as a result of industrial activity (Environment Canada and US Environmental Protection Agency, 2009).

Lake Ontario Lake Trout Contaminant Concentrations

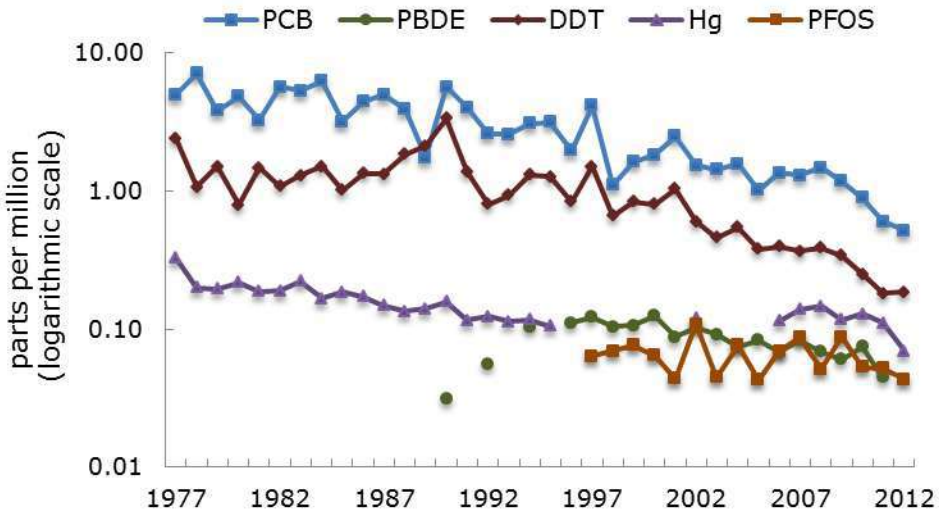


Figure 16: Trends in persistent organic pollutants in lake trout from Lake Ontario. Annual concentrations are the sum of individual congeners and are standardized to wet weight
Source: National Fish Contaminants Monitoring and Surveillance Program; Environment Canada 2013c; Zhu & Hites, 2004.

In 1997, Environment Canada began monitoring perfluorooctane sulfonate (PFOS), a persistent chemical subject to long-range transport that was commonly used to repel water, oil or soils from paper, packaging and fabrics. PFOS was voluntarily phased out in 2002 with some exceptions; for example, an

exception for aqueous fire-fighting foams expired in May 2013 (Environment Canada 2013c). PFOS concentrations increased in Lake Ontario lake trout (*Salvelinus namaycush*) from 1979–2000 and then stabilized (data not shown) (Furdui *et al.*, 2008). In 2012, concentrations of PFOS and PBDEs in lake trout were not above levels that would damage fish health but were at levels that are considered harmful for wildlife that consume fish (Environment Canada, 2013c and 2013d)[4]. PCBs and DDT concentrations have declined in lake trout in Lake Ontario from 1977 to 2012 (Figure 16). Mercury concentrations have remained relatively consistent and PBDEs have declined by about 4% per year since the late 1990s (Environment Canada, 2013c).

Marine Debris

Marine litter, primarily plastic waste, is an international issue and debris affects all oceans and coastlines of the world (UNEP, 2008). Marine plastics pose a threat to marine mammals, seabirds and other species that may mistake the plastic for food or become entangled in plastic debris. It is difficult to estimate the increase in mortality rates because most deaths take place at sea, making the impacts of marine plastics a difficult issue to adequately quantify (Laist, 1997; Williams *et al.*, 2011).

Northern fulmars (*Fulmaris glacialis*) are seabirds that feed exclusively at sea and have vast migratory ranges that cover the northern Pacific, high Arctic and northern Atlantic. The stomach contents from northern fulmars washed up on the west coast of Canada and northwest United States show that the mass of ingested plastic has increased dramatically from 0.04 g in 1969–1977 to 0.39 g in 2009–2011 (Figure 17) (Avery-Gomm *et al.*, 2012). Plastic ingestion can cause gastrointestinal blockages, reduced feeding, absorption of toxic chemicals and mortality (Laist, 1997; Teuten *et al.*, 2009). The type of plastic ingested has also shifted from industrial to consumer plastics (UNEP, 2008).

Plastics Ingested by Seabirds (1969-2011)

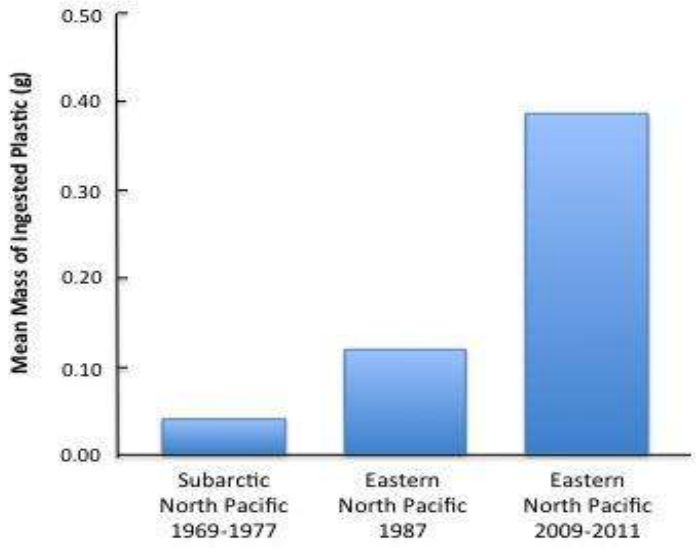


Figure 17: Plastics found in the digestive tracts of dead Northern Fulmars in the North Pacific.
Source: Adapted from Avery-Gomm *et al.*, 2012

[4] Reported concentrations are based on a homogenized sample of the whole fish including bone, skin and organs. Therefore, the numbers presented cannot be used to provide guidance for human consumption.

Outcome 3: Genetic Resources and Adaptive Potential Maintained

Genetic diversity is nature's insurance policy. It increases biological productivity, assures ecological resilience and creates options for future innovation. An outcome of genetic resources and adaptive potential means maintaining the full complement of genetic diversity of all species in situ and ex situ (wild and domestic) as well as the full geographic distribution of species necessary to ensure adaptive potential.

Genetic Diversity

Genetic diversity represents the raw material for evolution and adaptation. More genetic diversity in a species or population means a greater ability for some of the individuals in it to be resilient to changes in the environment, such as climate change and, therefore, for the species and population to adapt over time. Canada has a number of peripheral populations, that is, populations at the edge of their range (e.g., deerberry, *Vaccinium stamineum*). These peripheral populations have special importance for biological conservation and the long-term persistence of species. Peripheral populations may have unique genetic or behavioural attributes relative to the core population (Lesica and Allendorf, 1995). These attributes can provide the species with resilience to changing environmental conditions as well as providing a source of individuals for reintroductions and translocations (Channell and Lomolino, 2000; Laliberte and Ripple, 2004).

A genetic inventory of a population creates a baseline map of genetic variability over a geographical range (Schwartz *et al.*, 2007). This allows managers to estimate the population viability of isolated clusters if landscape fragmentation reduces gene flow (Fischer and Lindenmayer, 2007). With this information, managers can proactively target clusters of conservation or evolutionary importance (Schwartz *et al.*, 2007; Pelletier *et al.*, 2012).

As one example, there are an estimated 450,000 american black bears (*Ursus americanus*) in Canada, found mostly in British Columbia, Ontario and Quebec (Garshelis *et al.*, 2008). Although black bears are not currently threatened in Canada, future landscape fragmentation or climate change could have an impact on this iconic species. A genetic inventory of a contiguous Ontario population (Pelletier *et al.*, 2012) that covers a large tract of forest (1 million km^2) and has few barriers to dispersal found three genetic clusters (Northwest, Southeast and Bruce Peninsula) (Figure 18). The Bruce Peninsula cluster had the lowest genetic diversity and a low population size. This area also has the highest human density and black bear habitat is under pressure from development (Obbard *et al.*, 2010).

Spatial Distribution of Black Bear Genetic Diversity (2012)

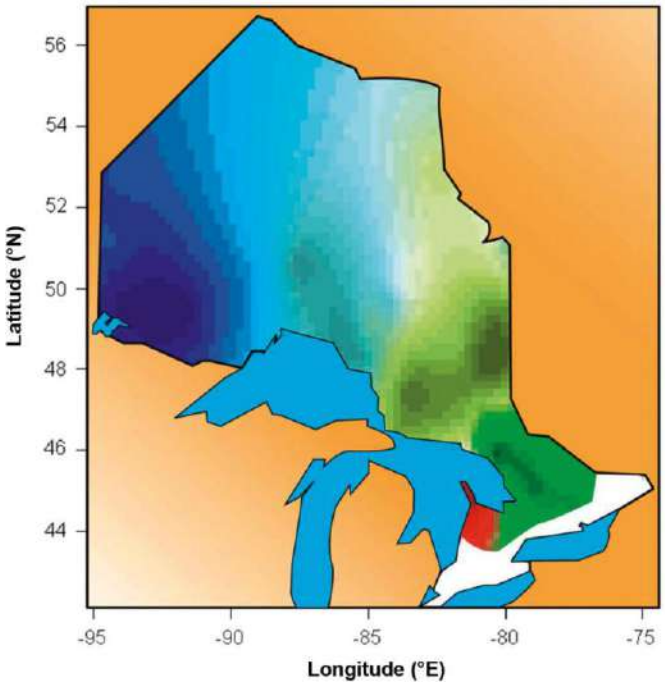


Figure 18: Genetic clusters of american black bears in southeastern Ontario, Canada, 2012.
There are three main genetic clusters differentiated by three colours: Northwest (blue), Southeast (green), Bruce Peninsula (red).
Source: Pelletier *et al.*, 2012.

There are extensive provincial/territorial and national-level activities pertaining to the assessment of the genetic diversity of native forest tree species (Beardmore *et al.*, 2012). These efforts are directed at identifying and understanding forest tree species' genetic diversity at various scales (e.g. population, range-wide, ecozone, and ecosystem), and the impact of a decline in genetic diversity on species vulnerability and resilience (Beardmore *et al.*, 2012; Aitken *et al.*, 2008). In particular, species vulnerability, the condition that results when a species is uniformly susceptible to pests, pathogens or environmental hazards as a result of its genetic constitution, is being assessed at the national and provincial/territorial levels (Beardmore *et al.*, 2012; Johnson, 2010).

Canadian tree improvement programs were initiated in several provinces in the 1960's in response to expanding reforestation programs. The objective of the tree improvement programs is to increase productivity, and may target other traits such as wood quality and pest resistance. Where forests are being planted with improved seed, they would have a degree of resiliency given the quality of seed being used. Additionally, where there are guidelines pertaining to seed transfer zones, recommendations are made to plant material (seed or seedlings) that is adapted to specific sites (Ying and Yamchuk, 2006). These efforts assist in ensuring that there is resiliency in planting material, even if it is monoculture plantings.

Knowledge pertaining to forest tree genetic diversity and species adaptability is also being used to make decisions pertaining to assisted migration (i.e. the human-aided movement of species within or beyond their historical range, with the intent to facilitate adaptation to predicted climate change). For example, British Columbia has the largest Canadian assisted migration trial and assisted migration is being used as a conservation strategy for two high elevation pines, whitebark pine (*Pinus albicaulis*) and limber pine

(*Pinus flexilis*) (British Columbia Ministry of Forests, Lands and Natural Resource Operations, 2013; Langor, 2007; Wilson, 2007). Assisted migration research results will impact forest management climate change adaptation strategies (Pedlar *et al.*, 2012; Wang *et al.*, 2012; Leech *et al.*, 2011). Additionally, the results of large-scale genomics research projects, such as AdaptTree, are genetically characterizing adaptability to changing environments (University of British Columbia, 2014). This information could enhance the precision in climate-based seed transfer systems and may alter seed transfer policies.

Wildlife Health & Disease

One example of an emerging wildlife issue in Canada is White Nose Syndrome. White Nose Syndrome is caused by an invasive fungus that was first found in North America in New York State in 2006 (Frick *et al.*, 2010). From 2006-2012, the disease is estimated to have killed 5.7 - 6.7 million bats in the northeastern U.S. alone. First detected in Canada in the winter of 2009-2010 (Ontario Ministry of Natural Resources, 2013), diseased bats are now found in five Canadian provinces (Figure 19). Six of Canada's bat species are known to be susceptible to the disease (Washington Department of Fish and Wildlife, 2012; Canadian Endangered Species Conservation Council, 2011). COSEWIC has assessed three of these as endangered and under imminent threat. This includes Canada's most common and widely distributed bat, the little brown (*Myotis lucifugus*), or little brown bat. The other two are the northern myotis or northern long-eared bat (*Myotis septentrionalis*) and the tri-colored bat or eastern pipistrelle (*Perimyotis subflavus*). The little brown myotis is estimated to have declined by 94% in Eastern Canada in hibernacula where bats have been exposed to the fungus for two or more years. For northern myotis documented declines average 98% after two years of exposure. The tri-colored bat is less common in Canada, so it is difficult to determine trends. However a decline of 94% was recorded for a Canadian hibernaculum (COSEWIC 2012a, 2012b, 2012c).

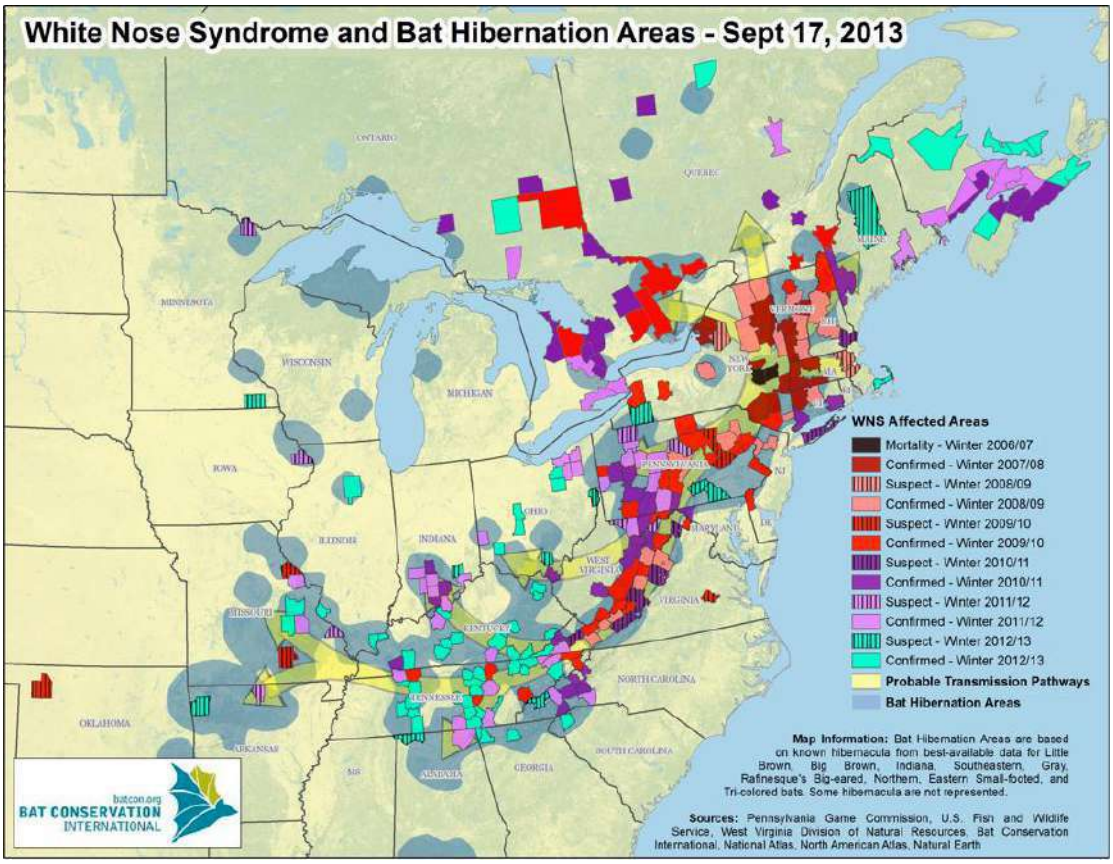


Figure 19: White Nose Syndrome and bat hibernation areas in eastern USA and Canada, 2013. Source: Bat Conservation International, 2013.

These three bats hibernate in Canada, overwintering in cold and humid hibernacula – usually caves, where the cold-loving fungus that causes White Nose Syndrome thrives. Although the fungus is most easily detected by white patches on the nose, the fungus also grows on their wings, causing severe damage (Reichard & Kunz, 2009). The damage to the wings is believed to contribute to dehydration, triggering more frequent arousal from hibernation which depletes needed fat and electrolytes (Cryan *et al.*, 2013a). Since they cannot find food to replenish themselves, the bats will die from starvation, dehydration or the cold. The emergence of bats in the winter to look for food is symptomatic of white nose syndrome (Cryan *et al.*, 2013b).

The full impact to Canadian populations of little brown myotis and northern myotis is expected to be within 12-18 years (COSEWIC 2013a, 2013b). Three bats are long-lived with slow population growth rates, so they are not expected to recover quickly (COSEWIC 2012a, 2012b, 2012c). Evidence suggests that White Nose Syndrome is more deadly where winter is longer. While this means that the outlook for these species may be better in the southern U.S., Canada is at risk of losing its cave-dwelling bats. Research is being done to better understand the disease and treatments and how to provide alternative, disease free hibernacula.

Outcome 4: Sustainable Use of Biological Resources

Ecologically sustainable production and consumption of natural resources assure stable jobs, traditional lifestyles, long-term food security and human health. Sustainable use of biological resources means the production and consumption of natural resources within ecological limits and thresholds to support economic capacity, livelihoods, local food security and human health. It also recognizes the importance of local and Indigenous knowledge, innovations and practices associated with ecosystems, species and genetic resources that are a necessary component of using biological resources sustainably.

Marine Resources

Fisheries and Oceans Canada establishes harvest limits for wild fish stocks to protect stocks for the future. Of the 155 major stocks assessed in 2012, 148 (95%) were harvested at levels considered to be sustainable (Figure 20). These levels are based on the best available scientific information[5]. For 83 (54%) stocks, there is sufficient historical information to set the level using the mathematically based removal reference, while the harvest levels for an additional 65 (42%) stocks were set using other scientific approaches. Seven stocks (5%) were harvested above approved levels[6]. The number of fish stocks harvested within levels approved by the Department has improved since 2011, when 11 stocks (7%) were harvested above approved levels. The improvement is in large part due to the implementation of *Sustainable Fisheries Framework Precautionary Approach Policy*.

Number of Major Stocks Harvested Relative to Approved Levels, Canada, 2011-2012

Figure 20: Major fish stocks harvested relative to approved levels.

[5] For a detailed explanation of harvest limits, indicator methodology, and data sources, please see www.ec.gc.ca/indicateurs-indicators.

[6] Percentages do not add up to 100 due to rounding.

Note: The removal reference is a harvest rate that is estimated to be biologically sustainable, based on an analytical assessment of historical stock productivity data. Major stocks were harvested above the removal reference and/or approved levels primarily in competitive fisheries or because of landings in other directed fisheries.
Source: Environment Canada, 2014a.

The Strait of Georgia is located on the Pacific coast of Canada between Vancouver and Vancouver Island. coho salmon (*Oncorhynchus kisutch*) were once abundant and formed a significant component of the fisheries catch in this region. However, coho salmon returns declined significantly in the mid-1990s. Fisheries and Oceans Canada responded to the declining returns by dramatically reducing fishery exploitation and the population declines were halted; recent spawner escapements have been similar to those before declining survivals (Figure 21). The observed decline in coho populations in the late 1990's was largely due to a decline in marine survival from 10% in the late 1970s to less than 1% by early 2000s (Beamish *et al.*, 2010). Changes in marine survival may be related to larger ecosystem level changes in the Strait of Georgia such as decreases and earlier timing of zooplankton blooms, warmer water temperatures, and earlier peaks in river discharge. Ongoing research is aimed at improving the early marine survival of hatchery coho by altering the timing of spring release (Irvine *et al.*, 2013). Stock levels are being reassessed to determine if an increase in exploitation would be possible without impacting the sustainability of this important resource.

Wild Coho Salmon Escapements and Total Returns for the Interior Fraser River Watershed (1975–2011)

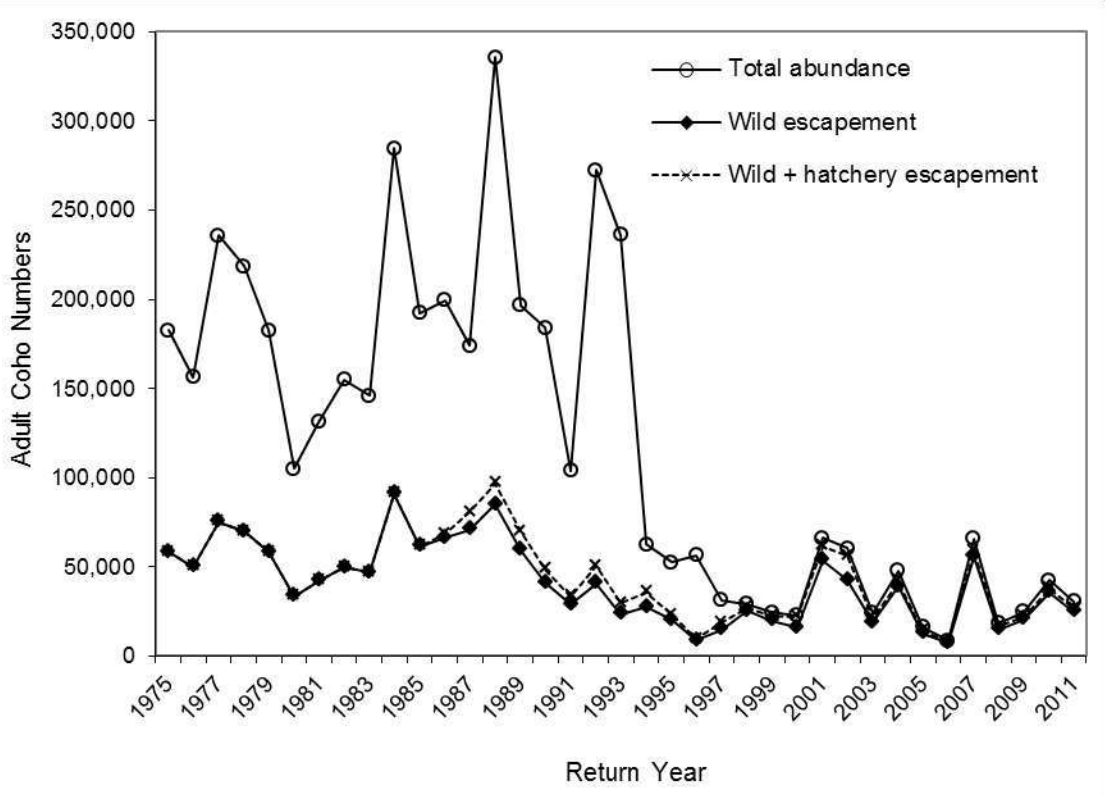
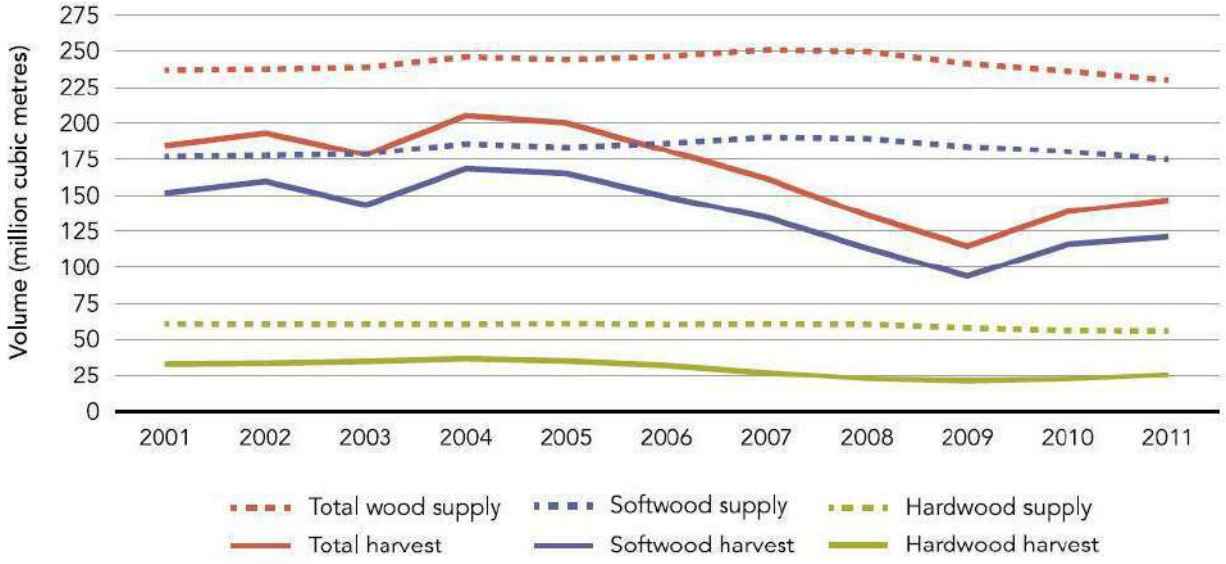


Figure 21: Reconstructed time series of wild coho salmon escapements and total escapements (wild + hatchery fish) and total returns (total escapement + catch) for the interior Fraser River watershed during 1975-2011.
Source: Decker & Irvine, 2013.

Forest Resources

Across the country, timber is being harvested at rates more than 30% below the wood supply considered to mark the sustainable limit. Between 2002 and 2011, the total harvest volume on all land types (provincial, territorial, federal and private) averaged 166 million cubic metres (m^3) per year, more than 30% below Canada's average total wood supply of 242 million m^3. Over the same period, softwood harvests on all land types averaged 136 million m^3 per year, 25% below the estimated wood supply of 183 million m^3. Hardwood harvests on all land types over the past decade have averaged 29 million m^3 per year, more than 50% below the average estimated wood supply of 59 million m^3. Significant declines in harvest as a result of the global economic downturn and related low demand for forest products began after 2004, and by 2009 less than half of the estimated wood supply was harvested. Although harvesting rates are steadily recovering, rising in 2010 and again in 2011, they remain well below the estimated wood supply (Natural Resources Canada, 2013a).

Annual Harvest Versus Supply Deemed Sustainable for Harvest (2001-2011a)



a Includes all land types (provincial, territorial, federal and private).

Figure 22: Annual harvest versus supply deemed sustainable for harvest (2001-2011).
Source: Canadian Council of Forest Ministers, 2013.

Canada continues to harvest at levels below the estimated wood supply considered to be sustainable each year, and this trend is expected to continue. In the medium term, the gap between harvested volume and sustainable timber volumes is expected to narrow. This change will be driven by the anticipated return of demand for solid wood products in the U.S., reductions in available wood supply because of the mountain pine beetle (*Dendroctonus ponderosae*) in British Columbia and policy changes in central Canada, including Quebec's *Sustainable Forest Development Act* and Ontario's *Forest Tenure Modernization Act*.

Cross-Cutting Challenges

Invasive Alien Species

IAS are those harmful alien species whose introduction or spread threatens the environment, the economy, or society, including human health. In Canada, IAS account for at least 27% of all vascular plants. In addition, there are an estimated 181 insects, 24 birds, 26 mammals, two reptiles, four amphibians, 55 freshwater fish and several fungi and mollusks that are invasive in Canada (Canadian Councils of Resources Ministers, 2004).

Invasive alien plants are a key example of the threats to the productivity of Canada's croplands and rangelands (Canadian Food Inspection Agency, 2008). Non-native plants can compete with native plants for resources and change ecosystem productivity, fire regimes, and nutrient cycles (Vilá *et al.*, 2011). Economic impacts of invasive non-native species include lowered real estate values, reduced habitat quality, decreased quality of forage for wildlife and livestock, and reduced recreational opportunities (Pimentel *et al.*, 2005; Frid *et al.*, 2009).

Invasive Alien Plant Species by Ecozone (2008)

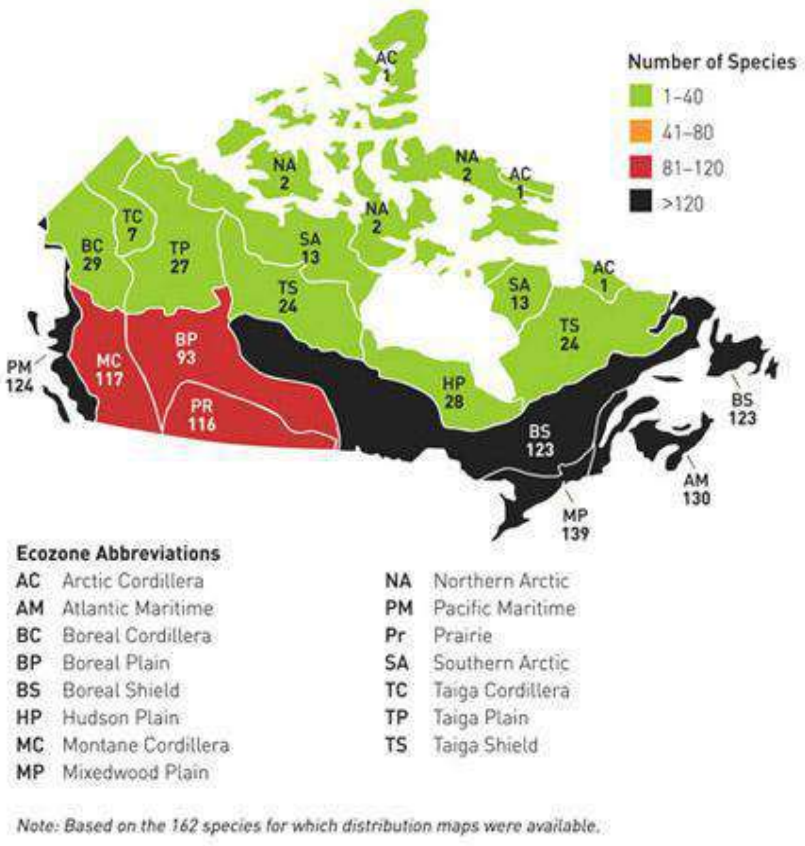


Figure 23: Number of invasive alien plant species in Canada by ecozone[+].
Based on the 162 species for which distribution maps were available.
Source: Canadian Food Inspection Agency, 2008.

Most of the more than 150 invasive plants established in Canada between 1800 and 1900 were introduced from Europe, western Russia and the Mediterranean as a result of increased trade, immigration and colonization. Since the 1900s, introduction rates have slowed to about one species every two years (Canadian Food Inspection Agency, 2008). However, with the high volume of trade and continued globalization, there is still a high risk of further introductions. Most invasive plants are found in southern Canada, with the highest number of invasive alien plant species found in the Mixedwood Plains, Atlantic Maritime, and Pacific Maritime ecozones[+] (Figure 23). Northern ecozones[+] have fewer invasive species but the impacts of these to biodiversity can still be severe (CAFF, 2010).

Habitat Loss from Urban Expansion

Built-up areas in and around cities and towns in southern Canada increased over the past decade as a result of the transformation of cropland and forests to built-up areas. For example, from 2000 to 2011, 3,361 km^2 were converted to built-up area in southern Canada. In the Greater Golden Horseshoe, an area of 33,200 km^2 located to the west of Lake Ontario including the Greater Toronto Area, natural landscapes have declined while populations increased. The population of the Greater Golden Horseshoe increased by 17% from 2001 to 2011. Settled areas, meanwhile, increased by 28% (627$km^{2)}$ from 2000 to 2011 (Figure 24) (Statistics Canada, 2013).

Urban Growth in the Toronto Area (1971-2011)

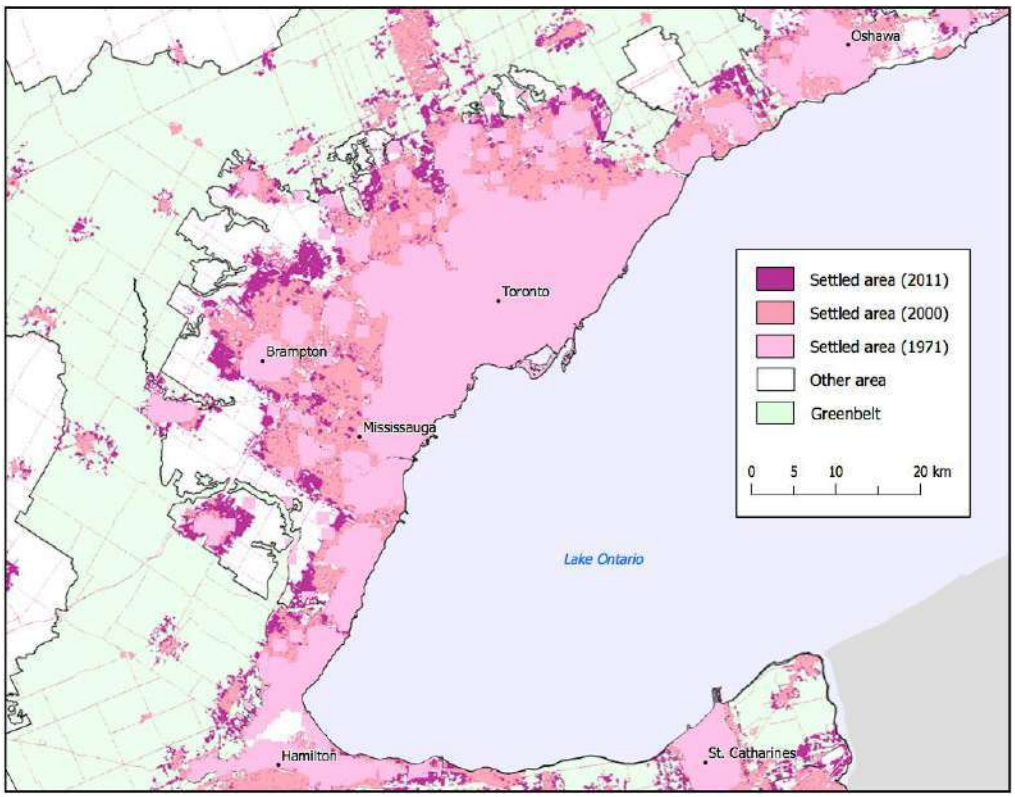


Figure 24: Area converted to settled landscapes within the Lake Ontario and Niagara Peninsula sub-drainage area, 1971, 2000 and 2011.
Source: Statistics Canada, 2013.

Challenges to Biodiversity from Climate Change

A key finding of *Canadian Biodiversity: Ecosystem Status and Trends 2010* (Federal, Provincial and Territorial Governments of Canada, 2010) was that rising temperatures across Canada, along with changes in other climatic variables over the past 50 years, have had both direct and indirect impacts on biodiversity in terrestrial, freshwater, and marine systems. Projected increases in temperature are expected to exceed biological tolerances for many species and ecosystems in Canada, resulting in decreased capacity to recover from disturbances and increased risk of extinction for many species (Prowse, 2009).

Wildfires

Wildfires are essential for maintaining forest ecosystem function, variability in age-class distribution and diversity in stand structure and composition (Weber and Flannigan, 1997; Weber and Stocks, 1998). Warmer weather associated with climate change will likely decrease forest floor moisture content and increase the likelihood of future fires (Wotton *et al.*, 2010). Recent climate change research suggests that the increase in area burned in Canada over the past four decades is due to human-caused increases in temperatures (Gillett *et al.*, 2004). Increased fire season length has been documented in the western US over the last 30 years (Westerling *et al.*, 2006), a climate warming impact also detected in historical Canadian fire weather statistics. These trends are expected to continue, resulting in longer fire seasons with greater severity, with a greater occurrence of extreme fire weather periods such as prolonged drought that will greatly increase the wildfire hazard (Flannigan *et al.*, 2009, 2013).

The Canadian wildland fire regime is characterized by infrequent large crown fires of high fire intensity (de Groot *et al.*, 2013a). The annual area burned in Canada averages about 21,000 km² (2.1 M ha) (<0.5% of total forest area) but is highly variable, ranging from 3,000 to 76,000 km² (0.3 to 7.6 M ha) (Figure 25). A review of large fires between 1969-1997 showed that large fires (>2km^2 in size) represent only about 3% of the total number of wildfires yet account for about 97% of the total area burned (Stocks *et al.*, 2002). Annual fire occurrence could increase about 25% by 2030 and 75% by 2100 (Wotton *et al.*, 2010) and area burned may increase as much as 2 – 5.5 times higher than current values by 2100 (Flannigan *et al.*, 2005; Balshi *et al.*, 2009). This would put increasing pressure on fire management agencies that could push current suppression capacity beyond a tipping point, resulting in a substantial increase in large fires (de Groot *et al.*, 2013b). Some of the largest increases are expected in the southern and central boreal forests as a result of more lightning strikes coupled with drier conditions (Wotton *et al.*, 2010).

Annual Area Burned in Canada (1970–2010)

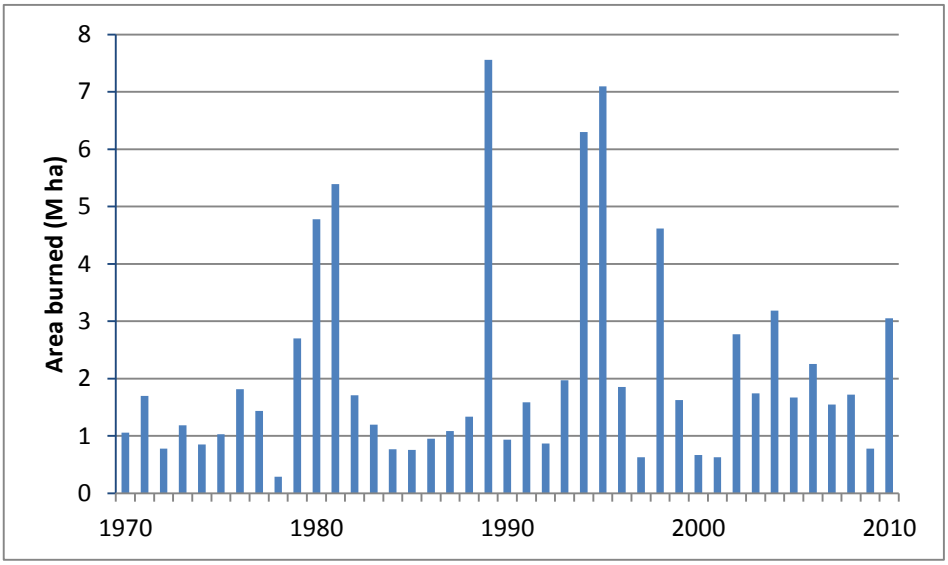


Figure 25: Annual area burned in Canada, 1970–2010.
Source: Canadian Council of Forest Ministers, 2013.

Glaciers

About 75% of Canada's approximately 200,000 km^2 of glacier cover is found in the Canadian Arctic Archipelago. Since 2005, summer air temperatures across this region have increased sharply which has resulted in a larger decline in mass balance since 2005 than the 1960 to 2004 average (Sharp *et al.*, 2011). As a result, glaciers and ice caps in the Canadian high Arctic have become the most important contributor to global sea-level rise outside of the ice sheets of Antarctica and Greenland (Gardner *et al.*, 2011).

In Canada's western Cordillera, glaciers are a major source of water to streams and rivers, especially during the summer when there is little rain. This cold melt water maintains habitat quality for cold water fish and other species. Glaciers here have been declining since measurements began in the 1960s, largely due to increases in summer air temperature and reductions in snowfall.

In British Columbia's southern Coast Mountains, Place and Helm glaciers have decreased by 39 and 41 m of water equivalent since 1965 and 1977, respectively (Figure 26). In the Canadian Rocky Mountains, Peyto Glacier has declined by 26 m since 1966. Arctic glaciers did not show significant declines until the 1990s. The three reference glaciers in the Arctic have declined from between 7 and 14 m over the past five decades. See *Canada's 4th National Report to the United Nations Convention on Biological Diversity* (Government of Canada, 2009) for additional information.

Changes in Glaciers (1960-2012)

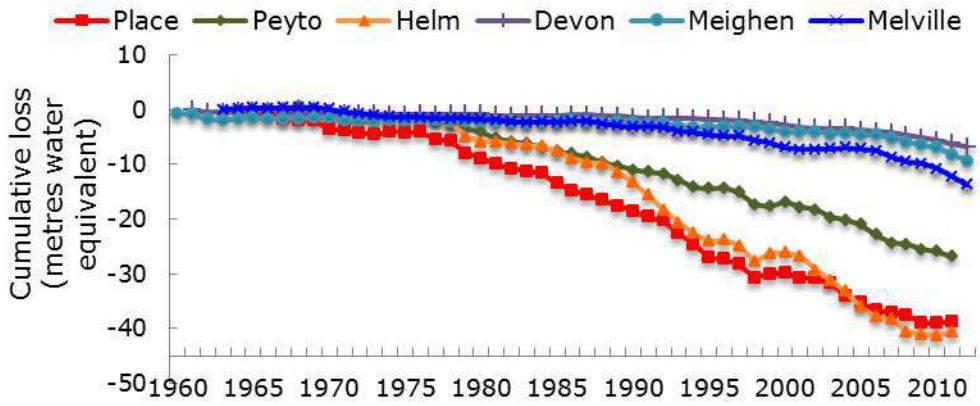


Figure 26: Loss of glacier mass for six reference glaciers, 1960–2012 (1977 for Helm glacier).
These reference glaciers are located in the coastal mountains (Place and Helm), Rocky Mountains (Peyto) and high Arctic (Devon, Meighen and Melville). The trends represent cumulative loss in metres water equivalent.
Source: Geological Survey of Canada, 2013.

Permafrost

Permafrost (soils frozen year-round) underlies much of the tundra and taiga ecosystems in Canada's North. In sub Arctic and boreal regions, thawing permafrost and collapse of frozen peatlands may flood the land, replacing forest ecosystems with wet sedge meadows, bogs, ponds, and fens (Jorgenson *et al.*, 2001; Jorgenson and Osterkamp, 2005) as is happening now in northern Quebec (Vallee and Payette, 2007; Payette *et al.*, 2004; Thibault and Payette, 2009). In colder areas, on the other hand, deepening of the ground layer that thaws in the summer (the active layer) or melting of ground ice can lead to collapse and drainage of channels and wetlands (Marsh and Neumann, 2001) or lower the water table and dry out the land (Woo *et al.*, 2006; Woo and Young, 2006) altering plant species and affecting wildlife (Woo *et al.*, 2006).

In the high Arctic polar desert site at Alert, Nunavut, ground temperatures (upper 25 m) in 2012 were the highest they have been since permafrost temperature measurements began in 1978 (Figure 27). At a depth of 15 m, the increase in permafrost temperature at one borehole (BH5) has been about 1.5 degree Celsius (°C) per decade since 2000, which is about 1°C per decade higher than the rate for the entire record. Smith *et al.*, (2012) found that significant increases in winter air temperature appear to be responsible for recent permafrost temperature increases in the high Arctic. Air temperatures have increased since 1980 by about 0.6 °C per decade with a higher rate of increase since 2000 of about 2.9 °C per decade. Some of the highest temperatures on record have occurred since 2000 with 2009-2012 being among the warmest years since monitoring began in 1951. The effect of this warming on ground temperatures is amplified at sites with limited snow cover which buffers the effect of winter air temperatures. This explains the more rapid warming of low snow cover sites (BH2 and BH5, Figure 27) compared to sites with higher snow cover (BH1).

Permafrost Temperatures in the High Polar Desert (1978-2012)

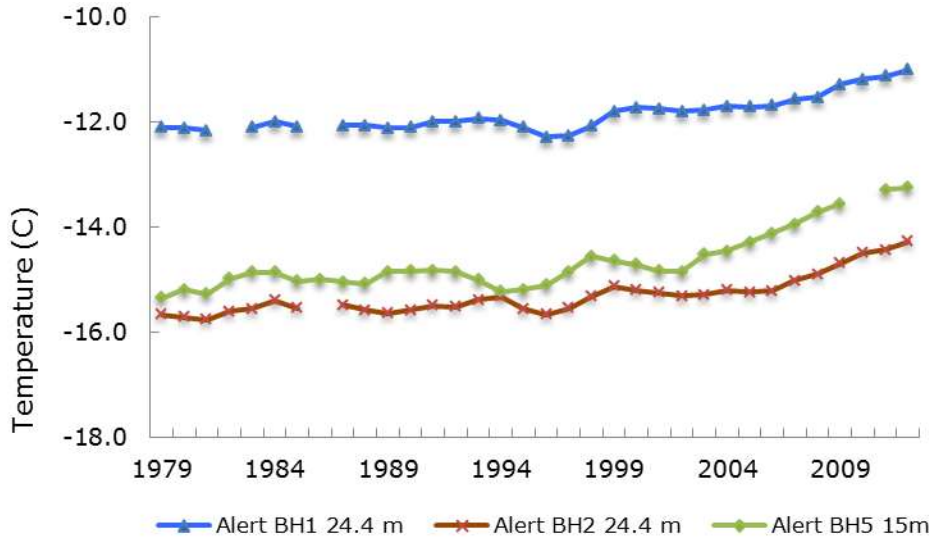


Figure 27: Time series of average annual permafrost temperatures in Alert, Nunavut, 1978–2012. Temperatures were recorded for three sites between 1978 and 2012 at depths of 15–24 m. Source: Updated from Smith *et al.*, (2010, 2012).

Very slow warming of permafrost continues in forested sites in the discontiguous permafrost zone of the central Mackenzie Valley in western Canada (Norman Wells and Wrigley, Northwest Territories) (Figure 28). Over the last decade, the rate that ground temperatures were increasing at Norman Wells slowed. Since 1982, air temperatures have increased by 0.5°C per decade. However, following a peak in 1998, air temperatures have been lower and an examination of the trend from 1998 to present shows a slight cooling trend of 0.2 °C per decade. Snow cover, which insulates ground temperatures from air temperatures, has been lower since 2005. Together the lower air temperature and lower snow cover may be contributing to the reduced rate of warming (Figure 28). Where permafrost is at temperatures close to 0°C (e.g., Fort Simpson, Northwest Territories), increases in permafrost temperature have been negligible due to the large amount of energy that is necessary to thaw ice-rich ground (Smith *et al.*, 2010). This creates a threshold at 0°C which is overcome more slowly than changes in temperature above and below 0°C.

Permafrost Temperatures of Forested Sites in Central Mackenzie Valley (1984-2013)

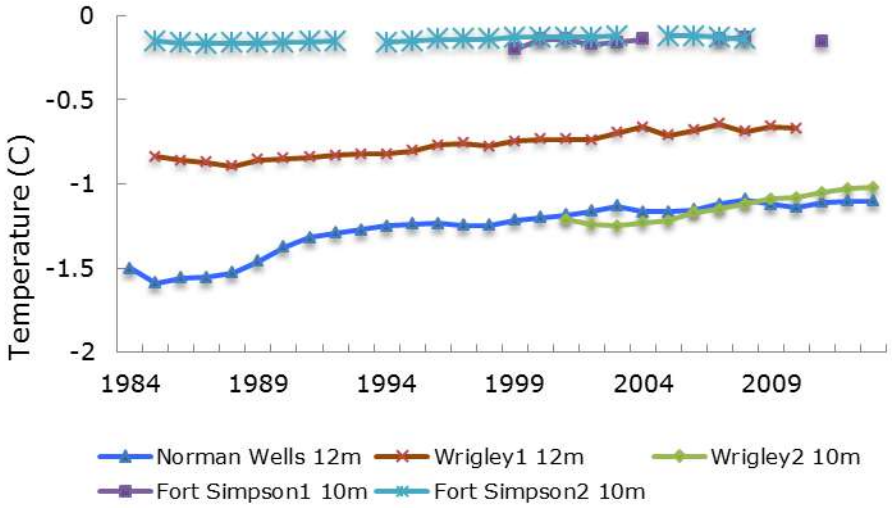


Figure 28: Time series of average annual permafrost temperatures of forested sites in the Mackenzie Valley, 1984–2013.
Temperatures were taken between 1984 and 2013 at depths of 10 to 12 m in the Mackenzie Valley south of Norman Wells, NWT. Norman Wells is the most northerly site and Fort Simpson is the most southerly site.
Source: Updated from Smith *et al.*, (2010) and Smith (2011).

Phenology

Phenology is the study of the seasonal cycles of plants and animals and how these are influenced by variations in climate. Many species use seasonal cues such as temperature or light levels to initiate reproduction, migration, or other life cycle events. Increases in temperature due to climate change have resulted in changes in some phenological events, such as bloom time. For example, the day of first bloom of Alberta plants advanced by about two days per decade between 1939 and 2006 (Figure 29). The first bloom day of 19 Canadian plants advanced by about 9 days between 2001 and 2012 (Gonsamo *et al.*, 2013). Changes in the phenology of plants may lead to mismatches with life-cycle events in dependent species such as insects or migrating birds that rely on seasonal cues such as light levels that are not affected by climate (Parmesan, 2007).

Advancement of Time of First Bloom of Alberta Plants (1939-2006)

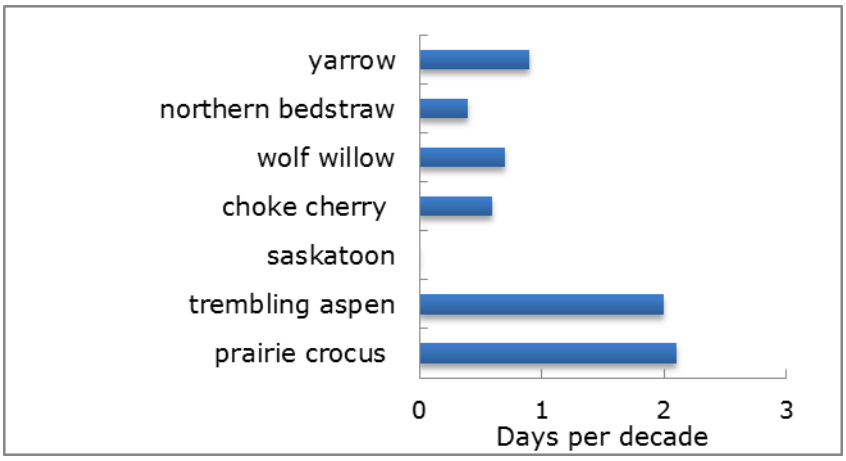


Figure 29: Number of days earlier per decade of the day of first bloom of Alberta wildflowers (estimated from 1939-2006).
Note: Latin names for species listed are: yarrow – *Achillea millefoliumm,* northern bedstraw – *Galium boreale,* wolf willow – *Elaeagnus commutata,* choke cherry – *Prunus virginiana,* Saskatoon – *Amelanchier alnifolia,* trembling aspen – *Populus tremuloides,* and prairie crocus – *Anemone patens.*
Source: adapted from Beaubien and Hamann 2011. Data originally from Plant Watch Canada.

Climate change is also affecting the phenology of ocean systems, leading in some years to a mismatch between seabird reproduction and food availability. For example, breeding success of colonies of cassins auklet (*Ptychoramphus aleuticus*) on Triangle Island on Canada's Pacific coast, was lower during warm water years when the peak abundance of their preferred zooplankton prey, *Neocalanus cristatus*, occurred earlier in the year (Bertram *et al.*, 2005; Hipfner, 2008). A strong temporal matching in the timing of breeding and peak prey availability leads to higher chick survival. This is especially important for seabirds that rely on zooplankton prey because they are short-lived animals that have a yearly window of peak abundance (Bertram *et al.*, 2005).

Impacts to Ecosystem Services from Changes in Biodiversity and the Socio-economic and Cultural Implications of these Impacts

Status of Ecosystem Services Assessment in Canada

Canadian academic institutions, environmental non-government organizations, and local, provincial, territorial, and federal levels of government are working to develop scientific knowledge and refine the use of methods for biophysical, sociocultural, and economic assessment of ecosystem services, and to improve understanding of the links that exist between biodiversity, ecosystem services and human well-being.

Canadian researchers are involved in international initiatives to advance the application of the ecosystem services concept. For example, Statistics Canada is involved in the United Nations Statistical Agency's work on the experimental System of Environmental-Economic Accounting as well as the International Wealth Accounting and Valuation of Ecosystem Services (WAVES) partnership led by the

World Bank. Canadian academics are actively engaged in scholarly debate and publication in this field, and have contributed to the design and implementation of site-scale assessments as well as to the UN Millennium Ecosystem Assessment; co-authored guidance documents about ecosystem services assessment for managers and practitioners; and have participated in the establishment of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services and the development of its work programme and conceptual framework. A new initiative, the National Science and Engineering Research Council of Canada (NSERC) Canadian Network for Aquatic Ecosystem Services, established in 2013, involves over 30 researchers from 11 universities, and will develop tools and knowledge necessary to understand different aquatic ecosystems in support of decision making.

Canada continues to operate the Environmental Valuation Reference Inventory (EVRI), the largest and most globally-oriented information system of environmental valuation studies. Over 1,400 studies have been added to the database since 2010, bringing the total number of records to over 3,600, many of which are directly related to biodiversity.

The following sections illustrate the scope of Canadian work in ecosystem services analysis. To date, very few studies describe the causal linkages from changes in biodiversity to changes in ecosystem processes and the resultant changes in ecosystem services and the implications for human well-being. These linkages are more often approached through separate studies that use different disciplines to understand direct relationships. For example, ecological studies assess the impacts of changes in biodiversity to ecosystem process and services; and economic values transfer approach is used to determine the socio-economic implications of changes in ecosystem services. Cultural implications of changes in ecosystem services are only recently emerging in the Canadian ecosystem services assessment literature.

Impacts to Ecosystem Services from Changes in Biodiversity

Loss of biodiversity can impact ecosystem processes which in turn can create changes in ecosystem services (Chapin *et al.*, 2000), and conversely, some changes in ecosystem processes can contribute to biodiversity loss. For example, in Atlantic Canada researchers from Dalhousie University have demonstrated the importance of eelgrass (*Zostera marina*) and rockweed (*Ascophyllum nodosum*), both coastal marine submerged plants, to biodiversity and to ecosystem services such as nutrient cycling, nitrogen retention, carbon storage capacity and juvenile habitat for ecologically and economically important marine species (Schmidt *et al.*, 2011). The researchers showed that factors including increased water temperature, nitrogen runoff, and shore use activities that disturb habitat are generating pressure that is likely to diminish the ecosystem's ability to produce these services.

Declines in some ecosystem services have been linked to the loss of once abundant species (Federal, Provincial and Territorial Governments of Canada, 2010). For example, the drastic decline in marine species such as coho salmon in the Strait of Georgia and groundfish species in the Scotian Shelf greatly impacted local communities and economies. The collapse of the cod fishery in Newfoundland in the 1990s resulted in the loss of tens of thousands of jobs and the costs of income assistance and retraining reached an estimated $2 billion (Millennium Ecosystem Assessment, 2005). Contaminants in wildlife can also reduce the suitability of wild species for human consumption, thereby restricting provisioning services. This can have a large impact on Aboriginal communities and others who rely heavily on traditional local food sources (Van Oostdam *et al.*, 2005).

Socio-Economic Implications of Changes in Ecosystem Services

Accounting for how changes in ecosystem services affect socio-economic well-being is the purpose of many assessments. Between 2004 and 2013, numerous assessments of ecosystem services values were

published in Canada that used an economic "values transfer" approach (e.g. Austin *et al.,* 2012; Troy and Bagstad, 2009) to estimate monetary values for selected ecosystem services. Most of the published ecosystem services assessments in Canada were developed as communications tools to demonstrate to the public, businesses, and governments the practical importance of nature and ecosystems, and to estimate the economic value of many services for which there is no market price. These reports address a range of environments in Canada including boreal forest, wetlands, grasslands, and agricultural landscapes.

A number of recent reports have focused on the assessment of services provided by ecosystems adjacent to major cities undergoing urban expansion. A study of the ecosystems neighboring Vancouver, a city with a population of 2.5 million, estimated the non-market value of ecosystems to provide services such as climate regulation ($1.7 billion), water supply ($1.6 billion), flood regulation ($1.2 billion), clean air ($409 million), waste treatment ($48 million), pollination ($248 million), salmon habitat ($1.3 million), recreation and tourism ($119 million), and local food production ($24 million) (Wilson, 2010). When estimates were summed over the study area (13 600 km^2) the authors calculated the total non-market value of selected ecosystem services as $5.4 billion per year (all values in CDN 2005 dollars). The analysis used primarily cost-based methods and the authors note that these estimates are preliminarily and likely conservative (Wilson, 2010).

Another report assessed services provided by ecosystems of the Greater Golden Horseshoe region of southern Ontario, an area of rapid urban expansion and home to about 25% of Canada's population (Wilson, 2013). The study focused on selected ecosystem services benefits from natural capital in 940 km^2 of rural and agricultural lands designated for development. Estimates were provided for annual non-market values for a selection of ecosystem services generated by wetlands ($39.1 million), forests ($28.6 million), croplands ($28 million), and idle land ($20.5 million), among others. The summed estimate for the study area was $122.3 million per year (all values in CDN 2013 dollars).

Ecosystem services assessments have been carried out by governments in Canada in support of regulatory process, environmental assessment, policy development, and management strategies. For example, the Canadian Council of Ministers of the Environment developed a guidance document in 2010 to help jurisdictions integrate water valuation information into decision-making for water management issues. The Province of Alberta undertook a pilot project (2010-2011) to improve methods for interdisciplinary ecosystem services assessment through which they demonstrated the use of an ecosystem services approach to support wetland management and decision-making; provided information to support potential compensation decisions related to development; and identified information and capacity gaps for future ecosystem services assessment. In 2013 the federal government used a values transfer approach to estimate an economic value for species preservation in the *Regulatory Impact Analysis Statement* for the greater sage grouse (*Centrocercus urophasianus*), a nationally-listed species at risk. In another case, the Province of Prince Edward Island partnered with four non-government organizations and businesses for a pilot study aimed at reducing agriculture-related erosion, improving water quality, improving/increasing wildlife habitat, and reducing impacts of climate change. Ultimately the pilot resulted in a voluntary "payment for ecosystem services" (PES) program to support best practices (Lantz *et al.*, 2009). The Alternative Land Use Services PES program has been measurably successful in meeting its objectives, leading to its extended renewal from 2013 through 2018 (PEI, 2013).

The Measuring Ecosystem Goods and Services (MEGS) initiative among seven federal government departments and agencies between 2011 and 2013 was designed to develop statistical capacity to measure, map, and value natural capital and ecosystem services in support of national-scale accounting as well as regulatory analysis (Statistics Canada, 2013). Key outcomes include development of the MEGS

geodatabase, and a land cover analysis showing a decrease in deciduous and mixed forest cover of 4% between 2001 and 2011 across Canada and significant conversion of prime agricultural land and natural areas to built settlement. A case study in the 22.3 km^2 Thousand Islands National Park identified pressures on the ecosystem due to human activity, habitat fragmentation and loss, introduction of exotic species, and pollution. The case study also estimated monetary values for ecosystem services[7] flows in the park, at between $12.5- $14.7 million (CDN 2012 dollars) using two different approaches to transfer values from existing studies of other locations (value transfer method) (Statistics Canada, 2013).

Cultural Implications of Changes in Ecosystem Services

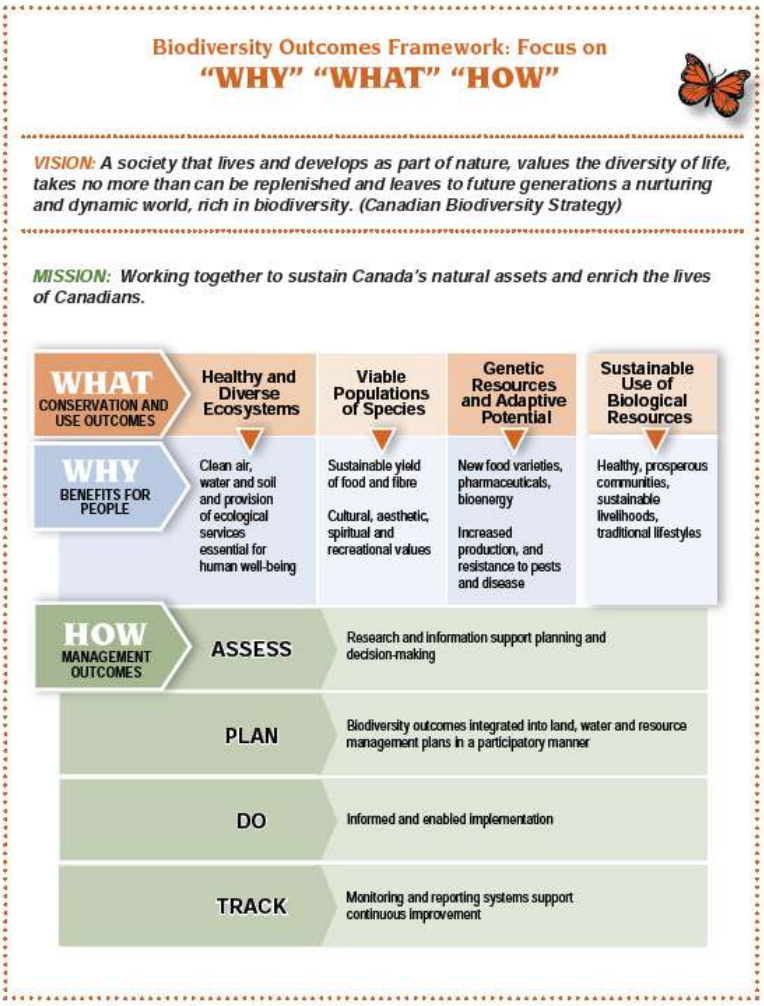
Many assessments do not explicitly consider the consequences of lost or degraded cultural ecosystem services to human well-being. There is still much debate over how – and if – non-market values for these services should be estimated. Although cultural ecosystem services pertain to all people, there is increasing attention to Aboriginal peoples' values relating to cultural services, for example in the context of development, impact assessment, and environmental damages compensation (Gregory and Trousdale, 2009; Chan *et al.*, 2012b). Efforts to assess and report on such implications are demonstrated in a report on the cultural and ecological value of caribou habitat in Canada's northern regions (Assembly of First Nations and David Suzuki Foundation, 2013). Among the key messages in this work is that multiple benefits, or ecosystem services, are often obtained through a single activity. The authors note that analysis of cultural values requires multiple approaches and cannot be reduced to economic measures alone.

Canadian researchers are currently working to clarify practical approaches for assessing the cultural implications of changes to ecosystem services (e.g. Chan *et al.*, 2012a, 2012b; Satterfield *et al.*, 2013). For example, interdisciplinary experts in environmental resources, policy and anthropology have used "ethnographic" interviews (where respondents provide insights qualitatively, from their cultural point of view) and subjective measures (e.g. where respondents rank issues on the basis of qualitative significance) to show how cultural concerns can be identified and reflected in analysis and decision processes. In addition, approaches such as "Structured Decision Making", which enable analysts to consider both qualitative and quantitative information together, have been developed in Canada (Gregory *et al*., 2012).

[7] The ES that were assessed in the Thousand Islands National Park case study are: atmospheric regulation; water quality, nutrient and waste regulation; water supply regulation; soil retention and erosion control; habitat and biodiversity; pollination and dispersal services; disturbance avoidance; recreation; aesthetic and amenity; and other cultural services.

Chapter II – Implementation and Mainstreaming of Biodiversity Conservation in Canada

NOTE: *Canada's 4th National Report to the United Nations Convention on Biological Diversity* provides extensive information on a wide range of actions being taken across the country to implement the Canadian Biodiversity Strategy and support the objectives of the Convention. The present report focuses on new initiatives or notable developments since 2009.



Federal, provincial and territorial governments are working together to implement the ***Canadian Biodiversity Strategy***, which was endorsed by Ministers in 1996. The Strategy provides a comprehensive blueprint for the conservation and sustainable use of Canada's living resources. Canada's ***Biodiversity Outcomes Framework***, developed jointly by all jurisdictions and adopted in 2006, complements the Strategy. It describes the long term outcomes that would result from effective implementation of

biodiversity plans and strategies. The framework has been used to connect and report on the results of sub-national plans and strategies.

A set of proposed 2020 biodiversity goals and targets for Canada has been developed through a federal-provincial-territorial working group, with input from a range of stakeholders and Aboriginal organizations, and using the Convention on Biological Diversity (CBD) Strategic Plan for 2011-2020 as a guide. The goals and targets identify specific, medium-term outcomes that are designed to support the long-term outcomes set out in the *Biodiversity Outcomes Framework*. The targets address both the "what" as well as the enabling conditions and suite of measures necessary to achieve results, or the "how". The proposed national biodiversity targets describe results to be achieved through the collective efforts of all Canadians. These draft targets were inspired by the global Aichi targets, and adapted to Canada's domestic context. Each of Canada's proposed national targets links to at least one Aichi target, as detailed in Chapter III. The proposed 2020 biodiversity goals and targets for Canada are currently undergoing final review and approval.

Draft 2020 Biodiversity Goals & Targets for Canada

Preamble

In order to achieve their long-term biodiversity outcomes, federal, provincial and territorial governments endorsed the following set of new medium-term goals and targets. These aspirational goals and targets describe results to be achieved through the collective efforts of a diversity of players both public and private whose actions and decisions have an impact on biodiversity. Governments need to do their part but cannot act alone.

Implementation of the goals and targets will rely on meaningful, full and effective participation of Aboriginal peoples, including First Nations, Inuit and Métis peoples. In this respect, while Aboriginal traditional knowledge and customary use of biological resources are specifically highlighted under targets 12 and 15, the traditional knowledge, innovations and practices of Aboriginal peoples are relevant for implementing all of Canada's biodiversity goals and targets, as is protecting and encouraging customary use of biological resources compatible with their conservation and sustainable use.

Local communities, urban and regional governments, business and industry, conservation and stewardship groups, educational and scientific institutions and citizens are also all able to contribute. Canadians are invited to commit to doing their part and to share the results of their efforts.

Goal A. By 2020, Canada's lands and waters are planned and managed using an ecosystem approach to support biodiversity conservation outcomes at local, regional and national scales.

1. By 2020, at least 17 % of terrestrial areas and inland water, and 10 % of coastal and marine areas, are conserved through networks of protected areas and other effective area-based conservation measures.
2. By 2020, species that are secure remain secure, and population of species at risk listed under federal law exhibit trends that are consistent with recovery strategies and management plans.
3. By 2020, Canada's wetlands are conserved or enhanced to sustain their ecosystem services through retention, restoration and management activities.
4. By 2020, biodiversity considerations are integrated into municipal planning and activities of major municipalities across Canada.

5. By 2020, the ability of Canadian ecological systems to adapt to climate change is better understood, and priority adaptation measures are underway.

Goal B. By 2020, direct and indirect pressures as well as cumulative effects on biodiversity are reduced, and production and consumption of Canada's biological resources are more sustainable.

6. By 2020, continued progress is made on the sustainable management of Canada's forests.
7. By 2020, agricultural working landscapes provide a stable or improved level of biodiversity and habitat capacity.
8. By 2020, all aquaculture in Canada is managed under a science-based regime that promotes the sustainable use of aquatic resources (including marine, freshwater and land based) in ways that conserve biodiversity.
9. By 2020, all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem-based approaches.
10. By 2020, pollution levels in Canadian waters, including pollution from excess nutrients, are reduced or maintained at levels that support healthy aquatic ecosystems.
11. By 2020, pathways of invasive alien species introductions are identified, and risk-based intervention or management plans are in place for priority pathways and species.
12. By 2020, customary use by Aboriginal peoples of biological resources is maintained, compatible with their conservation and sustainable use.
13. By 2020, innovative mechanisms for fostering the conservation and sustainable use of biodiversity are developed and applied.

Goal C. By 2020, Canadians have adequate and relevant information about biodiversity and ecosystem services to support conservation planning and decision-making.

14. By 2020, the science base for biodiversity is enhanced and knowledge of biodiversity is better integrated and more accessible.
15. By 2020, Aboriginal traditional knowledge is respected, promoted and, where made available by Aboriginal peoples, regularly, meaningfully and effectively informing biodiversity conservation and management decision-making.
16. By 2020, Canada has a comprehensive inventory of protected spaces that includes private conservation areas.
17. By 2020, measures of natural capital related to biodiversity and ecosystem services are developed on a national scale, and progress is made in integrating them into Canada's national statistical system.

Goal D. By 2020, Canadians are informed about the value of nature and more actively engaged in its stewardship.

18. By 2020, biodiversity is integrated into the elementary and secondary school curricula.
19. By 2020, more Canadians get out into nature and participate in biodiversity conservation activities.

Federal, Provincial and Territorial Strategies

A number of cross-cutting national and sub-national strategies and initiatives have been released or revised since 2009 and will support progress towards biodiversity conservation and sustainable use.

The **Ontario** government developed Ontario's first biodiversity strategy in 2005. The Strategy highlighted that the protection and sustainable use of biodiversity is a shared responsibility for all Ontarians, not just government. Recognizing this, the government established the Ontario Biodiversity Council -- a group of volunteers from environmental and conservation groups, government, academia, Aboriginal organizations and industry -- to guide implementation through shared responsibility and collective action. In 2011, the Council led the development of a renewed strategy, *Ontario's Biodiversity Strategy, 2011*. This document identifies updated goals, objectives and actions to conserve biodiversity and urges each sector, including the Ontario government, to develop its own implementation plan. The success of Ontario's strategy will be traced through 15 specific targets representing key areas of focus for Ontario and supporting national and international initiatives, including the Strategic Plan for Biodiversity 2011-2020 and the Aichi Targets. Monitoring and assessing progress on Ontario's strategy will occur over a 10-year time frame to encourage ambitious actions planned and coordinated across sectors.

Biodiversity: It's In Our Nature represents the **Ontario** government's implementation plan for advancing biodiversity conservation under *Ontario's Biodiversity Strategy, 2011*. It is a strategic framework arranged according to the four strategic directions of the Strategy: engage people, reduce threats, enhance resilience and improve knowledge, and it includes an ambitious series of over 100 actions and activities to be implemented during this decade. The plan builds on the work of the Ontario Public Service Biodiversity Network, a diverse cross-ministry forum established to exchange information, facilitate discussion and plan for biodiversity-related activities, policies, processes and projects across the province. The actions contained in the plan involve all 16 provincial ministries who are members of the network.

Released in 2012, *TomorrowNow - **Manitoba's** Green Plan* is the government's eight-year strategic plan for mobilizing Manitobans to work together to protect the environment while ensuring a prosperous and environmentally conscious economy. The plan sets out actions around five key priorities, including "Safeguarding our Water, Air and Land" and "Nurturing Our Living World" that include biodiversity-related commitments.

The CBD Strategic Plan for Biodiversity 2011-2020 and the Aichi Targets form the background for **Québec's** renewed efforts toward conserving biological diversity in the province – *Orientations gouvernementales en matière de diversité biologique 2013*. These government guidelines were adopted in June 2013, and directly involve Government of Quebec ministries and organizations. They are expected to help civil society participate in the determination and implementation of actions that help reach the Aichi targets. The proposed approach is founded on three fundamental issues that are captured under the three dimensions of sustainable development: living environments (environmental), ways of life (social) and living standards (economic).

As of March 2014, **Alberta** is nearing the final stages of developing Alberta's Biodiversity Policy. The policy provides provincial-scale direction for the conservation, restoration and maintenance of Alberta's biodiversity to ensure the cumulative effects of development and natural impacts on ecosystems and habitats are managed. The policy is integrated and aligned with provincial air, water and resource use policies including the *Land-Use Framework*, *Water for Life Strategy*, *Wetland Policy*, *Clean Energy Strategy* and *Climate Change Strategy*, as well as government direction related to biodiversity at both

provincial and regional scales. Key directions in the policy include: maintaining biodiversity at appropriate levels and variability; returning biodiversity and ecosystem function to ecologically sound conditions when human activity has resulted in a risk of permanent loss; ensuring long-term sustainable use and management of Alberta's biological resources; and adopting a stewardship commitment and ethic in Alberta to support conservation and sustainable use.

In October 2013, the **Government of Canada** released *Planning for a Sustainable Future: A Federal Sustainable Development Strategy for Canada 2013-2016 (*FSDS*)*. The Strategy is composed of goals, targets, implementation strategies and indicators that combine sustainable development commitments from 27 government departments and agencies into an integrated, whole of government picture. A requirement of the *Federal Sustainable Development Act*, the FSDS makes environmental decision-making more transparent and accountable to Parliament through updated strategies every three years and regular FSDS progress reports. This second cycle of the FSDS enhances the strategy's link between nature, the economy and society. As one of four main sections, it includes a nature theme that focuses in part on biological resources. Several of Canada's proposed biodiversity targets are reflected in the Strategy, including those focused on species at risk, conservation and protected areas, invasive alien species, sustainable forest management, aquaculture, and agriculture. The Canadian Environmental Sustainability Indicators (CESI) initiative is the main mechanism by which progress on the goals and targets of the FSDS will be tracked. The FSDS and CESI will be key mechanisms for advancing, as well as tracking and reporting on, the federal contribution to the proposed 2020 biodiversity goals and targets.

The Government has committed to developing a **National Conservation Plan**, which will be announced in 2014 and will build upon conservation announcements contained in Budget 2014, including investing in national parks, conserving recreational fisheries, supporting conservation and biodiversity programming for Canadians, and protecting ecologically sensitive land. The Plan would contribute to a more prosperous Canada by working to conserve and restore biodiversity and connect Canadians with nature. It would build on the conservation efforts being undertaken by governments of all levels, the non-government and private sectors, and all Canadians, including actions on working landscapes (e.g., agricultural land, sites of resource extraction, and forests). The Plan would encourage innovative conservation solutions and would help bring Canadians together in partnership to act as good stewards of Canada's lands, waters, and wildlife.

Action in Support of Biodiversity Conservation and Sustainable Use

Protected Areas and Other Effective Area-based Conservation Measures

As of December 2013, Canada has protected 1,036,645 km^2 (10.4%) of its terrestrial area and inland water and 51,485 km^2 (0.9%) of its marine area. Canada's terrestrial protected areas system has grown by 77,427 km^2 (an 8.1% increase) since 2009 and its marine protected areas system has grown by 10,043 km^2 (a 24% increase) since 2009.

Canada's Protected Areas Network (2012)

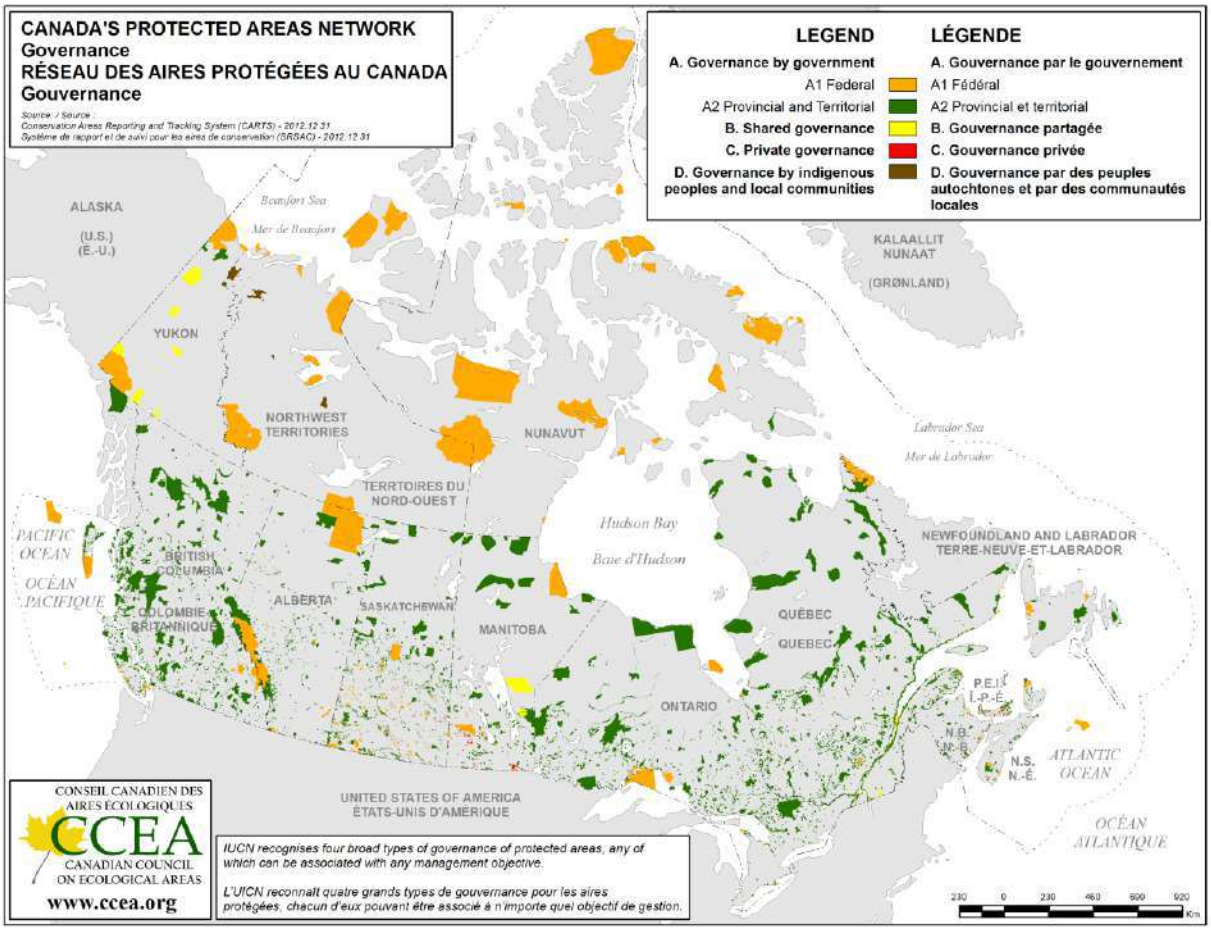


Figure 30: Canada's protected areas network by IUCN governance type.
Note: Map data is accurate as of 2012. Some sites identified below are not represented on the map.
Source: Canadian Council on Ecological Areas, Conservation Areas Reporting and Tracking System, 2012.

Progress has been made on developing a network of protected areas representative of Canada's terrestrial ecological regions and marine bioregions, and protected areas appear in all of Canada's ecozones and marine bioregions, although much work remains to expand coverage in less well-represented areas. As of 2012, the highest percentage of terrestrial area protected is found in the Pacific Maritime Ecozone (19%). As of 2012, the highest percentage of marine area protected is found in the Pacific Northern Shelf (5.3%).

The vast majority (94%) of protected territory in Canada is in management categories that are generally recognized to provide a higher level of protection (International Union for the Conservation of Nature Categories Ia/Ib to IV). All protected areas in Canada are managed to conserve nature, but the remaining 6% are either focused on preserving landscapes where long-term, sustainable human use has produced an area with natural and cultural features that are important, (Category V), are focused on maintaining sustainable use of natural resources (Category VI), or have yet to be classified.

A number of notable additions have been made to Canada's network since 2009. While the following list is not exhaustive, some of the largest areas protected since 2009 include:

- Akpait National Wildlife Area, Nunavut. Established in 2010. 791 km^2 protected, including 743 km^2 of marine area.
- Gwaii Haanas National Marine Conservation Area Reserve and Haida Heritage Site, British Columbia. Established 2010. 3,500 km^2 of marine area protected.
- Ninginganiq National Wildlife Area, Nunavut. Established in 2010. 3,364 km^2 protected, including 2,834 km^2 of marine area.
- Qaqulluit National Wildlife Area, Nunavut. Established in 2010. 398 km^2 protected, including 396 km^2 of marine area.
- Tarium Niryutait Marine Protected Area, Northwest Territories. Established in 2010. 1,740 km^2 of marine area protected.
- Whitefeather Forest Cheemuhnuhcheecheekuhtaykeehn (Dedicated Protected Area), Ontario. Established in 2011. 3,494 $km^2$of terrestrial and aquatic boreal ecosystems protected.
- Fisher Bay Provincial Park, Manitoba. Established in 2011. 842 km^2 protected.
- Nááts'ihch'oh National Park Reserve, Northwest Territories. Established in 2012. 4,850 km^2 protected.
- Pink Lake Representative Area Ecological Reserve, Saskatchewan. Established in 2013. 3,660 km^2 of boreal forest protected.
- Tursujuq National (Province of Quebec) Park, Quebec. Established in 2013. 26,100 km^2 protected.

On the very edge of the Pacific continental shelf, the lands and waters of Gwaii Haanas have long been celebrated for their stunning beauty and remarkable biodiversity. From its temperate rainforests to the surrounding marine waters, the archipelago is a place of great cultural and ecological significance. In 2010 **Gwaii Haanas National Marine Conservation Area Reserve and Haida Heritage Site** in British Columbia was established, protecting a large area of Pacific marine waters extending about ten kilometres offshore from the existing Gwaii Haanas National Park Reserve. Together the two sites protect approximately 5,000 km^2 of wilderness stretching from alpine mountain tops to the deep sea beyond the continental shelf. The land and the waters are cooperatively managed by the Haida Nation and the Government of Canada.

In July, 2013, Saskatchewan designated a new protected area in the provincial boreal forest, the **Pink Lake Representative Area Ecological Reserve**. At 3,660 km^2, it is Saskatchewan's largest provincially-designated protected area. With the Pink Lake designation, representation in the Churchill River Upland Ecoregion increases from 4.9% to 8.2% of the total area. As an ecological reserve no new industrial development will be allowed in the area. Leases or permits in place at the time of the designation will be grandfathered to allow existing activities to continue. Traditional activities by First Nations and Métis people, as well as recreational hunting and angling, will continue. The Pink Lake Representative Area Ecological Reserve was proposed as part of the Misinipiy Integrated Land Use Plan, developed in partnership with the Lac La Ronge Indian Band with extensive public and stakeholder involvement.

Examples of protected areas planning in Canada's provinces and territories:

In August, 2013, **Nova Scotia** released "Our Parks and Protected Areas – A Plan for Nova Scotia". This plan provides for the protection of 13% of the province's landmass by 2015 – up from 9.3% - and includes efforts to conserve other lands that could increase that protection beyond 13%. It also updates Nova Scotia's park system to secure and strengthen its long-term success. The multi-year interdepartmental planning process included extensive public and stakeholder involvement. The achievement is noteworthy in that there is relatively little public land in Nova Scotia, and achieving this increase in protected areas involved substantial investments by the Nova Scotia government to purchase and protect private lands. The effort also benefited from the establishment of a Mi'kmaq-Nova Scotia Protected Areas technical committee to provide advice and information to the province and Assembly of Nova Scotia Mi'kmaq Chiefs. Lands included in the plan were identified through conservation science with a focus on biodiversity protection. Extensive work was also done to reflect social and recreational values, and reduce conflict with other land uses.

In addition to federal, provincial and territorial protected areas, there are many conservation areas that complement the role of protected areas in conserving nature. Conservation areas on private land in more densely populated areas of southern Canada, for example, provide vital habitat and contribute to the maintenance of ecosystem services in fragmented ecosystems. Five provinces currently report nationally on private conservation lands in Canada, totaling about 1,259 km^2, and governments are working with non-governmental conservation organizations to improve reporting on the range of conservation measures in place, such as private conservation lands and areas under Aboriginal management that are set aside for the purposes of conservation. Aboriginal peoples have contributed to the establishment of tens of thousands of km^2 of protected areas designated during the reporting period 2010-2013 through modern land claims, treaties, other agreements or collaborative land-use plans. Canada will continue to work to accurately reflect these areas in conservation tracking and reporting.

In 2007, the Government of Canada allocated $225 million over five years for the **Natural Areas Conservation Program,** which has helped the Nature Conservancy of Canada, Ducks Unlimited Canada, and other non-profit non-government organizations secure and ensure the protection of ecologically significant land in southern Canada. In 2013, the federal government invested an additional $20 million in the Program. As of December, 2013, over 3,690 km^2 had been conserved through the Program. Areas protected through the program appear in every province and provide habitat for at least 160 species at risk as well as many other species.

The federal and some provincial governments offer tax benefits for land donations under initiatives such as the **Ecological Gifts Program**. The Ecological Gifts Program encourages Canadians to donate ecologically significant land for conservation. As of December 2013, over 1,050 ecological gifts valued at more than $640 million have been donated, protecting over 1,500 km^2 (150,000 ha) of wildlife habitat

across Canada. More than one-third of these ecological gifts contain areas designated as being of national or provincial significance, and many are home to some of Canada's species at risk.

Currently, Canadian governments and conservation organizations are collaborating to develop guidance on identifying and reporting "other effective area-based conservation measures". Since privately owned land does not typically extend into the marine environment, Canada is examining what types of area-based conservation measures contribute to the conservation of marine biodiversity and will warrant reporting in future National Reports. Accurately classifying and reporting on all of Canada's protected spaces, including publicly and privately owned protected areas and other effective area-based conservation measures on land and at sea is a key to understanding and sharing information on Canada's progress. Canada has initiated work on a comprehensive inventory to help engage and inform the public by showcasing local and regional conservation areas, and support conservation decision-making at all levels of government by highlighting gaps in the conservation network and opportunities to make connections.

In order to make further progress on in-situ biodiversity conservation, all levels of government, the private sector, the non-profit sector, individuals and communities will need to work together to safeguard Canada's lands and waters with an emphasis on areas that are representative of Canada's diverse ecosystems and areas that are particularly sensitive and/or important for biodiversity and ecosystem services. Cooperation amongst all players will support effective and equitable management of conservation areas and the integration of these areas into the land- and seascapes in which they are situated.

Ecosystem-Based Management, Regional Land Use Planning and Integrated Oceans Management

In **British Columbia**, provincial legislation allows for the establishment of old growth management areas to maintain old-growth forest and biodiversity values. Work is currently underway to establish old growth management areas in the northeast of the province under the *Oil and Gas Activities Act*. At the landscape level, other examples of measures to protect biodiversity in British Columbia include the establishment of Parks and Protected Areas, ungulate winter ranges, or wildlife habitat areas. Ungulate winter ranges allow protection for areas that are critical for the winter survival of ungulate species such as deer, moose, elk, and caribou.

In March 2009, the Province of British Columbia, First Nations, environmental groups and forest companies agreed to a five-year timeframe to review the implementation of ecosystem based management land use objectives in the **Great Bear Rainforest**. Ecosystem-based management takes an adaptive approach to managing human activities that seeks to ensure the coexistence of healthy, fully functioning ecosystems and human communities. Recommendations were submitted in early 2014 for evaluation by the Province and First Nations as part of the five-year review. The Great Bear Rainforest covers 6.4 million ha on British Columbia's north and central mainland coast and is world-renowned for its biodiversity.

The Government of **Alberta** introduced the Land-use Framework initiative in 2008. The Framework provides a blueprint for land-use management and decision-making to address Alberta's growth pressures and achieve the province's long-term economic, environmental and social goals. The Framework commits to the development of land-use plans for each of seven land-use regions. Land-use Framework regional plans use environmental management frameworks as a key approach to managing the long-term cumulative effects of development on the environment at a regional level. Environmental management frameworks identify the key indicators of interest for air, water and biodiversity and set targets and/or triggers (i.e., proactive warning signs) and limits (i.e., clear boundaries in the system that

cannot be exceeded) for these indicators and/or their stressors as appropriate. Ongoing monitoring, assessment and reporting of environmental conditions relative to triggers and limits are completed and management actions taken, as needed, based on conditions found in the environment. In 2012, the Alberta government released the Lower Athabasca Regional Plan, the first of the seven regional plans. The South Saskatchewan Regional Plan is scheduled for release in 2014 and development of the remaining plans is underway.

Canada is integrating marine conservation measures into surrounding seascapes through an **Integrated Oceans Management** (IOM) process. IOM helps to ensure that sustainable human uses of the ocean can continue over the long term, in a way that maintains ocean health and productivity. IOM is done through collaboration with federal, provincial/territorial governments, aboriginal organizations and coastal communities and informs decisions related to the range of activities occurring in ocean areas and the need to protect important areas. The Government of Canada has led the development of IOM plans in five Large Oceans Management Areas (LOMAs). Implementation of these plans is underway, and will likely extend beyond LOMAs into bioregions over time as resources allow. Another initiative is the Marine Planning Partnership for the North Pacific Coast (MaPP), co-led by 18 First Nations and the Government of the Province of British Columbia. MaPP is planning for marine uses in four regions along the ecologically important North Pacific Coast. Regional plans developed through MAPP will provide recommendations for decision-makers related to activities and protection in the area, as well as guidance for oceans users.

Species Protection and Recovery

Canada's approach aims to prevent wildlife species from becoming extinct by securing the necessary actions for their recovery, while managing other species to prevent them from becoming at risk. The *Accord for the Protection of Species at Risk,* which commits Canada's federal, provincial and territorial governments to a common approach to protecting species at risk, the federal *Species at Risk Act* (SARA) and activities under programs such as the **Habitat Stewardship Program for Species at Risk** are key components of a Canadian strategy for the protection of wildlife species at risk. All provinces and territories have species at risk or wildlife legislation or policies that mandate the protection of species and habitat.

As noted in Chapter I, every five years, Canada conducts an assessment of wild species. Of the 3541 species ranked as secure in 2005, 3286 species were reassessed in the *2010 General Status of Species in Canada* report (the remaining species were either not previously assessed or affected by information and taxonomic changes). Of the 3286 species ranked the majority (3249 species or 99%) remained secure. Thirty-one species had an increased level of risk, of which between 7 and 12 (23% - 39% of species with increased level of risk) were associated with biological changes[8]. The status of the remaining species with changed rank did not increase in risk, but rather changed from secure to undetermined, not assessed, or exotic.

Canada currently has over 500 species that are listed under federal law as “at risk”, largely as a result of habitat disturbance and loss, effects of invasive alien species, and changes in ecological processes or dynamics. When a plant or an animal is determined to be at risk under the *SARA*, plans for its recovery or management must be made. Recovery strategies assess whether recovery is feasible, outline what threats need to be addressed, outline goals and approaches for recovery, and identify critical habitat.

[8] Remaining causes include improved knowledge, procedural changes, taxonomic changes and new COSEWIC assessments,

Concerted effort at local, provincial, territorial and federal levels is essential to ensure improvements in the condition of species and meet the objectives laid out in recovery strategies.

Of the 192 species at risk that had final recovery strategies in 2013, 67 had both population-oriented goals and a reassessment since final recovery strategies were released, allowing for the evaluation of whether trends in population numbers and distribution are consistent with recovery goals. Of these 67 species, 28 (42%) have current population trends that are consistent with the goals laid out in the recovery strategies, and 20 (30%) show trends that are inconsistent with goals. Another 5 (7%) have both some indication of improvement and some indication of decline. For the remaining 14 species (21%), there are insufficient data to determine trends.

Species require time to recover, and recovery of long-lived species may require many decades. In addition, observations of rare species are often difficult to collect. Indicator results should not be interpreted as a measure of recovery success until sufficient time has passed to allow species to recover and to collect sufficient information to assess that recovery.

Are Population Trends in Species at Risk Consistent with Recovery Goals? Canada (2013)

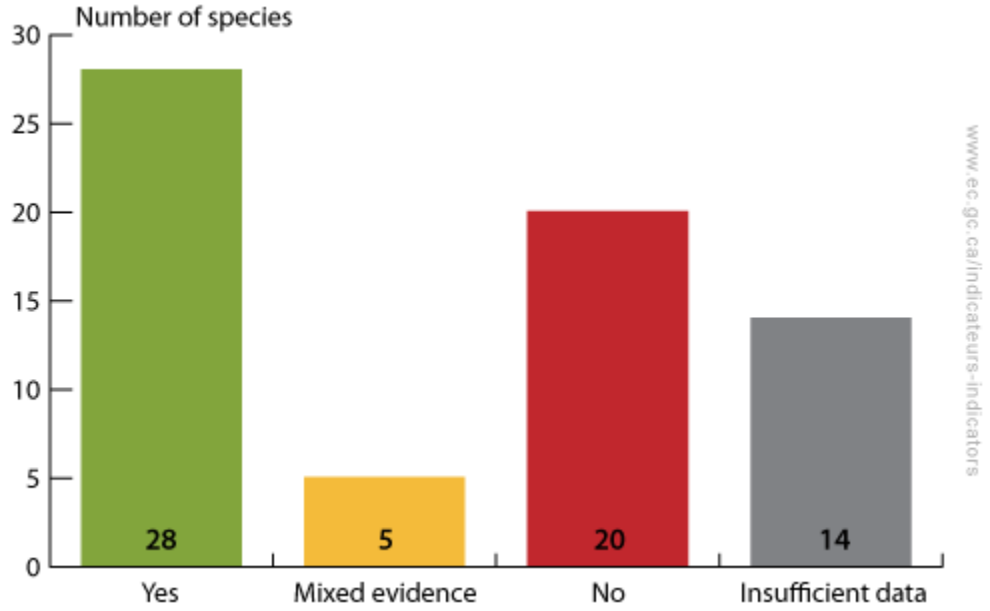


Figure 31: Are population trends in species at risk consistent with recovery goals? Canada (2013).
Note: Categories are assigned based on the most recent available information, accounting as much as possible for the amount of time that has been available for recovery.
Source: Environment Canada, 2013e.

Continued cooperation beyond Canada's borders is needed to address the many species at risk that have only a portion of their global or continental range in Canada. Recovery strategies aim to make certain that the Canadian portion of these species' recovery needs is ensured.

Recent Provincial and Territorial Legislation

The **Northwest Territories** (NWT) adopted a new *NWT Wildlife Act* in 2014. The legislation is respectful of Aboriginal and treaty harvesting rights. With this new legislation, land claims and self-government agreements provided the foundation for how wildlife management will now be undertaken in the NWT.

The fundamental principles underlying the new *Wildlife Act* are the conservation (wise use and protection) of wildlife and incorporation of traditional values and knowledge as the majority of harvesters in the NWT are Aboriginal. An example of this type of approach can be found also in the new *Nunavut Wildlife Act*, which is based on Inuit principles of wildlife management.

The new *NWT Wildlife Act* was drafted using an innovative and inclusive collaborative process. In areas of the NWT where there are settled land claim agreements, the responsibility for managing wildlife is shared between the Government of the Northwest Territories (GNWT), the wildlife co-management boards established under land claim agreements and the Tlicho Government, where Tlicho lands are concerned. In areas where land claims are not yet settled, the GNWT has an obligation to consult with anyone who has Aboriginal and treaty rights to ensure wildlife management actions do not infringe on those rights. Collaboration is also the corner-stone of the legislation, where all NWT organizations who have responsibilities for wildlife management in the NWT work together to ensure wildlife and wildlife habitat are effectively conserved, respected and managed for present and future generations.

Species at Risk legislation the northern way – Traditional knowledge and science inform consensus decisions: The *Species at Risk (NWT) Act* came into force in February 2010. It provides a process and modern tools to identify, protect and recover species at risk in the Northwest Territories. Traditional knowledge (TK), community knowledge, and science are used in all steps of the legislation, from assessment, listing, recovery and stewardship. The NWT Species at Risk Committee has been established as an independent group of experts that assesses the biological status of species that may be at risk of extinction in the NWT using the best available information. Each species report has two components: TK and community knowledge, and science. The information is then integrated to assess the biological status of species. The Conference of Management Authorities is the group of wildlife co-management boards and governments that share management responsibility for the conservation and recovery of species at risk in the NWT. The Conference of Management Authorities provides direction, coordination and leadership on species at risk. The group operates by building consensus among Management Authorities. It respects the roles and responsibilities of Management Authorities established under land claim and self-government agreements.

In 2012, **New Brunswick** updated its endangered species legislation to improve the approach to conserving species in danger of disappearing from the Province. The new provincial *Species at Risk Act* replaces the *Endangered Species Act* introduced in 1973. The new act clearly separates the steps that officially recognize a species is at risk from the decisions on what government and society will do to address threats to the species. Highlights of the new *Species at Risk Act* include:

- An independent committee of experts to assess the biological status of species that may be in trouble and make recommendations to the Minister of Natural Resources.
- The minister lists species in a regulation based on scientific assessments and ensures that recovery planning documents are developed which address the conservation needs of listed species.
- In response to the recovery planning, protection assessments are undertaken to determine if general prohibitions and habitat protection is required. If required, a socio-economic impact assessment, including consultation, take place.
- A public registry to inform the public of key decisions as well as the protection status of species. Status reports, recovery documents, and process timelines are available on the registry.

Examples of Strategies and Actions to Support Species at Risk Recovery

South of the Divide (SoD) Stewardship in Action is a joint initiative of the governments of Canada and Saskatchewan to conserve species at risk in the Milk River Watershed in southwestern Saskatchewan. The goal of the project is to conserve species at risk and their supporting habitats by collaborating with land owners and land users to identify and promote cost-effective land stewardship practices that respect cultural, traditional and economic values of this working landscape. The SoD project area spans 14,350 km², or about 1.5 million ha, and is one of the few large contiguous areas of native grassland remaining in the Canadian prairies, making it of provincial, national and continental significance. A key output of the project will be the South of the Divide Multi-Species at Risk Action Plan: a federal document that is compliant with SARA, meets Saskatchewan's species-at-risk legislative obligations, and, is supported by landowners and stakeholders. The SoD Action Plan will complement other regional plans and will outline detailed approaches for implementing pre-existing SARA recovery strategies and management plans for species at risk in the SoD area.

Work is underway to finalize "Protecting Vulnerable Species: A Draft Five-Year Plan for Species at Risk in **British Columbia**". This strategic document sets out high-level management actions the Province plans to take in the next five years to improve the management of species at risk in the province.

Environment Canada, in collaboration with its provincial and territorial counterparts, has put in place a **recovery strategy for the boreal caribou**. The broad strategy has a goal of achieving self-sustaining local populations in all boreal caribou ranges, to the extent possible. It provides a practical and balanced approach, with flexibility for provincial and territorial governments (responsible for implementing the strategy in their areas) to recover the species in the way most appropriate to local circumstances.

Since its inception in 2000, the **Habitat Stewardship Program for Species at Risk** has supported local and community organizations in securing over 1,730 km^2 (173,000 ha) of habitat. Another 2,000 to 3,000 km^2 (200,000 to 300,000 ha) of habitat are afforded temporary protection under voluntary conservation agreements with landowners on an annual basis. In addition, the **Aboriginal Fund for Species at Risk** program helps to build capacity and protect and recover critical habitat or habitat important for species at risk on First Nations reserves or on lands and waters traditionally used by Aboriginal peoples.

Ontario's Species at Risk Stewardship Fund supports Ontario's efforts under the Ontario *Endangered Species Act* to protect and recover listed species and their habitats. The fund is available to individuals and groups, including landowners and farmers, Aboriginal communities, academic institutions, industries, municipalities and conservation organizations. In 2013/14, $5 million in funding was provided for 75 new projects and 32 multi-year projects. Since its inception, the project has helped restore more than 240 km^2 (24,000 ha) of important habitat and more than 200 different species at risk, while also supporting 2,100 jobs and an estimated 256,600 hours of volunteer work in Ontario communities.

Wetlands

Numerous efforts to conserve and enhance Canada's wetlands are underway. **The North American Waterfowl Management Plan** (NAWMP), for example, is a continental initiative to conserve sufficient wetland and associated upland habitats to sustain healthy populations of waterfowl shared by Canada, the United States, and Mexico. Working with private landowners and governments, the Plan has helped to reduce the rate of habitat loss and degradation since 1986 by protecting wetlands, establishing conservation agreements, and influencing stewardship activities of landowners, farmers, land managers and conservation agencies. While the program is continental in scope, implementation is regional. From

2009 to 2012 9,578 km^2 of wetland and associated uplands were retained[9], and since the establishment of the Plan, over 80,000 km^2 have been retained in Canada. Similarly, between 2009 and 2012 Canada managed and/or restored 238,046 km^2 and over 433,000 km^2 have been managed and/or restored since the Plan was first established. These activities occur within NAWMP's four Habitat Joint Ventures: Pacific Coast (Canada portion only); Canadian Intermountain; Eastern Habitat; and Prairie Habitat, including the Western Boreal Forest region for the period since 1990.

In November of 2013, the Government of **Alberta** released its new provincial wetland policy, which provides the strategic direction and tools to support informed wetland management decisions. The goal of the Alberta Wetland Policy is to conserve, restore, protect, and manage Alberta's wetlands to sustain the benefits they provide to the environment, society, and the economy. To achieve this goal, the Policy focuses on the following key outcomes:

1. Wetlands of the highest value are protected for the long-term benefit of all Albertans.
2. Wetlands and their benefits are conserved and restored in areas where losses have been high.
3. Wetlands are managed by avoiding, minimizing, and if necessary, compensating for impacts.
4. Wetland management considers regional context.

Alberta's wetlands are highly diverse in form, function, use, and distribution across the Province; they are not all of equal value. Under the Alberta Wetland Policy, relative wetland value will be assessed on the basis of supported biodiversity, ability to improve water quality, importance to flood reduction, and human uses. Individual wetlands will be evaluated against these key criteria and assigned an overall wetland value, which will be used to inform regulatory responses in cases where human activities have the potential to impact wetlands. By incorporating a range of biophysical and social metrics into wetland valuation protocols, the Alberta Wetland Policy seeks to enable an informed, comprehensive decision making process based largely on cumulative effects management.

In Saskatchewan, **Ducks Unlimited Canada** has led an innovative "reverse auction" to pay landowners for restoring wetlands in their fields and pastures, as a mechanism to restore 560 km^2 (56,000 ha) of wetlands over 20 years.

New Brunswick has a rich diversity of inland and coastal wetlands. In 2002, a provincial wetlands conservation policy was introduced to guide the conservation and use of the provinces wetlands. The policy recognizes the many important ecological, economic and social functions wetlands play. The objectives of the policy are:

- To manage human activity on or near wetlands to achieve no loss of Provincially Significant Wetland habitat and no net loss of wetland function for all other wetlands, and
- To promote and facilitate the development and implementation of wetland stewardship, awareness and education through government and cooperative initiatives.

The province's watercourse and wetland alteration regulation is the principal regulatory tool for administering the policy along with the environmental impact assessment regulation. A 30 metre regulatory zone is in place around all mapped wetlands. Activities such as forestry, agriculture and housing development within this zone require a permit with applicable conditions and beneficial management practices. Wetlands are mapped and available to be viewed on the GeoNB website.

[9] Retained is defined as protected permanently or protected for the medium term (i.e. over 10 years).

NAWMP'sEastern Habitat Joint Venture partnership is a significant force for wetland stewardship and awareness building within New Brunswick and eastern Canada as a whole.

The **City of Windsor** is currently supporting wetlands through a joint project between the Federal Government and the Province of Ontario - the Hon. Herb Gray Parkway. The project has focused on protecting endangered species during the highway construction project as well as restoring wetlands that were destroyed for the parkway construction.

Work is underway to better track the status of Canada's wetlands, building on the mapping efforts of all jurisdictions by creating standards for detecting, mapping, and classifying wetlands by type across Canada. Environment Canada is developing a wetlands indicator under the Canadian Environmental Sustainability Indicators (CESI) initiative.

Local governments and biodiversity

A number of Canadian municipalities are already working directly and indirectly on biodiversity conservation through their planning, awareness-raising, decision-making, and service delivery. Increasingly, municipalities across the country are recognizing the importance of biodiversity through the development of biodiversity conservation strategies and integration of biodiversity objectives in municipal plans and activities. The Canadian Office of **ICLEI – Local Governments for Sustainability** has been working since 2009 with Canadian municipalities to raise their awareness of biodiversity issues, profile the champions and stewards of biodiversity, and to create a platform for sharing ideas.

Based on the responses to a 2014 survey of all municipalities with a population over 30,000 (except in Quebec); 36% of respondents have a dedicated biodiversity policy or strategy; 58% of respondents have biodiversity objectives in their municipal planning documents; 63% have environmental programs that focus on community engagement; and 77% have a framework for natural area protection.

The following examples profile a range of local biodiversity initiatives:

City of Saskatoon, Saskatchewan – Saskatoon and the Meewasin Valley Authority have worked together to develop a resource management plan (2013) for the Northeast Swale, an ecologically significant area that interfaces with recent and future neighbourhood development. The plan will seek to conserve the area, which includes important wildlife habitat, while providing a resource for residents to experience nature for passive and active recreation.

British Columbia's Species and Ecosystems at Risk Local Government Working Group (**SEAR LGWG)** was established in the fall of 2009 in response to the Minister of Environment's interest in developing a collaborative, provincial vision for the protection of species and ecosystems at risk on private land. It is intended to be a forum for communication and consensus to foster collaboration on SEAR issues. The Working Group consists of representatives from municipal, regional and provincial governments and the Union of British Columbia Municipalities (UBCM). In January 2011, the SEAR LGWG provided 45 recommendations under five strategies: increase local government awareness of species at risk; facilitate use of effective tools and techniques; identify and collaborate on shared responsibilities; conduct ecosystem mapping and encourage data sharing; and engage landowners in species at risk habitat protection. Implementation of the recommendations will include collaboration between the SEAR LGWG and existing regional and local conservation programs, land trusts and other environmental stewardship organizations.

City of Kelowna, British Columbia - The Mission Creek Restoration Initiative, a habitat compensation bank, was created in 2008 to address environmental impacts associated with City's infrastructure projects. The City and its partners work together to direct compensation and restoration to the Mission

Creek Restoration Initiative as a way to restore valuable fish habitat and provide additional flood protection throughout the city. Stage 1 (2008-2013) included project start-up and coordination, and strategic and implementation planning. Stage 2 (2014-2016) is focusing on actual restoration.

City of Campbell River, British Columbia – Since 2012, the City of Campbell River has been working with Fisheries and Oceans Canada to restore severely eroded marine foreshore lands using Green Shores principles. Instead of using traditional methods that only intensify the wave energy, partners are now re-contouring the beach slope to dissipate wave energy and prevent erosion to safeguard intertidal habitat. Through this process partners are hoping to re-establish habitat suitable for spawning forage fish (surf smelt and sand lance) which support a myriad of other marine mammals, fish and birds.

Ontario's Biodiversity Strategy 2011 includes the following target: "By 2015, natural heritage-systems plans and biodiversity conservation strategy are developed and implemented at the municipal and landscape levels." Key Ontario Government actions include taking steps to reduce urban sprawl, and promoting and supporting the development of urban biodiversity and green infrastructure strategies.

Town of Oakville, Ontario – The Oakville Wildlife Strategy (2012) is a policy and implementation program focused on enhancing wildlife and its supporting conditions (e.g. habitat) within the town. Ten key recommendations were developed as part of the policy, a number of which are currently in implementation phases. These include the development and delivery of a comprehensive public outreach and education program ("living with wildlife"), a road ecology strategy, a monitoring and data collection program and a wildlife corridors and habitat identification and restoration strategy. Oakville also has a Coyote Management Strategy and a Canada Goose Management Program aimed at addressing issues that are specific to these species.

Climate Change and Biodiversity – Vulnerability and Adaptation

Nationally, since 2009, governments and stakeholders have undertaken numerous assessments of the vulnerability of ecological systems and biodiversity to climate change in sectors and regions across Canada. In addition, ongoing efforts are contributing to the maintenance and protection of healthy, resilient ecosystems and biodiversity in Canada in the face of a changing climate.

For example, at the national level:

- The **Canadian Parks Council's** 2013 report *Canadian Parks and Protected Areas: Helping Canada Weather Climate Change* outlines some of the actions that provinces and territories are taking on natural environments and protected areas in the context of a changing climate.
- Canadian jurisdictions are expanding their systems of parks and protected areas as part of their overall approach to climate change adaptation. For example, the Government of **Saskatchewan** has partnered with environmental organizations to secure a significant amount of land to connect fragmented patches of habitat to enhance biodiversity conservation and facilitate climate change adaptation.
- The **Canadian Council of Ministers of the Environment** (comprised of environment ministers from the federal, provincial, and territorial governments) has developed a suite of tools to address climate change adaptation from a water resource management perspective. These include, for example, guidance to assist the development of climate change vulnerability assessments of water quantity and water quality at a watershed scale, evaluating water monitoring networks to support adaptation needs, and a reference document focused on valuation of water.

- The **Canadian Council of Forest Ministers Climate Change Task Force** has developed a comprehensive, scalable, nationally-applicable framework to assess forest and forest sector vulnerability and adaptation options. Described in a series of reports, the techniques and information enable forest managers to evaluate climate change-related risks, vulnerabilities and opportunities and make informed decisions regarding the need for adaptation and which measures may be most beneficial. To assist in the uptake and application of these products, the Task Force has conducted over 70 presentations, workshops, and webinars and has established a pan-Canadian Forestry Adaptation Community of Practice to allow forest managers, policy-makers, consultants, and researchers to share best practices and lessons learned.

Several provincial and territorial initiatives are underway or have been recently completed that contribute to adaptation from a biodiversity or ecosystem perspective:

- The government of **Alberta** has conducted hydro-climatic variability studies in the South and North Saskatchewan River Basins to understand how climate variability impacts water demand and supply. Alberta is currently conducting a pilot project which examines biodiversity connectivity, species vulnerability, and migration in relation to climate change.
- The Government of **Nova Scotia** has taken steps to include biodiversity connectivity, species vulnerability, and ecosystem migration and adaptation when selecting which provincial areas to protect under its *Parks and Protected Areas Plan* (2013). Nova Scotia has also examined the impact of climate change on saltwater intrusion into coastal groundwater aquifers and produced a province-wide groundwater vulnerability map.
- Through its adaptation strategy and related efforts, the Province of **British Columbia** is working with researchers, non-government organizations, businesses, local governments, and the federal government to advance adaptation in natural resource management and conservation across British Columbia. The Ministry of Forests, Lands and Natural Resource Operations invested $5.1 million in research to support adaptation of British Columbia's forests, developing new tools to help forest managers identify future climate conditions, assess drought risk, and inform tree species selection decisions. BC Parks is considering climate change impacts in its conservation program, increasing emphasis on managing landscapes, including maintaining and restoring connections between landscapes.
- The Government of **Quebec** published its *2013–2020 Climate Change Adaptation Strategy*, which serves as an update to its 2006–2012 strategy. One of four priority areas focuses on the maintenance of ecological services, and builds on ongoing initiatives such as taking adaptation into account in decisions related to land use and urban planning.
- The Government of **Ontario** developed *Climate Ready: Ontario's Adaptation Strategy and Action Plan* (2011) which outlines the province's strategy and actions to address climate change impacts over a four year period (2011–2014).The strategy helps support the Ontario government and partners to prepare for risks and opportunities resulting from climate change in the province. It identifies impacts from climate change on various sectors and suggests specific courses of action, such as undertaking vulnerability assessments, promoting water conservation and mainstreaming adaptation into provincial policies and programs. Vulnerability assessments are recommended actions in both Ontario's *Biodiversity Strategy*, 2011, and *Biodiversity: It's In Our Nature*, 2012. *A Practitioner's Guide to Climate Change Adaptation in Ontario's Ecosystems* (2012) was also developed to assist natural resource managers to identify ways that climate change risks can be integrated into decision-making processes. In support of these strategic documents, the Ontario Ministry of Natural Resources and partners have undertaken two pilots,

one at a tertiary watershed level (Lake Simcoe watershed) and one at an ecodistrict level (Clay Belt in Northeastern Ontario) to explore the vulnerability of ecosystems and natural resources to a changing climate. Effort is now underway to integrate findings from these vulnerability assessments into local decision-making.

The federal government is also taking a range of actions, including the following:

- **Parks Canada** is implementing an adaptation program in northern national parks aimed at understanding climate-driven ecological changes in Canada's North, and how these changes will in turn affect ecological integrity and traditional ways of life in the North.
- **Natural Resources Canada** is developing an update to its 2008 report titled *From Impacts to Adaptation: Canada in a Changing Climate*, to be released in 2014. Although the 2008 assessment took a regional approach, the update takes a sector-based approach which focuses on natural resources (e.g., forestry, mining, and energy), food production, industry, the natural environment and biodiversity, human health, and infrastructure.
- The **Canadian Forest Service**'s Forest Change Initiative, when complete, will include a Tracking System to enable reporting on the effects of climate change on Canada's forests; a sustainable forest management Adaptation Toolkit composed of a range of knowledge products (e.g. maps, guidebooks, decision-support systems, etc.); and an Integrated Assessment of the implications of climate change on Canada's forests and forest sector.
- Through its **Aquatic Climate Change Adaptation Services Program** (ACCASP), Fisheries and Oceans Canada is conducting a series of aquatic basin scale assessments that, among other things, will consider both ecosystem and socio-economic climate impacts. This information will help to generate a new understanding of the future for biodiversity in Canada's three oceans and inland waters.
- **Environment Canada** provides updated information about observed and projected changes in climate, as well as climate change scenarios.

Initiatives to better understand links between climate change and biodiversity also include the work of academic and non-government organizations to assess and monitor ocean acidification. For example, the Canadian Parks and Wilderness Society and World Wildlife Fund Canada partnered in the development of an assessment of the impacts and vulnerabilities of marine and coastal ecosystems on Canada's Pacific coast (Okey *et al.*, 2012, 2014).

Monitoring and reporting on changes in biodiversity over time using a variety of tracking mechanisms will be important for identifying adverse trends as a basis for developing and implementing adaptation measures.

Sustainable Forest Management

Canada has a comprehensive set of 46 indicators that represent a wide range of forest values Canadian citizens want conserved or sustained. These indicators, developed with broad public input, characterize the essential components of sustainable forest management. They recognize forests as ecosystems that provide a wide, complex and dynamic array of environmental and socio-economic benefits.

For about 200 communities across Canada, the forest sector makes up at least 50% of the economic base. In 2012, direct employment in the forest industry reached almost 236,000 and the forest sector's contribution to Canada's GDP reached $18.7 billion (1.1% of GDP). Canadian forest industries count on a

healthy, productive and sustainable forest resource base. A sample of the indicators shows positive results in this area:

- Canada has 3.48 million km^2 of forest – representing 38% of the country's total land area and 10% of the world's forest cover – as well as another 409 thousand km^2 of other wooded land and 85 thousand km^2 of other land with tree cover. Of this total, about 2 million km^2 are under management planning, with some fire and insect management occurring in additional areas for an overall managed forest area of 2.29 million km^2. The forest area is fairly stable, with about 450 km^2 converted to other land uses annually. This accounts for about 0.01% of Canada's forest.
- Across the country, timber is being harvested at rates more than 30% below the sustainable wood supply. The impact of natural disturbances has, however, created localized timber supply concerns in some areas. See p. 36 for additional details on the sustainability of Canada's timber harvest.
- Forests harvested on Canada's public land must be successfully regenerated with forest cover. In 2011, the proportion of forest area planted or seeded climbed to 67% of the total harvest area—notably higher than the traditionally 50/50 proportions of artificial and natural regeneration.

Forest Regeneration on Provincial Crown Lands across Canada (2001-2011)

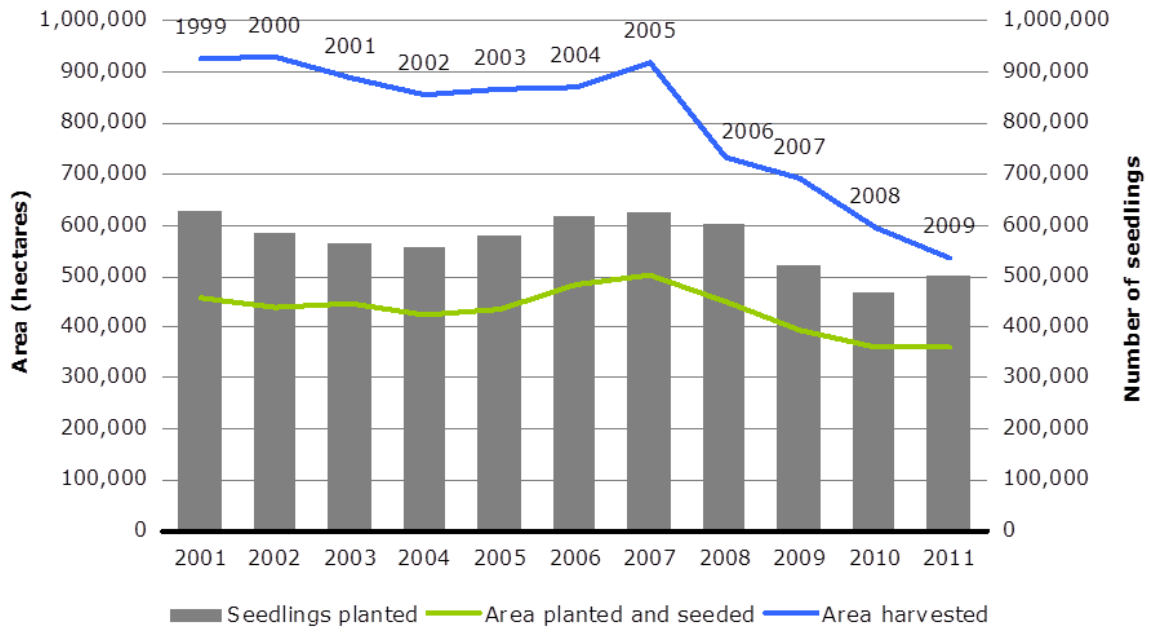


Figure 32: Forest regeneration on provincial Crown lands across Canada, 2001-2011.
Note: For "Area harvested," because there is typically a delay of two years between harvest and regeneration to allow for site preparation and provision of nursery stock, regeneration data are compared with harvest data from two years before. In Canada, provincial public (Crown) lands account for most of the forest area that is under management planning.
Source: Canadian Council of Forest Ministers, National Forestry Database, 2013.

Another indicator shows that about 6400 km^2 of forest were harvested in 2012 — just under 0.2 % of Canada's total forest land.

In November 2012 and May 2013, the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) reassessed 17 forest-associated species. Fourteen of those had no change in their risk level, none were moved to a higher-risk category, and three were moved to a lower-risk category. For additional indicator data and analyses, visit nrcan.gc.ca/forests.

There are a number of specific provincial and territorial initiatives that further illustrate progress on Sustainable Forest Management (SFM). For instance, the Province of **Ontario** recently updated its approach to biodiversity conservation in forests. Previously there were multiple guides that each dealt with a single wildlife species or group of species or a forest pattern. These have been replaced with the *Forest Management Guide for Conserving Biodiversity at the Stand and Site Scales* and *Forest Management Guide for Landscapes*. The Great Lakes – St. Lawrence volume and the yet to be released Boreal volume address biodiversity conservation during forest operations in a holistic manner, in order to ensure that there is suitable habitat across the entire forest landscape for plants and animals, as well as to protect specific habitat features (e.g. nests and species at risk). Ontario is also developing a new and improved version of its Forest Resource Inventory with a stronger ecological focus and incorporating the use of new technologies, data sources, and processes in an effort to achieve higher quality information, enabling Ontario to more effectively manage and conserve its biodiversity resources.

The "Field Guide to the Ecosites of **Saskatchewan**'s Provincial Forests" (published in 2010) provides information about the characteristics associated with the terrestrial and wetland ecosystems found in Saskatchewan's provincial forests and parks. The guide is a valuable tool for resource professionals, providing a common understanding of Saskatchewan's ecosystems.

New Brunswick's 3 million ha of Crown forests are among the most intensively managed and allocated in Canada. A system of Crown Timber Licenses and long-term forest management planning (80-year time frame) have been the order of business since 1982. Among the first forest inventories in Canada to be available on a computer-based Geographic Information System, spatially referenced timber harvest and habitat blocking has been a component of forest management plans since 1992. Planned timber management activities continue to reduce the abundance and patch size of older forest on Crown land. To ensure habitat remains to support old-forest associated wildlife and biological diversity into the future, the New Brunswick Department of Natural Resources has established structural definitions and minimum abundance thresholds for 14 old forest community types and 6 old-forest wildlife habitats. Forest meeting the tree species composition, structure and patch size criteria is mapped in the forest management plans across the 7 eco-regions of the province. In addition to these 20 old-forest habitats, watercourse and wetland buffer zones, deer wintering areas and a network of protected natural areas are also mapped and factored into the forest management plans and long-term wood supply levels. Timber harvesting under specialized rules is permitted in all of these conservation focused land-bases with the exception of the Protected Natural Areas. Forest management plans are redone every 5-years to reflect advances in policy, science and industrial requirements. Collectively, about 28 % of the New Brunswick's Crown forest has been identified to meet old forest biodiversity and other conservation goals.

Private and non-government organizations are also taking steps to support sustainable forest management. The **Canadian Boreal Forest Agreement** (CBFA) is a private agreement, signed in May 2010, which currently includes 19 forest companies, who are members of the Forest Products Association of Canada, and 7 environmental non-governmental organizations (ENGOs). It seeks to

develop a new model of collaboration among these parties to enable a stronger, more competitive forest industry as well as a better protected, more sustainably managed boreal forest.

Agricultural Working Landscapes

Improving biodiversity on agricultural lands is key to maintaining water quality and quantity, supporting pollinators, wildlife habitat and connectivity in the broader landscape, and making agro-ecosystems better able to recover and adapt to environmental stresses such as drought.

In April 2003, Canada launched a **National Environmental Farm Plan (EFP) Initiative**, which includes a set of nationally consistent principles and program elements for EFP programs across the country. An EFP is a voluntarily prepared, formal written assessment of environmental issues or risks on a farm such as soil erosion, potential sources of water contamination or pesticide drift. An EFP contains an action plan detailing the beneficial management practices (BMP) that should be put in place to mitigate or eliminate those risks. These potential on-farm agri-environmental risks and practices are identified by the farmer in consultation with agrologists, EFP facilitators/coordinators, and supporting materials (e.g., EFP workbooks and reference manuals). In 2011, 35% of Canadian farms had a formal Environmental Farm Plans (compared to 27% in 2006), while 2% indicated they were in the process of developing their EFP (Figure 33). Of the farms with an EFP, the majority (95%) had either fully or partially implemented the practices recommended in their EFP.

Farms with an Environmental Farm Plan – Canada, Provinces and Region (2011)

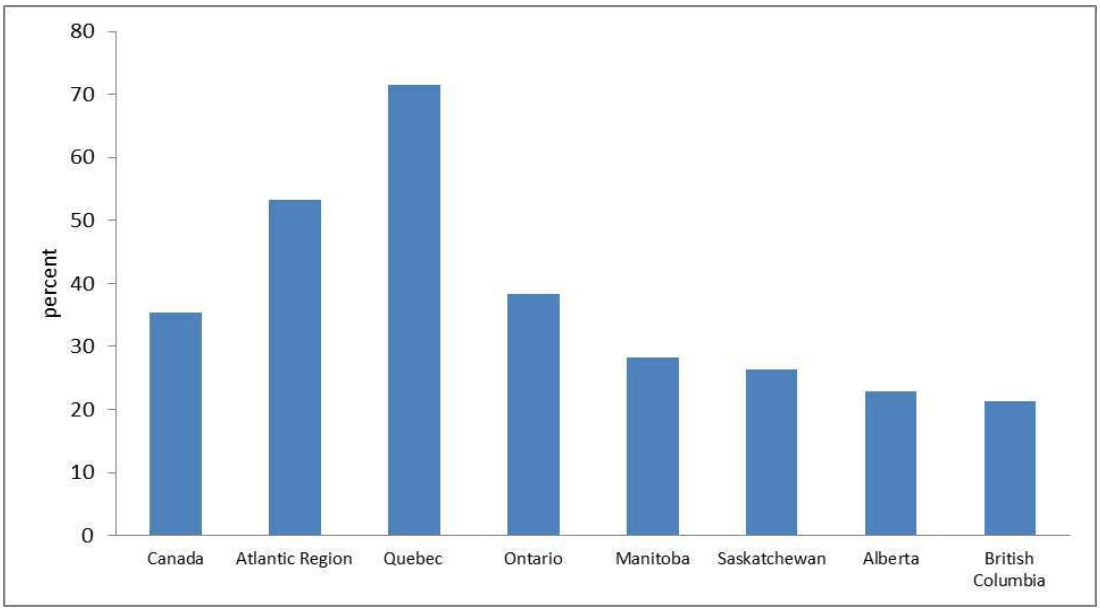


Figure 33: Farms with an Environmental Farm Plan – Canada, Provinces and Region, 2011.
Source: Statistics Canada, Environment Accounts and Statistics Division, 2013.

Agricultural programs in Canada are currently guided by the Federal-Provincial-Territorial *Growing Forward 2* Policy Framework. This five-year policy framework provides cost-shared funding to producers to identify on-farm environmental risks and to support the implementation of beneficial management practices, including some that directly or indirectly support biodiversity on agricultural lands.

Canada's farmers are implementing practices that increase diversity on their farms such as planting shelterbelts and windbreaks, improving and managing riparian buffers, and integrating practices like

crop rotation, strip cropping and agroforestry. In certain cases, funding is available to support this work including, for example, through the **Species at Risk Farm Incentive Program** (SARFIP). Funded by the Ontario Ministry of Natural Resources and the Government of Canada, and administered by the Ontario Soil and Crop Improvement Association, SARFIP provides cost-share funding for best management practices that promote the protection of species at risk and habitats on privately-owned Ontario farms. While encouraging land owners to protect species, it also recognizes the need for sustainable production and profitability. Eligible activities include controlling the spread of invasive plants, protecting or restoring habitats for at-risk species, managing erosion damage along riverbanks, and improving pest management.

A number of organizations in Canada continue to work with industry to promote beneficial practices. The **Alberta Riparian Habitat Management Society**, also known as "Cows and Fish," is a non-profit society that provides education and awareness to achieve healthier riparian areas, cleaner water and healthier landscapes. In Quebec the **Fondation de la faune**, in partnership with l'Union des producteurs agricoles (the Union of Agricultural Producers), has introduced a program for habitat management to improve biodiversity along rivers and streams in agricultural environments.

At the same time, industry is continuing to develop and champion agro-environmental technologies and practices that support productivity and environmental sustainability – such as those practices recognized by the Canadian Federation of Agriculture and Pollinator Partnership with their **Canadian Farmer-Rancher Pollinator Advocate Award** to recognize farmers who contribute significantly to pollinator species protection and conservation on working and wild lands.

Canada has developed an indicator to measure the capacity of agricultural land to provide suitable habitat for terrestrial vertebrates. The **Wildlife Habitat Availability on Farmland Indicator** provides a multi-species assessment of broad-scale trends in the capacity of the Canadian agricultural landscape to provide suitable habitat for populations of terrestrial vertebrates. Results from the most recent analysis of the indicator are expected to be reported in late 2014.

Aquaculture

In Canada, aquaculture management is an area of shared jurisdiction among federal, provincial and territorial governments. Current initiatives include regulatory reform to increase transparency and coordination between regulatory partners. In this context, the federal and provincial/territorial governments work with industry, other stakeholders, and with Aboriginal communities, to advance sustainable aquaculture management. In addition, the **National Aquaculture Strategic Action Plan Initiative** provides a comprehensive strategic vision for the sector, identifying actions for federal, provincial and territorial governments and industry from 2011 to 2015. Maintaining healthy and productive aquatic ecosystems has been identified as an overall condition for sustainable aquaculture development.

Aquaculture management based on the best available science advice reduces direct and indirect pressures on biodiversity and supports the sustainable use of aquatic resources for aquaculture purposes across Canada. Canada is developing a framework to support the collection of information, analyses, and reporting on progress.

Fisheries Management

Canada is taking steps to ensure long-term sustainability of nationally managed fisheries by developing and implementing comprehensive fishery management plans supported by new policies and tools, monitoring, the best available science advice, and compliance and enforcement activities. The new policies and tools include those developed under the **Sustainable Fisheries Framework** (SFF), which provides an overarching science-based policy framework for the sustainable management of Canadian fisheries. The SFF is adaptive; new policies and tools will be added over time to achieve the sustainable use of fish and evolve towards ecosystem-based management for all fishing activity licensed and/or managed by Canada, including those outside of Canada's Exclusive Economic Zone. This will help ensure that fisheries are managed using a precautionary approach, that overfishing is avoided, and that recovery plans and measures are in place for all depleted species. Furthermore, this approach will help to ensure that fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems, and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits. The SFF policies are applied through individual Integrated Fisheries Management Plans. Efforts are underway to advance ecosystem approaches to fisheries management at fishery and area levels. Canada tracks its progress in implementing sustainability measures on an annual basis. Since the Fishery Checklist survey began in 2007, substantial progress has been made through the application of the Sustainable Fisheries Framework policies, and other initiatives, in Canadian fisheries.

Of 155 major fish stocks assessed in 2012, 75 stocks (48%) were classified as "healthy." Fifteen stocks (10%) were classified as "critical", i.e., the productivity of the stock is considered to be at a level that may cause serious harm to the resource. This represents an improvement since 2011, when 72 stocks were in the "healthy" category and 17 stocks were in the "critical" zone.

In addition, our knowledge about the state of the stocks has improved, with 7 fewer stocks in the "unknown" category. Most of the stocks that were previously of unknown status have been placed in

Under **Ontario**'s *Fish and Wildlife Conservation Act*, an aquaculture licence is required to culture fish. As the lead provincial regulator, the Ontario Ministry of Natural Resources (MNR) works collaboratively with multiple agencies including the Ontario Ministry of the Environment (MOE), Ontario Ministry of Food and Agriculture (OMAF) and Fisheries and Oceans Canada (DFO) to ensure the industry is effectively managed. MNR has been engaged in a collaborative process with these agencies, stakeholders and the cage aquaculture industry to develop a science based benthic monitoring program, supporting policy and licence conditions to ensure that ecological impacts associated with cage based aquaculture in the Great Lakes are kept to a minimum. Once finalized, licence conditions will be placed on aquaculture licences requiring sediment monitoring and reporting to track sediment quality in and around these cage sites. The sediment program will complement the established water quality monitoring requirements associated with cage aquaculture. Licence holders are required to undertake water quality monitoring on a regular basis to ensure that the water in and around the facilities are aligned with Provincial Water Quality Objectives. The province is also finalizing the Coordinated Guidelines for Cage Aquaculture Applications in Ontario which provides a framework for reviewing new cage site applications to ensure that they are located in areas best suited for cage aquaculture.

the “cautious” or “healthy” zone. Of the 120 stocks with a known status in 2011, 8 stocks improved their status in 2012.

Status of Major Fish Stocks, Canada (2012)

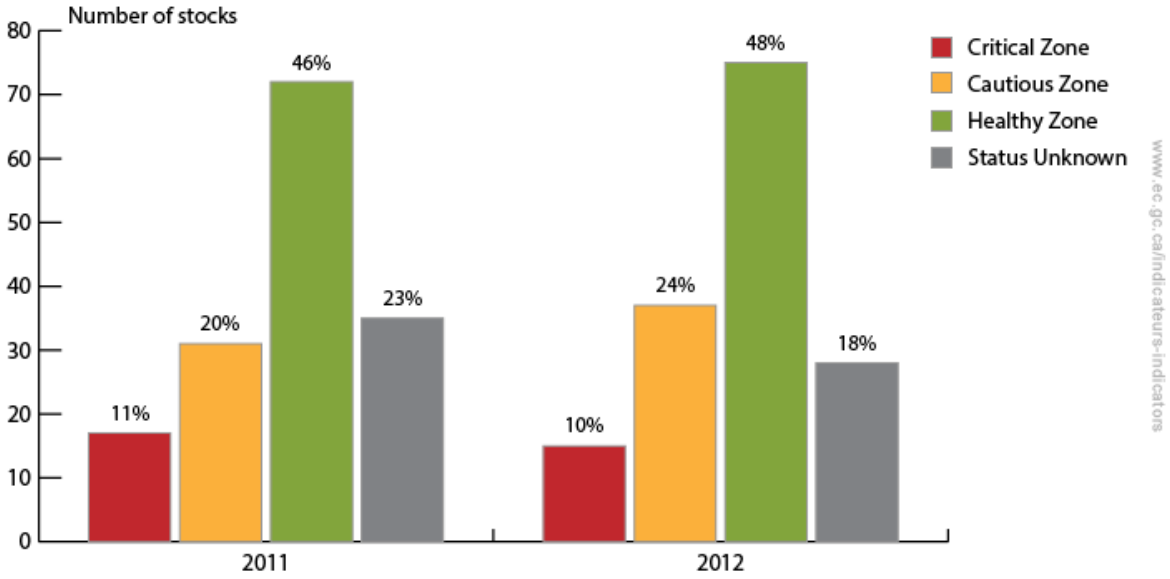


Figure 34: Status of major fish stocks, Canada, 2012.
Note: Fish stocks are classified by comparing the size of stocks to “reference points,” which are established based on the productivity of the stock.
Source: Environment Canada, 2014b.

In 2008, the province of **Ontario** adopted a new framework for recreational fisheries management by creating 20 Fisheries Management Zones (FMZs) based on ecological factors and angler use patterns, such as: the province's climate zones; watersheds; fishing pressure; and road networks. These FMZ’s are now the unit of management for most fisheries in Ontario. Fisheries objectives are developed for each zone in partnership with public advisory councils, and management actions such as catch limits and seasons, are based on these zones. To support this management framework, fish are monitored and assessed at the zone level. Between 2008 and 2012 the inland lakes Broad-scale Monitoring program sampled 700 lakes; data will be used to evaluate success at meeting FMZ objectives by estimating the current status, trends and changes in Ontario’s fish communities and fisheries. The program will also contribute to knowledge about the distribution, extent and diversity of aquatic ecosystems in Ontario and identify stresses and their impacts on aquatic resources.

Reducing Pollution in Aquatic Ecosystems

Canada is working to protect its lakes and rivers, which account for 7% of the world's renewable freshwater. Significant investments have been made to protect and restore key water bodies including the Great Lakes, Lake Winnipeg and Lake Simcoe, and progress is being made to reduce nutrient loads to these areas. Three Canadian Areas of Concern in the Great Lakes are fully restored (Collingwood Harbour, Severn Sound and Wheatley Harbour) and two more areas are in recovery (Spanish Harbour and Jackfish Bay). In addition, the Government of Canada has put in place Wastewater Systems Effluent Regulations to phase out the release of untreated and undertreated sewage into waterways - thereby addressing the largest point-source of pollution.

To help track the status and trends of freshwater quality across the country, Canada draws data from a geographically representative network of 172 monitoring sites. Between 2003-05 and 2009-11, there was an increase in the percentage of sites rated good or excellent and a decline in the percentage of sites rated poor or marginal. Overall, the scores have significantly improved for 13 sites and declined for 4 sites. There has been no statistically significant change detected in the freshwater quality indicator scores for the remaining 84 sites where data were available for 2003 to 2011.

From a regional perspective, for the 2009 to 2011 period, freshwater quality was assessed on select rivers throughout Canada where freshwater quality is at risk of being impaired by human activity. The highest numbers of sites rated good or excellent were found in the Newfoundland–Labrador, Maritime Coastal and Saint John–St. Croix drainage regions, areas with reduced human development. In contrast, the highest numbers of sites with poor and marginal water quality were found in the St. Lawrence, Assiniboine-Red and Winnipeg and Great Lakes drainage regions, areas with larger human populations. Rivers in the most populous regions of Canada had lower water quality exerting the greater pressure on aquatic plant and animal health.

Canada and the United States work together to manage pollution including eutrophication (nutrient loading) of shared water bodies, including the Great Lakes. At present, phosphorus levels remain an issue in the open waters of three of the four Canadian Great Lakes. Phosphorus levels in the middle of Lake Superior and in the eastern basin of Lake Erie currently meet water quality objectives. Phosphorus levels in Lakes Huron and Ontario are below water quality objectives, and above objectives in the western and central basins of Lake Erie.

Status and Trends of Phosphorus Levels in the Open Waters of the Canadian Great Lakes (1970-2010)

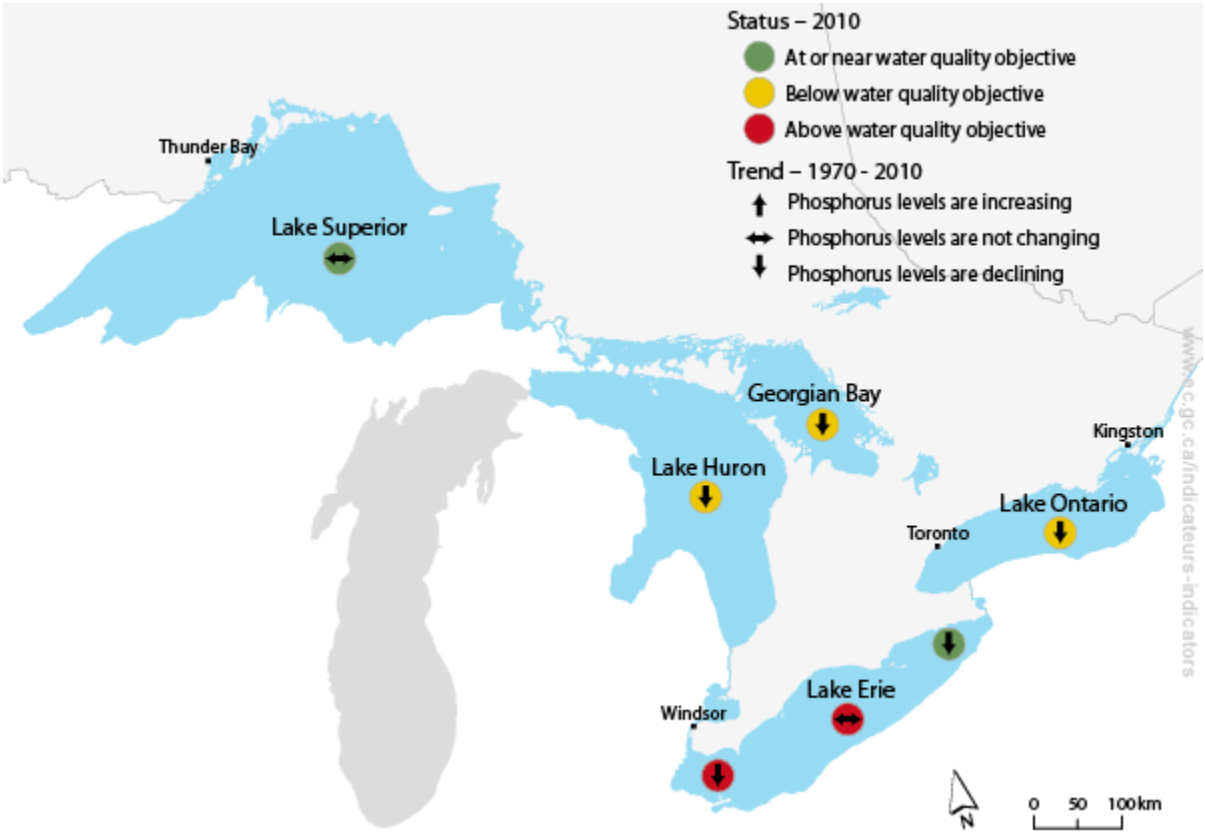


Figure 35: Status and trends of phosphorus levels in the open waters of the Canadian Great Lakes, 1970-2010. Source: Dove & Warren, 2011.

Phosphorus levels at the majority of water quality monitoring stations along the St. Lawrence River are above water quality guidelines for 2008 to 2011. Higher phosphorus levels are found in agricultural areas on the south shore of Lake Saint-Pierre.

Lake Winnipeg Bioeconomy Project: Non-government organizations and other sectoral groups, including industry, play an important part in managing water quality in Canada. A good example of such work is the award-winning and internationally recognized Lake Winnipeg Bioeconomy Project (LWBP), led by the International Institute for Sustainable Development's (IISD) Water Innovation Centre. The LWBP is a key mechanism for achieving sustainable development in the Lake Winnipeg Basin.

The project has three main goals:

- Environmental Sustainability, demonstrated through improved water quality, reduced nutrient loads to Lake Winnipeg and improved watershed health.
- Economic Sustainability, demonstrated through robust clean technology research and development in Manitoba focused on clean water, nutrient recovery, biorefining and other relevant co-benefits; and
- Social Sustainability, demonstrated through rural economic development and ultimately the reversal of rural depopulation in Manitoba.

As a practical example of work carried out under the Project, IISD is showing how the cattail (*Typha* spp.), a common wetland plant, can be a valuable input into a modern bioeconomy. Harvesting and processing cattails produces low-cost bioenergy, fights eutrophication (nutrient loading) by capturing phosphorus, recycles this phosphorus into fertilizer, produces carbon credits and improves wetland habitat.

Invasive Alien Species

Invasive alien species are one of the greatest threats to biodiversity in Canada's ecosystems. Addressing this challenge includes assessing risk, identifying the routes, or pathways, invasive species use to spread to new areas and intercepting potentially invasive alien species. The responsibilities for managing invasive alien species are shared among all levels of government and co-operation is a key principle in the fight against them. The federal government continues to apply and support An ***Invasive Alien Species Strategy*** for Canada. The *Strategy* aims to minimize the risk of invasive alien species to the environment, economy, and society. One of the components of the *Strategy* is cooperation among participating federal and provincial governments. Aboriginal governments, municipalities, and other stakeholders are also important contributors in responding to the challenges of invasive alien species. Invasive alien species councils and committees, for example, established in most provinces and territories in Canada, are multi-stakeholder bodies that play an important role in working with their partners to identify regional priorities and leverage local actions to address invasive alien species. In

2013 the Canadian Council on Invasive Species was formed and works collaboratively across jurisdictional boundaries.

Since 2009, at least 47 intervention or management plans have been developed by governments, often in partnership with non-government organizations, to address the threat of invasive alien species. Additional management and intervention plans were developed before 2009 and are still in place.

Quebec Invasive Alien Species Council – Ash Borer Project: In response to the urgent need for strategic action, the purpose of this project is to develop and implement a prevention program, prepare for the arrival of the ash borer, and launch an intensive information campaign for municipalities and various stakeholders. The participating municipalities have agreed that concerted regional and inter-regional management is necessary because the borer knows no boundaries. To build a basis for integrated management, five main action components are therefore being developed: joint action, awareness-raising and mobilization, monitoring and detection, response, and research and assessment.

In 2012, the Canadian Government announced new funding totaling $17.5 million over five years to protect the Great Lakes from the threat of Asian carp. Similarly, in order to help protect marine and freshwater systems against invasive species, Canada augmented its support in enforcement and monitoring of ballast water regulations and increased ballast water inspection capacity in the Arctic.

Fisheries and Oceans Canada, in partnership with the provinces and territories is addressing the threat of aquatic invasive species by developing a national aquatic invasive species regulatory proposal for prohibiting possession, transport and import of aquatic invasive species, and establishing authorities for control and eradication activities.

As part of its ongoing response to invasive plants, in 2012 the **Canadian Food inspection Agency** (CFIA) drafted an Invasive Plants Directive which describes the CFIA's invasive plants policy and provides a list of pest plants that are prohibited in Canada. Invasive plant surveys were conducted that focussed on high-risk pathways and facilities, such as bird seed facilities, and the CFIA developed and implemented new import-related phytosanitary measures aimed at reducing risk associated with those high-risk pathways. CFIA also participated in international standard-setting, harmonization of approaches, and bilateral meetings with key trading partners to discuss the risks associated with Asian Gypsy Moth (AGM). Work towards eradicating AGM included broad stakeholder consultations and engagement, including an AGM Summit in December, 2012. As a result, revisions were made to strengthen the AGM program and help mitigate the risk of introduction of AGM to Canada.

In April 2011, the Governments of **Canada** and **Ontario** collaborated to establish the **Invasive Species Centre** (ISC). The facility also houses the Insect Production and Quarantine Laboratories, the only facility of its kind in Canada dedicated to combating insect pests, both alien and domestic, terrestrial and aquatic, that threaten Canada's natural resources and ecosystems. During its first year of operation, the ISC worked with partners to advance more than 60 scientific research and strategic project initiatives. These and future projects will inform policy and program development in combating the threats of invasive species.

Natural Resources Canada (NRCan) also contributes to the national effort of combating invasive alien species and has recently contributed expertise to the analysis of the impacts of the spread of Emerald ash borer to Manitoba and Northern Ontario, as a member of the Canadian Council of Forest Ministers. This expertise supported the identification of prevention efforts and early actions applicable to any un-infested area in Canada. More broadly, NRCan produced a risk-impact matrix for five groups of high-

priority pathogens in Canada. In addition, NRCan completed a risk assessment of the invasive *Phytophthora ramorum* to Canadian larch in collaboration with the CFIA.

The Government of **Saskatchewan and Alberta** are partnering to help combat the spread of the invasive Mountain pine beetle. Though native to western Canada, this invasive beetle is expanding from its historical range and threatening the eastern boreal forest therefore becoming a regional concern. The **Saskatchewan** government will provide up to $1.1 million over the next year as part of a partnership agreement with Alberta to help prevent the spread of the Mountain pine beetle into northern forests. The Government of **Alberta** has implemented both a long-term and short-term strategy to manage the invasive Mountain pine beetle infestation and protect the health of its forests in order to reduce the opportunity for Mountain pine beetles to spread further into its pine forests.

In February 2014, the **Ontario** government introduced a bill to support the prevention, early detection, rapid response and eradication of invasive species. The proposed Invasive Species Act would give Ontario the tools to ban activities such as possessing and transporting certain high risk invasive species and enable rapid response actions to address urgent threats.

Provinces and territories have also been addressing challenges associated with invasive alien species through the development of independent programs targeting prevention, awareness, identification, and eradication. For example, **Ontario's** Grow me Instead (GMI) program focuses on identifying popular invasive plants sold within the horticultural industry and providing examples of non-invasive alternatives for consumers. A number of nurseries have signed on to provide the GMI information which includes booklets, brochures, and posters. The participating nurseries also have signs which identify the alternatives within their nursery, so that the consumer can easily find them. By educating consumers about the plants prior to purchase, they are preventing the spread of these species. Participating nurseries are listed on the Ontario Invasive Species Council website. Currently there are over 30 nurseries across the province participating in the program. The GMI program contributes to advancing actions in the Ontario Invasive Species Strategic Plan 2012. This strategic plan supports the national *Invasive Alien Species Strategy for Canada* and the national action plans for aquatic invasive species, terrestrial plants and plant pests and the strategy for wildlife disease

The **Yukon** Invasive Species Council (YISC)'s Spotter's Network is a territory-wide program. In the Spotter's Network workshops members of the public and professionals are trained in identification of target species. Results are increased awareness of the effects of invasive species, encouraged stewardship, and expanded knowledge and understanding of the distribution of invasive species. A priority list and a reporting procedure have been developed. Data will be used to establish an invasive species data base in cooperation with Yukon government.

Between 2005 and 2012, the federal **Invasive Alien Species Partnership Program** supported 170 projects totaling nearly $5.6 Million in funding to engage Canadians in actions to prevent, detect, and manage invasive alien species. One project funded the Congress of Aboriginal Peoples (CAP) to support their participation in the work of the National Alien Species Working Group and to produce a culturally sensitive communication tool to improve awareness of IAS threats.

Business and Biodiversity

A growing number of Canadian businesses are integrating biodiversity considerations into their operations and business plans. Below are just a few recent examples.

Through its **Towards Sustainable Mining Initiative,** Mining Association of Canada members are required to publicly report annually on their environmental performance at the facility level (for Canadian

operations), using specific indicators related to tailings management and biodiversity conservation management. Facility reporting against these indicators is required to be verified as per an established terms of reference to ensure credibility.

ATCO Electric was one of the first utilities in Canada to formalize an avian protection initiative. In 2012, the company retrofitted existing power line structures in south-eastern Alberta to reduce the number of bird electrocutions. This retrofit will also improve the reliability of electricity supply to customers as bird-caused outages are significantly reduced. The affected birds include hawks, owls, ravens and sparrows. The project included installation of covers for transformer bushings and other components, as well as the installation of perch deterrents.

Using a collective approach, **BC Hydro**, **FortisBC**, and **Columbia Power** are helping to close the information gap for the Umatilla dace. This tiny fish is a threatened species that lives in select rivers in southeast British Columbia. In 2011, FortisBC partnered with Columbia Power Corporation to expand the geographic scope of Umatilla dace research that BC Hydro initiated in the Columbia watershed.

In 2011, **Nova Scotia Power** and the provincial Department of Natural Resources signed a collaborative agreement to monitor 10 lakes identified as critical habitat for the Atlantic Coastal Plain Flora, a group of 90 species of taxonomically unrelated wetland plants that inhabit lake and river shores, bogs, fens, and estuaries. Some of the plants are unique to Nova Scotia and most of them are confined to the Tusket River watershed. Permanent monitoring transects have been established on ten lakes, and the results of this monitoring project will feed directly into the recovery strategy for these rare plant species.

The **Canadian Business and Biodiversity Council (CBBC)** is an initiative involving business, government, non-government organizations and academia arising from recommendations by industry and government leaders. Operational support for the initiative comes primarily from Canadian businesses. The role of the CBBC is to assist Canadian businesses in conserving biodiversity and maintaining ecosystem services in Canada and globally, by encouraging good environmental stewardship practices based on sound science, by sharing best practices and lessons learned, and by showcasing successful results. The CBBC has produced a number of publications in support of its mission, including those which provide conservation planning guidance to business, including small and medium-sized enterprises, which showcase best business practices in biodiversity conservation and which share lessons learned. The CBBC was instrumental in the creation of and currently Chairs the Global Partnership for Business and Biodiversity and is assisting other countries in developing similar initiatives. It hosted the Partnership's annual conference in 2013, in cooperation with the CBD Secretariat.

Syngenta Crop Protection Canada, Inc. and the Fondation de la faune du Québec are partners in the Operation Pollinator program. This is the Canadian component of an international initiative to restore natural habitats and food sources to revive the populations of native pollinators, such as bees, butterflies, and other insects, that thrive when diverse sources of food are available. Syngenta provides the seeds for such insect food to farmers and golf courses, among others, and supports scientific research to improve the initiative. The program's progress and success is assessed by independent scientific partners.

The **Canadian Sphagnum Peat Moss Association**, through Scientific Certification Systems (SCS) of California, has developed a third party certification program of its peatland management practices. The

Veriflora® Certified Peatland Products for Responsible Peatland Management is the only peatland management certification in the world. It includes such reportable criteria as protection and conservation of ecosystems, conservation of resources and energy efficiency, and integrated waste management. The achievement of certification under this standard is considered an important component of the industry's commitment to sustainability accounting.

Customary Use by Aboriginal Peoples of Biological Resources

For thousands of years, Aboriginal peoples in Canada have depended on the land, water and healthy ecosystems to meet their physical, social, cultural and spiritual needs. Many Aboriginal peoples continue to have an intimate cultural relationship with the landscape and the resources derived from the land and water. The customary use of biological resources, including such activities as hunting, fishing, trapping and gathering, is an important element of this relationship. Aboriginal women have a central role to play in a range of cultural practices that are linked to biological resources such as food gathering.

Customary use of biological resources can be exercised by Aboriginal communities, if this customary use is supported under Canadian law. This includes the customary aspects of the exercise of Aboriginal or Treaty rights that are confirmed and protected under section 35 of the *Constitution Act*, 1982. In Canada, Aboriginal rights are rooted in the practices, customs and traditions which have continuity with the practices, customs and traditions that existed prior to contact with European society[10]. Treaties with Aboriginal Peoples include treaties reached between 1701 and 1923 and modern-day treaties known as comprehensive land claim settlements. Much of Canada's land mass is covered by both historic and 26 modern treaties. Numerous additional modern treaties are under negotiation. Modern treaties, among other things, address the role of treaty signatories with respect to land management, wildlife harvesting and management, establishment and management of parks and conservation areas, and natural resource conservation and development.

Agreements between governments and Aboriginal authorities have led to the creation of cooperative management regimes for wildlife. Many Aboriginal communities have certain management authorities relating to the use of settlement and reserve lands. Through negotiated cooperative agreements, Aboriginal peoples are assuming increased responsibility for the management of biological resources.

Customary use of biological resources by Aboriginal peoples is one way in which Aboriginal traditional knowledge (ATK) is promoted and applied. For example, the loss of traditional food sources has an impact on the promotion and application of Aboriginal traditional knowledge.

According to the *First Nation Regional Health Survey*, between 2002-03 and 2008-2010, the rate of participation in hiking, snowshoeing, berry picking or other food gathering, and canoeing or kayaking has declined. Approximately one-fifth (22.1%) of all First Nations adults reported hunting or trapping, with more than one-quarter (28.3%) reporting berry picking or other food gathering. Approximately 85% of all First Nations adults had someone share traditional food with their household at least "sometimes" in the 12 months prior to the survey. The percentage of First Nations adults eating land-based animals (moose, caribou, bear, deer, bison, etc.) "often" was stable between 2002-2003 and 2008-10 (25.7% vs.

[10] The Supreme Court of Canada decision in *Powley*, established the practices, customs and traditions that are Métis Aboriginal rights are the ones that are in continuity with the practices, customs and traditions that existed prior to the Crown effective control.

26.4%), while their consumption of freshwater fish increased (from 16.6% to 22.3%) and berry or wild vegetation consumption diminished (from 26.0% to 18.6%).

The *Aboriginal Peoples Survey* (2012) reveals that many Aboriginal peoples are involved in the arts and traditions of their culture. Traditional activities include making clothing or footwear; arts and crafts; hunting, fishing, and trapping; and gathering wild plants. Seventy-nine percent of Inuit adults, 60% of First Nation adults off reserve and 60% of Métis adults had taken part in at least one traditional activity in the year previous to the survey.

According to the *2007-2008 Adult Inuit Health Survey*, more than two-thirds of households from the Inuvialuit Settlement region, 75% from Nunavut and 80% from Nunatsiavut share their traditional foods with others in the community. For Nunavik Inuit (Blanchet, C. & Rochette, L., 2008), traditional foods supplied 16% of total calories in comparison with 84% supplied by store-bought foods.

Data concerning consumption of traditional foods by Aboriginal peoples living off reserves are deficient.

For Aboriginal peoples in Canada, challenges to engage in customary use of biological resources remain. These challenges include the ongoing deterioration of traditional knowledge which customary use draws upon, access to land and resources, as well as pressures on ecosystems and species that may impact the health or abundance of species. However, the following case studies are positive examples that can help guide future policies and initiatives.

The **Cree Trapper's Association** (CTA) plays a key role in the conservation of traditional Cree practices and the wildlife habitats they rely upon. The CTA was created in 1978 as part of the James Bay and Northern Quebec Agreement (JBNQA), to ensure that Cree hunting, fishing and trapping ways of life continue to thrive, at a time when the region's resource and infrastructure development was increasing significantly. As conservation and habitat protection are central to its mandate, the CTA has developed several programs which focus on conservation. In 2009 the CTA developed an official Eeyou Hunting Law based on traditional ways of hunting, fishing and trapping to ensure that the resources are available to present and future generations. These CTA programs illustrate how customary Cree practices are contributing to the conservation and preservation of wildlife and wildlife habitat.

First Nations Food, Nutrition and Environment Study (FNFNES): This comprehensive ten-year (2008-2018) study looks at the safety and nutritional benefits of the diets of over 100 randomly selected First Nations communities across Canada. Partners include the Assembly of First Nations, the University of Ottawa, the Université de Montréal and Health Canada. Using an ecozone sampling framework, the FNFNES provides information on the health and diversity of the environment as it concerns traditional lifestyles by measuring the types and amounts of traditional foods that are currently being consumed on a regionally representative basis as well as documenting what challenges First Nations currently face in pursuing a traditional and healthy diet that is based upon harvesting of plants, fish and wildlife.

Arctic Char – A Pilot Social Fishing Enterprise: The Inuit Health Survey, which completed fieldwork in 2007-08, indicates that traditional food consumption is critical to protecting the health of the Inuit of Nunatsiavut. In partnership with the Nunatsiavut Government's Nain Fish Plant and the Department of Education and Economic Development, the Nain Research Centre and community freezer has implemented a pilot program (2013) to increase the Arctic char fishery. The Nain Research Centre has partnered with, and is providing char to, several stakeholders and programs in all Nunatsiavut coastal communities including Inuit Community Governments, community freezers, daycares, Language Nest programs, Aboriginal Head Start programs and elders' programs. The Nain Research Station is simultaneously evaluating the impact and benefits of the program, including employment, time on the land, improved health and enhanced food security status.

Healthy Eating and Food Security for Aboriginal Peoples Living in Vancouver: In 2011, the British Columbia Provincial Health Services Authority initiated a project to explore the barriers to healthy eating and food security, the patterns of consumption of traditional food and the barriers to accessing traditional food in the urban setting of Vancouver. The diagram below provides a summary of the main findings. This research project illustrates the importance of traditional foods to the health of Aboriginal peoples by not only improving healthy eating, but through connection to family and community, culture and traditions, waterways and land; traditional foods also improve the mental, emotional and spiritual health of Aboriginal peoples.

Summary of Main Factors That Determine Access to Traditional Foods in Vancouver

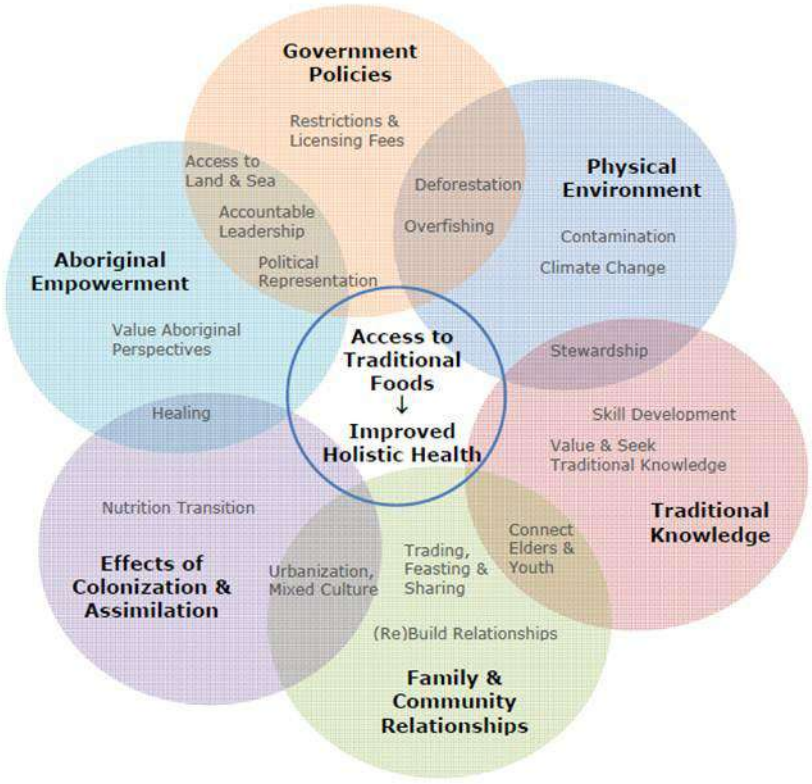


Figure 36: Summary of Main Factors That Determine Access to Traditional Foods in Vancouver.
Source: Elliott & Jayatilaka, 2011.

Knowledge and Information to Support Conservation Planning and Decision-Making

Canada's biodiversity and ecosystem services knowledge base is growing, through efforts to incorporate relevant information from multiple perspectives. Notable initiatives include Canada's Ecosystem Status and Trends reports, the Value of Nature to Canadians Study (each described below) and the Government of Canada's Measuring Ecosystem Goods and Services (MEGS) project (described on p. 46, above).

Canadian Biodiversity: Ecosystem Status and Trends 2010 is a collaborative project of the Canadian federal, provincial and territorial governments. The national highlights report was published in 2010. Since then, nearly 40 technical reports have been published that assess Canada's ecosystem status and

trends by theme and by ecozone+. Over 500 experts participated in the preparation of foundation technical reports. Twenty-two key findings emerged from the technical information which are now being used to inform the national biodiversity agenda, complement the focus on species, and help set biodiversity priorities.

Since 2009, Canada's Federal, Provincial and Territorial governments have also been working together on the **Value of Nature to Canadians Study (VNCS**). In addition to contributing to public outreach on biodiversity, for example through the *Nature Matters! Contest*, the VNCS has produced several research reports on aspects of ecosystem services and biodiversity. This includes: the transdisciplinary literature review, *How Canadians Value Nature*; a secondary analysis of existing public opinion research about Canadian's awareness and attitudes towards nature; and a content analysis of entries in the Nature Matters! Contest. Projects with a specific focus on ecosystem services included development of a modified production-function methodology to reveal the value of unaccounted-for subsidies provided by ecosystems that underpin the natural resources sectors, an analysis of the carbon sequestration potential of native tall-grass prairie habitat and associated approach for rural landholders to access voluntary carbon markets, and the assessment of the socio-cultural and economic values of a coastal ecosystem. Two surveys collected data on a large scale: provincial data on nature-based activities of Canadian households at or close to home in the *2011 Households and Environment Survey*; and national data on participation in a broad range of nature-based activities in the *2012 Canadian Nature Survey*. The Study's focus now is on developing practical guidance to support a fully interdisciplinary approach to ecosystem services values analysis and use with policy instruments.

Ongoing research and monitoring, both in the terrestrial and marine environments, is also helping to furnish a deeper understanding of biodiversity (although further enhancements to monitoring efforts and additional information are needed). Notable examples of biodiversity research and monitoring include the work of the **Alberta Biodiversity Monitoring Institute**, and the joint **Canada-Alberta Oil Sands Monitoring Plan**. University- and museum-based researchers are also helping to strengthening the biodiversity knowledge base. For instance, the **Canadian Museum of Nature** conducts regular field work as part of its program of collection-based systematics research. This program has produced a long-term series of biodiversity observations (over 150 years) that are vouchered in the national collection and shared as whole specimens and as digital information through the Canadian national node (the Canadian Biodiversity Information Facility to the Global Biodiversity Information Facility.

As the science that distinguishes, classifies and documents living things, taxonomy is also essential to our understanding of biodiversity. As of October 2013, there were 32,144,561 taxonomically classified specimens in Canadian collections available for scientific use. Of these, 21,838,366 were species that occur in Canada. Of those species that occur in Canada, 23.9% (5,228,092) of specimens had digital records.

New technologies related to taxonomy and to biodiversity science in general, are transforming the ways knowledge is created and shared. For instance, the "DNA barcoding" that is at the core of the **Barcode of Life** project led by the University of Guelph in Ontario, adds a new tool to the taxonomists' toolbox and enables non-experts to make accurate identifications. New technologies also provide opportunities for developing new knowledge infrastructure that links the relevant science base, decision support tools, best practices and innovative governance. Natural Resources Canada's **Canadian Geospatial Data Infrastructure (CGDI**), for example, is an on-line resource that improves the sharing, access and use of geospatial information – information tied to geographic locations in Canada. The CGDI helps decision-makers from all levels of government, the private sector, non–government organizations and academia make better decisions on social, economic and environmental priorities, and supports biodiversity-sensitive decision-making from local to national levels. The infrastructure itself consists of data, standards, policies, technologies and partnerships that are in place to allow the sharing and visualization of information on the Internet.

Islands of Life: A Biodiversity and Conservation Atlas of the Great Lakes Islands is an international collaboration involving the Province of Ontario, the Nature Conservancy of Canada, the Nature Conservancy and the Great Lakes Program of the US Environmental Protection Agency. With over 32,000 islands, the North American Great Lakes contain the largest collection of freshwater islands in the world (Henson, 2010). Ranging in size from small rocky knolls to the largest freshwater island in the world (Manitoulin Island), these special places are globally unique and rich in biodiversity. Great Lakes islands support endemic species, rare vegetation communities such as alvars and coastal dunes, and arctic-alpine relict flora. They provide nesting habitat isolated from predators for colonial birds and stopover habitat for migratory species. This project produced a comprehensive spatial database of Great Lakes islands and their associated biodiversity values, threats and conservation status. An ecologically-based analysis identified islands and island complexes that are the highest priority for conservation action. Many of the islands that are outstanding in biodiversity are also more at risk from human activity.

Aboriginal Traditional Knowledge

Aboriginal traditional knowledge (ATK) makes important contributions to conservation planning and decision-making. ATK and western science are complementary in many ways, including the way they benefit biodiversity conservation and management in Canada, and the linkages between them need to be developed and strengthened.

A number of mechanisms already exist to promote and consider ATK in biodiversity related work, such as species assessment and recovery, park planning and management, research and capacity-building, and impact assessment. A first but non-exhaustive counting revealed that about one hundred mechanisms are in place for Aboriginal traditional knowledge to inform decision-making.

A dozen of these are **Wildlife Management Boards** (WMBs). These institutions have been established under Land Claims Agreements and are the main instruments for wildlife management within their territories. The WMBs and their co-management partners combine the knowledge and understanding of wildlife managers, users, and the public to make decisions concerning the management of wildlife, such as harvest levels. Their mandate is to conserve wildlife through the application of ATK and scientific knowledge.

The challenges for customary use by Aboriginal peoples of biological resources identified above also apply to Aboriginal traditional knowledge, while the following case studies provide examples of best practices upon which further work can build.

Traditional Knowledge Guiding National Park Management: As part of a collaborative clam monitoring and management project with the Coast Salish Nations, Parks Canada undertook a traditional knowledge study with Elders and knowledgeable people to gain more information regarding historic clam abundance levels and traditional management techniques. This study has allowed Parks Canada to better understand contemporary shellfish data and to identify potential techniques to improve restoration and management of clam populations in Gulf Islands National Park Reserve in British Columbia.

Parks Canada continues to work with a broad range of Coast Salish knowledge holders to learn more about traditional resource management techniques such as clam gardens and how they can be used to improve both cultural and ecological integrity. This is part of a broader relationship with Aboriginal peoples where cooperative management allows Aboriginal traditional knowledge to inform all aspects of park planning and operations, including the monitoring and restoration of park ecosystems.

Prey Items and Predation Behavior of Killer Whales in Nunavut: Killer whales (*Orcinus orca*) are the most widely distributed cetacean, occurring in all oceans worldwide. Within ocean regions different ecotypes are defined based on prey preferences but prey items are largely unknown in the eastern Canadian Arctic. In 2007-2010, a research team conducted a survey of Inuit traditional knowledge on the feeding ecology of killer whales through 105 semi-directed interviews with Inuit hunters and elders in 11 communities in the Kivalliq and Qikiqtaaluk regions of Nunavut. The results detailed local knowledge of killer whale prey items, hunting behaviour, prey responses, distribution of predation events, and prey capture techniques (Ferguson *et al.*, 2012). Continuing the long-term relationship between scientists and hunters will provide for successful knowledge integration and has resulted in considerable improvement in understanding of killer whale ecology relevant to management of prey species.

Fisheries Management in the Canadian Western Arctic through Documentation of Local and Traditional Knowledge: The management of freshwater and marine fisheries in the Gwich'in Settlement Area (GSA) and the Inuvialuit Settlement Region (ISR) in the Canadian Western Arctic has largely been successful through the collection and incorporation of local and traditional knowledge (TK). The development and signing of the Integrated Fisheries Management Plan (IFMP) for Dolly Varden char (*Salvelinus malma malma*) (2011) was a key milestone in the management process. The IFMP included a large TK component which identified Dolly Varden distribution, biology, population size, trends, harvest practices and traditional management. Existing TK documents were also included in the 2010 COSEWIC assessment of Dolly Varden, which identified the populations as being of Special Concern and was the impetus behind the development of the IFMP. The IFMP is implemented largely by two Working Groups (Rat River and West Side) which bring together community members, researchers and decision-makers to review pertinent issues and to make recommendations to co-management partners. This annual adaptive co-management process has shown that community and TK can inform research, planning, and management actions at all stages, leading to greater community involvement and resulting in an improved outlook for the conservation and sustainable use of species.

The **Porcupine Caribou Management Board** (PCMB) is a co-management board responsible for setting recommendations to governments concerning the conservation and sustainable use of the Porcupine Caribou Herd (PCH). Due to the natural high variability of barren-ground caribou herds, the low productivity of the PCH, and in response to concerns in the late 2000's about the size of the herd, the PCMB developed a Harvest Management Plan for the Porcupine Caribou Herd in Canada in 2010 (HMP).

The HMP uses a set of annually updated indicators (based on both scientific and Aboriginal traditional knowledge) to track the condition of the herd to ensure harvest is sustainable.

Since legislative amendments to Manitoba's *Endangered Species and Ecosystems Act* took effect in December 2013, the province is the first jurisdiction in North America to introduce legislation that protects essential habitats, rather than only identifying the threatened or endangered species found in it. The **Manitoba Endangered Species and Ecosystem Advisory Committee** is made up of government appointed members with a diverse background in both western science and ATK. This committee, which now has an expanded role, provides advice to the responsible Minister on the conservation status of species and ecosystems that are endangered or threatened. This advice informs the listing of species or ecosystems at risk under Manitoba's *Endangered Species and Ecosystems Act*.

Aboriginal languages in Canada

Linguistic diversity and number of speakers are useful indicators of the retention and use of traditional knowledge, including knowledge of biodiversity. Language is traditional knowledge that is transmitted inter-generationally from Aboriginal peoples' activities - tied to learning of, from and on the land. Aboriginal peoples' environmental knowledge is embedded in their Aboriginal names, oral traditions and taxonomies specific to their homelands and crucial to its environmental protection.

Since the last national report, there are still over 60 Aboriginal languages being spoken in the country. However, there are 14 Aboriginal languages in Canada that have 50 or fewer speakers remaining, and another 24 Aboriginal languages throughout Canada that have 500 or fewer, mostly elderly fluent speakers remaining (Lewis *et al.*, 2013).

According to the *2011 National Household Survey* (NHS), 240,815 Aboriginal people, or 17.2% of the population who had an Aboriginal identity, responded that they were able to conduct a conversation in an Aboriginal language. This compares with 21.0% according to the *2006 Census of Population*. Between 2006 and 2011, the number of Aboriginal people who reported that they were able to conduct a conversation in an Aboriginal language declined by 2.0%, while the Aboriginal identity population increased by 20.1%.

Knowledge of Aboriginal Languages (2001-2011)

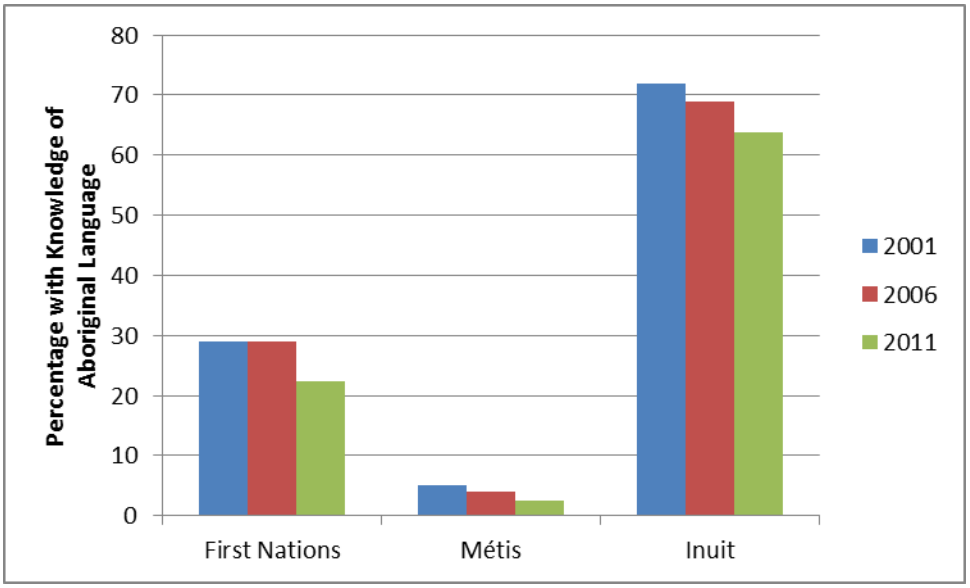


Figure 37: Knowledge of Aboriginal Languages (2001-2011).
Note: This trend compares estimates from the *2006 Census* long form and estimates from the *2011 National Household Survey* (NHS). It is important to note that these two sources represent different populations and have potentially different non-response error levels. Moreover, in 2011, 36 Indian reserves and settlements did not participate or were incompletely enumerated in the NHS compared with 22 in the *2006 Census*.
Source: Adapted from Statistics Canada, 2008 and 2011.

Among the three Aboriginal peoples in Canada (First Nations people, Métis and Inuit), the proportion reporting an ability to conduct a conversation in an Aboriginal language was the highest among Inuit. In 2011, 63.7% of Inuit reported being able to conduct a conversation in an Aboriginal language, mostly Inuktitut. The proportion was 22.4% among First Nations people and 2.5% among Métis.

Measures of Natural Capital Related to Biodiversity and Ecosystem Services

Canada is pursuing opportunities to help ensure the diverse values of biodiversity can be fully reflected in all relevant public and private decision-making frameworks. In a Canadian context, this could include any or all of: environmental statistics and national wealth accounts; indices of well-being; land use and resource management plans and development plans; environmental impact assessments and other similar assessments; and incorporation of biodiversity concepts and tenets in planning and monitoring regimes.

In 2013 Statistics Canada adopted an environmental statistics framework based on the concept of natural capital. Statistics Canada currently measures selected stocks and flows related to natural capital in physical terms and, where feasible and appropriate, in monetary terms. They maintain a set of extensive, geo-referenced, national-scale databases on land cover and land use, fresh water resources, timber, and agriculture. These databases make it possible to measure and produce map layers of individual elements of Canada's natural capital. This work is ongoing and is already being published in sources such as the *Human Activity and the Environment* and *Envirostats* reports. Additional progress on ecosystem services data will focus on freshwater, building on existing national data on the renewal of freshwater.

Statistics Canada has a history of publishing basic statistics on selected elements of natural capital, including some that are produced elsewhere in the government. For example: forest area harvested by province and territory; forest fires and forest land burned, by province and territory; forest land by province and territory; land and freshwater area, by province and territory; landed fish catch and value; principal heights by range or region; principal lakes, elevation and area, by province and territory; principal rivers and their tributaries; and the Great Lakes, dimensions.

Recently, Statistics Canada has been working with partner departments to implement its new **Framework for Environmental Statistics**. This includes working towards implementing the United Nations recommendations on Environmental – Economic Accounting (UN SEEA Central Framework), and working with the federal policy departments and the international community to develop guidelines and data for ecosystem accounts (UN SEEA EEA). As a result, new data series have been made available recently. For example, data on land cover, biomass, wetland extent, natural land parcel size and ecosystem goods and services valuation are now available.

Biodiversity in Formal Education

Formal education is a key avenue for teaching Canada's youth about biodiversity. Provincial and Territorial educational systems are the key vehicle for integrating biodiversity issues into the formal curriculum, and efforts are already underway in various institutions across the country. In **Ontario**, for example, integrating biodiversity into curricula for elementary, secondary and post-secondary schools, including schools of business, is included as a target in the provincial Biodiversity Strategy.

The **Council of Ministers of Education** offers another vehicle for encouraging the integration of biodiversity into elementary and secondary school curricula through, for example, their Pan-Canadian Education for Sustainable Development Framework for Collaboration and Action.

Integration into formal curricula is often supported by informal education at Canadian zoos, aquariums, botanical gardens, National and Provincial parks, museums, outdoor education and environmental education centres and by organizations or programs focused on youth biodiversity education and awareness, such as **Envirothon**.

In a 2014 scan of provincial and territorial governments, of the five provinces and territories reporting, all indicate that biodiversity has been integrated in the elementary and secondary school curricula and all indicate that biodiversity is a specific unit or theme within the curriculum. Biodiversity is taught primarily in the Science or the Science and Technology subject areas across all grade levels. Additionally, in several provinces, key biodiversity concepts weave through different grades in other subject areas including Art, Career and Technology Studies, Social Studies, Health and Physical Education and Music.

Key concepts identified by jurisdictions align with the key strands identified by Learning for a Sustainable Future for understanding biodiversity: the science of the diversity of life, the role of living things within ecosystems, human impact on biodiversity, economic and technological utility and impact, and; socio-cultural perspectives including the role of government.

British Columbia and **Ontario** have environmental education policies or direction to inform curriculum and program development and the teaching of environmental and sustainability concepts in the classroom. The focus of these documents is to provide students with the knowledge, skills, perspectives and practices they need to be environmentally responsible citizens.

British Columbia's Sustainability Education Framework will help ensure that all K-12 students in the province are being educated in the basics of living sustainably. Students and the education community

will understand that sustainable development requires each individual to examine issues within the context of economic prosperity, consumption, social justice, and ecological stewardship.

The first goal of *Acting Today, Shaping Tomorrow: A Policy Framework for Environmental Education in Ontario Schools* is: "By the end of Grade 12, students will acquire knowledge, skills, and perspectives that foster understanding of their fundamental connections to each other, to the world around them, and to all living things" (Ontario Ministry of Education, 2009).

While the **Yukon** has no official policies in place for environmental or outdoor/experiential education, the Yukon Department of Education supports experiential education through a full-time Experiential Curriculum Coordinator, and the Department of Environment with a full-time Environmental Education and Youth Programs Manager.

Public Awareness, Engagement and Participation in Biodiversity Conservation

Private, public and non-governmental organizations are all key players in getting Canadians into nature and involved in conservation activities. Participation can be tracked by examining trends in behaviour, such as park visitation and participation in relevant biodiversity related activities and programs.

Statistics Canada's national Households and the Environment Survey in 2011 and 2013 collected data on Canadians' activities in nature at home or close to home. It found that in 2011, 86% of households were within 10 minutes of a public park or other greenspace, 75% of households reported that at least one member participated in outdoor recreation activities, and that 19% of Canadians volunteered in nature conservation activities. Further, 25% of Canadians made purchases to feed or shelter birds, and 56% reported that they grew fruit, vegetables, herbs, or flowers for personal use. Results of the 2013 survey will be released in spring 2015.

The *Canadian Nature Survey 2012* measured Canadians' participation rates in and expenditures on nature-related activities, including recreation, leisure, education, subsistence, and conservation, for the 12-month period prior to completing the questionnaire. In addition, the survey identified Canadians' awareness of certain nature-related concepts and asked how they respond to negative interactions with wildlife. Results will be published in 2014.

Canada's population grew by approximately 4 million (or 10 %) in the last 10 years. Per capita analysis of park visitation shows that visitation has remained steady or declined in most provinces (and nationally) in the short term, and particularly over the long term. So despite population growth in Canada, fewer Canadians are experiencing many national and provincial parks than a decade ago.

Figure 38 (below) demonstrates the trends in Parks' visitation by provinces. The trends have been determined according to the 10 year changes in population in each of the provinces. The green arrow indicates that visitation has increased more rapidly than the overall population, the black arrow indicates that visitation has increased in the same proportion as the overall population, and the red one indicates that visitation has decreased in comparison of the growth of the overall population.

Per Capita Park Visitation Trends

		Per capita baseline (per 100 residents) 2012(13)	Trends			Pop Δ 10 yr
			3 Yr	5 Yr	10 Yr	
Atlantic						
NL	Camping nights	12	→	↑	↑	+2%
NS	Camper nights	6	→	→	→	+1%
NB	Total visits	99	↓	↑	↑	+1%
PE	Campsite nights	23	↓	→	↓	+6%
Central						
QC	Visit days	51	↓	↑	↑	+8%
ON	Visitors	69	↓	↓	↓	+10%
Prairies						
MB	Vehicle visitors	401	↓	↓	↓	+7%
SK	Visitor days	328	↑	↑	↑	+9%
West						
AB	Day use visitors	255*	↓*	↓*		+9%*
BC	Visitors	458	↑	↑	↓	+10%
Federal						
PCA	Person visit	37	→	→	↓	+10%

Figure 38: Per Capita Park visitation trends.
Table derived from analysis of visitation statistics provided by park jurisdictions
Trend: 3yr (2012/13 vs. 2010/11); 5 yr (2012/13 vs. 2008/09); 10 yr (2012/13 vs. 2003/04)
Population source: Statistics Canada, CANSIM *Table 051-0001*.
*Trend is calculated with different years due to the availability of partial data only. 3 yr (2005/06 vs. 2002/03); 5 yr (2005/06 vs. 2000/01); population trend for Alberta is based on 5 yrs (2000 to 2005) for comparison purposes.
'Visitor' is defined differently among park systems, due to differences in resources, operational needs, and geographic complexity of the parks themselves. For some, a visitor is based on initial presence at an entry point (e.g., person visits), while duration of a visitor's stay (e.g., visit days) is used by others. Example, one adult staying 3 days would be counted as 1 visitor in a national park, but as 3 visitors in a Saskatchewan park.

Getting Out into Nature

The renaturalisation of urban spaces and the establishment of conservation areas nearer to large population centres, such as **Rouge National Urban Park** in the Greater Toronto Area, provide increasingly large numbers of Canadians with access to nature.

The **Ontario Children's Outdoor Charter** aims to make sure all Ontario children have opportunities to play and explore in the outdoors. Research shows that children who play outdoors regularly grow up healthier, happier and do better in school. And, when children have opportunities to discover the wonders of nature, they are also more likely to grow up caring for biodiversity. The Charter was developed by the Back to Nature Network, Ontario Ministry of Natural Resources, Parks and Recreation Ontario, Ontario Ministry of Tourism Culture and Sport, Royal Botanical Gardens, KidActive, Biodiversity Education and Awareness Network, Ontario Nature and the Fish & Wildlife Heritage Commission. Through their own programs, the partners will promote the Charter and its goals. The partners recognize that many other groups, agencies and organizations work to connect children and nature. Others are welcome to sign on to the charter. The Ontario Children's Outdoor Charter advances actions in *Ontario's Biodiversity Strategy, 2011* and *Biodiversity: It's In Our Nature*, the Ontario Government Plan to Conserve Biodiversity.

The Get Outside Project is a collaborative youth leadership project for 14-18 year olds that aims to strengthen youth attachment to Canada's wilderness. The purpose of the project is to connect youth to the outdoors in a meaningful and sustainable way by giving them a sense of purpose and the capacity to inspire others to spend more time outside and form connections to Canada's natural spaces. The project began in British Columbia in 2011 as a collaborative effort between Canadian Parks and Wilderness Society – BC Chapter (CPAWS-BC), BC Parks, Mountain Equipment Co-op (MEC), the Child and Nature Alliance of Canada and Parks Canada. Get Outside has since spread to other provinces across the country. Through participating in an outdoor leadership summit and planning and hosting their own outdoor community projects, the participants gain the necessary skills and support needed to inspire youth in their communities to get outside.

Encompassing more than 40 km^2 of natural landscape and farmland within the Greater Toronto Area, **Rouge Park** is slated to become Canada's first national urban park. The park has a rich diversity of natural and cultural heritage resources, including: a nationally rare Carolinian forest; numerous species at risk; a national historic site; geological outcrops from the interglacial age; and evidence of human occupation dating back over 10,000 years. The future Rouge National Urban Park will be created and managed to ensure the protection of the area's rich natural and cultural heritage, while at the same time offering residents of Canada's largest city nature-based experiences for generations to come.

Engagement and Stewardship

There are millions of active environmental stewards in Canada, along with several thousand organizations dedicated to preserving biodiversity through a broad range of activities. Countless efforts to engage Canadians in biodiversity conservation are underway across the country, particularly at the local and regional level, through local environmental organizations and volunteer programs, and through government-run conservation programs such as **EcoAction** and the **New Brunswick Wildlife Trust Fund**. *Canada's 4th National Report to the United Nations Convention on Biological Diversity*, and the 2010 highlights report, *Caring for Canada's Biodiversity,* showcased a wide range of examples, and the variety and level of citizen engagement continues to grow.

The **New Brunswick Wildlife Trust Fund** was established in 1997 to further wild life conservation in the province. The fund is managed by the NB Wildlife Council, a group of 17 volunteers appointed by the Minister of Natural Resources. These dedicated individuals represent a wide range of wild life interests: hunters, fishers, trappers, naturalists, environmentalists and First Nations. The main source of revenue for the fund is a conservation fee applied to all hunting, fishing and trapping licenses. Additional monies come from New Brunswickers that pay a little extra to buy specialized "conservation" license plates for their vehicles. Individuals and corporations can also donate directly. The fund contributes almost 1 million dollars per year to successful applicants for project related to fish and wildlife population and habitat enhancement, education and science. Between 1997 and 2011, the Wildlife Trust Fund supported over 1,200 conservation projects.

In 2013, 1,800 volunteers made a commitment to nature through the **Nature Conservancy of Canada's Conservation Volunteers** program, contributing more than a year's worth of time — over 10,000 hours — to more than 230 conservation projects.

Canadians are also contributing to our understanding of species through a variety of citizen-science programs. These include bird-monitoring programs such as the **Breeding Bird Survey**, which began in 1966 and is one of the oldest surveys of its kind in North America. Other citizen-science programs include Frogwatch, which uses frogs and toads as indicator species for monitoring the health of wetlands, and Plantwatch, which records flowering times as an important indicator of a changing climate.

The number of Breeding Bird Survey participants has declined slightly over the last decade. This change may be due to fewer observers bringing assistants, and some observers surveying more routes, as the total number of routes being surveyed has actually increased. At the same time, participation in two other volunteer-based bird surveys – the **Christmas Bird Count** and **eBird** has increased, with eBird participation doubling between 2010 and 2012.

Participation in Volunteer-Based Bird Surveys (2000-2012)

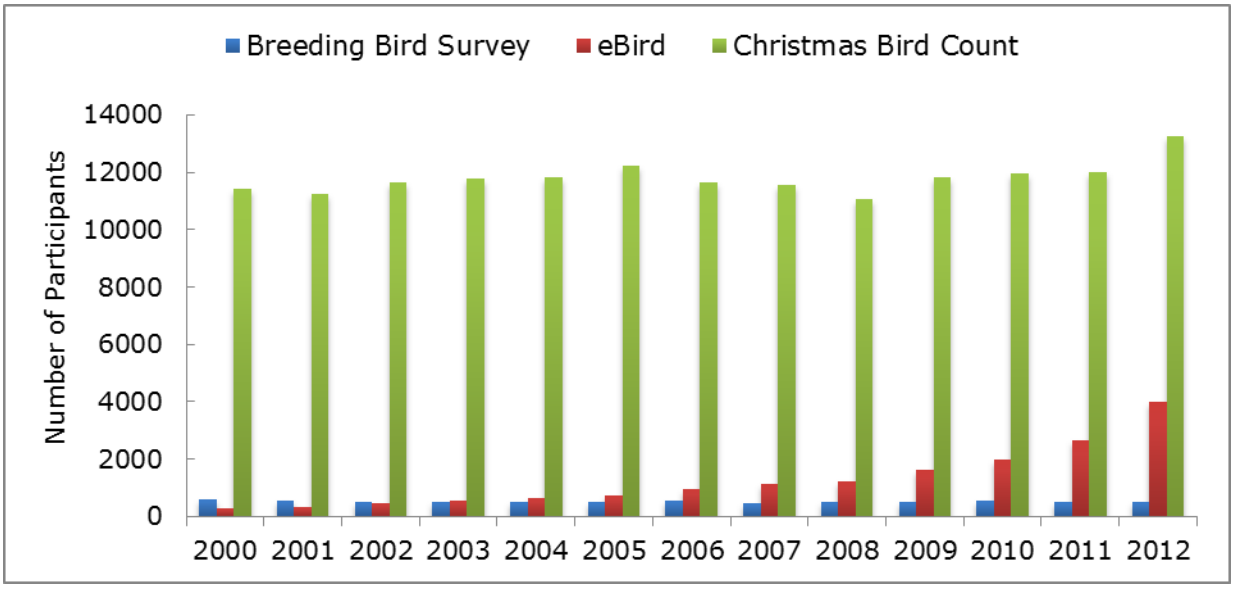


Figure 39: Participation in volunteer-based bird surveys
Source:Data provided by Environment Canada, 2014.

In the fall of 2013, Parks Canada and the Royal Ontario Museum partnered for a major **BioBlitz in Rouge Park**. The 2013 BioBlitz engaged more than 400 nature lovers of all ages as citizen scientists. During the BioBlitz, scientists and members of the public work together to identify and record all animal, plant and fungal species found in the Park over a 24-hour period. Its goal was to document all life in Rouge Park while providing an opportunity for Canadians to learn about the importance of our biological diversity. This joint effort, combined with an inaugural BioBlitz in Rouge Park in 2012, has resulted in close to 1,700 species being identified with more expected to be found in the 2014 BioBlitz. By connecting people with the natural world, events like BioBlitzes foster a lifelong appreciation for nature and a desire to contribute to its protection.

Awareness

For the 2010 International Year of Biodiversity, Canada held a **Nature Matters! contest** for youth to submit original written or video essays on the subject of "why nature matters to me". Two winners in each of the media categories in each of three age groupings were honoured at the Canadian Museum of Nature on International Biodiversity Day. Canada presented a Nature Matters! video to delegates from 193 countries during one of the plenary sessions at COP10. Qualitative analysis of the content of the submissions found that the top six values expressed by youth in their essays were: appreciation or gratitude for ecosystem services; human embeddedness and dependence on nature; health and well-being; aesthetic appreciation; experiential, forming individual identity; and, stewardship and a moral or ethical obligation to protect nature.

Yukon Biodiversity Awareness Month (YBAM!) - Every April, Yukon celebrates Biodiversity Awareness Month. The diversity of opportunities to enjoy nature, from viewing thousands of Trumpeter Swans returning from their annual migration, to listening for spring frogs, to searching for the first crocus of the year make April a great time to celebrate Yukon's biodiversity. Every year there are different activities such as free birding tours by the Yukon Bird Club, Family Fishing Days organized by the Yukon Fish and Game Association, a lecture series put on by the Yukon Science Institute, presentations and posters at the annual Biodiversity Forum, wilderness photography lessons, watercolour painting workshops, and games and activities for the whole family. Approximately 10% of Yukon's people participate in one or more of these activities each spring. As a result, biodiversity awareness and appreciation is a part of everyday life for many Yukoners.

Established in 2006 to implement Ontario's Biodiversity Strategy, the **Biodiversity Education and Awareness Network** **(BEAN**) is a collaborative network of groups and individuals representing private industry, formal and non-formal education, government, the environment and conservation. BEAN's mission is to build a provincial network that actively develops, delivers and supports biodiversity education and awareness that leads to effective public participation in conserving biodiversity and promoting sustainable resource management. In addition to supplying teachers with Ontario-developed lesson plans linking to the theme of the International Day for Biological Diversity, BEAN administers a small grant program to promote biodiversity awareness and understanding each May 22nd.

Chapter III – Contributing to Progress Towards the Aichi Biodiversity Targets

Chapter II details actions in Canada on a broad range of topics to support biodiversity conservation and sustainable use. This Chapter cross-references the global Aichi targets with the proposed 2020 biodiversity goals and targets for Canada, and associated domestic indicators (existing and *in development*), and provides additional information related to other CBD and global priorities.

Aichi Targets	DRAFT national targets	Indicators related to proposed national targets
Goal A. Address the underlying causes of biodiversity loss by mainstreaming biodiversity across government and society		
1. By 2020, at the latest, people are aware of the values of biodiversity and the steps they can take to conserve and use it sustainably.	18. By 2020, biodiversity is integrated into the elementary and secondary school curricula. 19. By 2020, more Canadians get out into nature and participate in biodiversity conservation activities.	- The number of jurisdictions that have integrated biodiversity into elementary and secondary curricula - Percentage of Canadians who report that they take definite action to protect the environment - Participation in volunteer-based citizen-science monitoring programs - Trends in park or conservation area visitation - Trends in the percentage of Canadians who report that they visited parks or public greenspaces
2. By 2020, at the latest, biodiversity values have been integrated into national and local development and poverty reduction strategies and planning processes and are being incorporated into national accounting, as appropriate, and reporting systems.	4. By 2020, biodiversity considerations are integrated into municipal planning and activities of major municipalities across Canada. 17. By 2020, measures of natural capital related to biodiversity and ecosystem services are developed on a national scale, and progress is made in integrating them into Canada's national statistical system.	- The number of medium and large population centres that have developed biodiversity conservation strategies - The number of medium and large population centres that have biodiversity objectives in municipal planning documents - The number of individual elements of natural capital for which Statistics Canada has published national-scale data tables - The number and extent of individual elements of natural capital for which Statistics Canada has published national-scale map layers - The number of ecosystem services for which there is national-scale data
3. By 2020, at the latest, incentives, including subsidies, harmful to biodiversity are eliminated, phased out or reformed in order to minimize or avoid negative impacts, and positive incentives for the conservation and sustainable use of	13. By 2020, innovative mechanisms for fostering the conservation and sustainable use of biodiversity are developed and applied.	- Case studies which showcase the conservation and/or sustainable use of biodiversity through innovative mechanisms, in sectors and regions across Canada

Aichi Targets	DRAFT national targets	Indicators related to proposed national targets
biodiversity are developed and applied, consistent and in harmony with the Convention and other relevant international obligations, taking into account national socio-economic conditions		
4. By 2020, at the latest, Governments, business and stakeholders at all levels have taken steps to achieve or have implemented plans for sustainable production and consumption and have kept the impacts of use of natural resources well within safe ecological limits.	3. By 2020, Canada's wetlands are conserved or enhanced to sustain their ecosystem services through retention, restoration and management activities. 6. By 2020, continued progress is made on the sustainable management of Canada's forests 7. By 2020, agricultural working landscapes provide a stable or improved level of biodiversity and habitat capacity. 8. By 2020, all aquaculture in Canada is managed under a science-based regime that promotes the sustainable use of aquatic resources (including marine, freshwater and land based) in ways that conserve biodiversity 9. By 2020, all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem-based approaches.	- Habitat area retained, managed, and restored under the North American Waterfowl Management Plan. - Relevant indicators drawn from the existing suite of indicators in the Canadian Council of Forest Ministers (CCFM) Criteria and Indicators (C&I) Framework - *The extent to which aquaculture is managed under a science-based environmental regulatory framework* - Wildlife habitat capacity on farmland - Environmental farm planning on agricultural land - Status of major fish stocks - Percentage of major fish stocks where the harvest rate is at or below approved levels (e.g. removal reference, quota)
Goal B. Reduce the direct pressures on biodiversity and promote sustainable use		
5. By 2020, the rate of loss of all natural habitats, including forests, is at least halved and where feasible brought close to zero, and degradation and	3. By 2020, Canada's wetlands are conserved or enhanced to sustain their ecosystem services through retention, restoration and management activities. 6. By 2020, continued progress is made on the sustainable	- Habitat area retained, managed, and restored under the North American Waterfowl Management Plan - Relevant indicators drawn from the existing suite of indicators in the Canadian Council of Forest Ministers (CCFM) Criteria and Indicators (C&I) Framework

Aichi Targets	DRAFT national targets	Indicators related to proposed national targets
fragmentation is significantly reduced.	management of Canada's forests. 7. By 2020, agricultural working landscapes provide a stable or improved level of biodiversity and habitat capacity.	- Wildlife habitat capacity on farmland - Environmental farm planning on agricultural land
6. By 2020 all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem based approaches, so that overfishing is avoided, recovery plans and measures are in place for all depleted species, fisheries have no significant adverse impacts on threatened species and vulnerable ecosystems and the impacts of fisheries on stocks, species and ecosystems are within safe ecological limits.	9. By 2020, all fish and invertebrate stocks and aquatic plants are managed and harvested sustainably, legally and applying ecosystem-based approaches.	- Status of major fish stocks - Percentage of major fish stocks where the harvest rate is at or below approved levels (e.g. removal reference, quota)
7. By 2020 areas under agriculture, aquaculture and forestry are managed sustainably, ensuring conservation of biodiversity.	6. By 2020, continued progress is made on the sustainable management of Canada's forests 7. By 2020, agricultural working landscapes provide a stable or improved level of biodiversity and habitat capacity. 8. By 2020, all aquaculture in Canada is managed under a science-based regime that promotes the sustainable use of aquatic resources (including marine, freshwater and land based) in ways that conserve biodiversity.	- Relevant indicators drawn from the existing suite of indicators in the Canadian Council of Forest Ministers (CCFM) Criteria and Indicators (C&I) Framework - Wildlife habitat capacity on farmland - Environmental farm planning on agricultural land - *The extent to which aquaculture is managed under a science-based environmental regulatory framework*
8. By 2020, pollution, including from excess nutrients, has been	10. By 2020, pollution levels in Canadian waters, including pollution from excess nutrients,	- Phosphorus levels in the Great Lakes - Phosphorous levels in the St. Lawrence River - Regional freshwater quality in Canadian rivers

Aichi Targets	DRAFT national targets	Indicators related to proposed national targets
brought to levels that are not detrimental to ecosystem function and biodiversity.	are reduced or maintained at levels that support healthy aquatic ecosystems.	- Change in the national freshwater quality indicator through time
9. By 2020, invasive alien species and pathways are identified and prioritized, priority species are controlled or eradicated, and measures are in place to manage pathways to prevent their introduction and establishment.	11. By 2020, pathways of invasive alien species introductions are identified, and risk-based intervention or management plans are in place for priority pathways and species.	- Number of known new invasive alien species in Canada, by Federal Regulatory Status - Percentage of federally regulated foreign invasive alien species not established in Canada - Number of intervention or management plans in place
10. By 2015, the multiple anthropogenic pressures on coral reefs, and other vulnerable ecosystems impacted by climate change or ocean acidification are minimized, so as to maintain their integrity and functioning.	3. By 2020, Canada's wetlands are conserved or enhanced to sustain their ecosystem services through retention, restoration and management activities.	- Habitat area retained, managed, and restored under the North American Waterfowl Management Plan.
Goal C. To improve the status of biodiversity by safeguarding ecosystems, species and genetic diversity		
11. By 2020, at least 17 % of terrestrial and inland water, and 10 % of coastal and marine areas, especially areas of particular importance for biodiversity and ecosystem services, are conserved through effectively and equitably managed, ecologically representative and well connected systems of protected areas and other effective area-based conservation measures, and integrated into the wider landscape and seascapes.	1. By 2020, at least 17 % of terrestrial areas and inland water, and 10 % of coastal and marine areas, are conserved through networks of protected areas and other effective area-based conservation measures. 16. By 2020, Canada has a comprehensive inventory of protected spaces that includes private conservation areas.	- Percentage of total terrestrial territory (including inland water) conserved in protected areas and other effective area-based conservation measures - Percentage of total coastal and marine territory conserved in marine protected areas and other effective area-based conservation measures - The establishment of a centralized comprehensive inventory - The number and/or nature of new elements and/or methods that are incorporated into Canada's protected spaces tracking and reporting system

Aichi Targets	DRAFT national targets	Indicators related to proposed national targets
12. By 2020 the extinction of known threatened species has been prevented and their conservation status, particularly of those most in decline, has been improved and sustained.	2. By 2020, species that are secure remain secure, and populations of species at risk listed under federal law exhibit trends that are consistent with recovery strategies and management plans.	- Species at risk population trends (i.e. trends in population sizes of species at risk compared to federal recovery strategy objectives) - Changes in wildlife species disappearance risks - Trends in the general status of wild species
13. By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity.		
Goal D. Enhance the benefits to all from biodiversity and ecosystem services		
14. By 2020, ecosystems that provide essential services, including services related to water, and contribute to health, livelihoods and well-being, are restored and safeguarded, taking into account the needs of women, indigenous and local communities, and the poor and vulnerable.	3. By 2020, Canada's wetlands are conserved or enhanced to sustain their ecosystem services through retention, restoration and management activities.	- Habitat area retained, managed, and restored under the North American Waterfowl Management Plan.
15. By 2020, ecosystem resilience and the contribution of biodiversity to carbon stocks has been enhanced, through conservation and restoration, including	3. By 2020, Canada's wetlands are conserved or enhanced to sustain their ecosystem services through retention, restoration and management activities.	- Habitat area retained, managed, and restored under the North American Waterfowl Management Plan.

Aichi Targets	DRAFT national targets	Indicators related to proposed national targets
restoration of at least 15 % of degraded ecosystems, thereby contributing to climate change mitigation and adaptation and to combating desertification.		
16. By 2015, the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilization is in force and operational, consistent with national legislation.		
Goal E. Enhance implementation through participatory planning, knowledge management and capacity building		
17. By 2015 each Party has developed, adopted as a policy instrument, and has commenced implementing an effective, participatory and updated national biodiversity strategy and action plan.		- Proposed 2020 biodiversity goals and targets for Canada have been developed by a federal-provincial-territorial working group. Once final targets are adopted, they will complement the Canadian Biodiversity Strategy and *Biodiversity Outcomes Framework*.
18. By 2020, the traditional knowledge, innovations and practices of indigenous and local communities relevant for the conservation and sustainable use of biodiversity, and their customary use of biological resources, are respected, subject to national legislation and relevant international obligations, and fully integrated and reflected in the implementation of the Convention with the full and effective participation of	12. By 2020, customary use by Aboriginal peoples of biological resources is maintained, compatible with their conservation and sustainable use. 15. By 2020, Aboriginal traditional knowledge is respected, promoted and, where made available by Aboriginal peoples, regularly, meaningfully and effectively informing biodiversity conservation and management decision-making	- Number of households participating in traditional activities - Consumption of traditional foods - Case studies illustrating customary use of biological resources - Number of mechanisms in place for Aboriginal traditional knowledge (ATK) to inform decision-making - Case studies assessing effectiveness of established mechanisms for ATK to inform decision-making - Case studies illustrating best practices in promoting ATK or having it inform decision-making - Trends in linguistic diversity and number of speakers of Aboriginal languages

Aichi Targets	DRAFT national targets	Indicators related to proposed national targets
indigenous and local communities, at all relevant levels		
19. By 2020, knowledge, the science base and technologies relating to biodiversity, its values, functioning, status and trends, and the consequences of its loss, are improved, widely shared and transferred, and applied.	5. By 2020, the ability of Canadian ecological systems to adapt to climate change is better understood, and priority adaptation measures are underway. 14. By 2020, the science base for biodiversity is enhanced and knowledge of biodiversity is better integrated and more accessible. 16. By 2020, Canada has a comprehensive inventory of protected spaces that includes private conservation areas.	- Completion of assessments of the vulnerability of ecological systems and biodiversity to climate change in sectors and regions across Canada that identify priority areas and species of greatest concern - *The number and extent of management, land use and development plans completed and implemented that integrate explicit consideration of adaptation to facilitate or enhance the resilience and sustainable use of species and areas of greatest concern* - Completion of a national assessment of biodiversity science required to address policy needs - *The number of peer-reviewed reports written by 2020 which contribute to addressing key biodiversity science needs* - *Number of biodiversity monitoring programs contributing information to a national or provincial web portal* - Number of taxonomically classified specimens in Canadian collections that are available for scientific use, and the proportion of those specimens with digital records - The establishment of a centralized comprehensive inventory - The number and/or nature of new elements and/or methods that are incorporated into Canada's protected spaces tracking and reporting system
20. By 2020, at the latest, the mobilization of financial resources for effectively implementing the Strategic Plan 2011-2020 from all sources and in accordance with the consolidated and agreed process in the Strategy for Resource Mobilization should increase substantially from the current levels. This target will be subject to changes		- In 2012, Canada submitted its baseline assessment of Canadian resources mobilized in support of biodiversity. See below for details.

Aichi Targets	DRAFT national targets	Indicators related to proposed national targets
contingent to resources needs assessments to be developed and reported by Parties.		

Canada has actively participated in international negotiations regarding **access and benefit sharing** (ABS) arising from the utilization of genetic resources. These negotiations resulted in the adoption of the Nagoya Protocol by the Conference of the Parties to the Convention on Biological Diversity in 2010. Currently, Canada is engaging provinces, territories, Aboriginal groups and other key stakeholders to provide them with an opportunity to consider possible elements of a domestic ABS policy and contribute to an increased understanding of the potential impacts of the Nagoya Protocol in Canadian jurisdictions.

In response to a CBD COP-10 decision, in 2012 Canada submitted to the CBD Secretariat a report on **resources mobilized by Canada** for biodiversity: 2006 to 2010. The document provided an estimate of Canadian public and private contributions to biodiversity resource mobilization, using a diverse range of publicly-available and published source data and information. The report estimated that annual Canadian public and private financial flows related to the objectives of the CBD range between $8.45 billion in fiscal year (FY) 2006-2007 to $9.48 billion in FY 2010-2011, with a five-year average of $9.17 billion. Additionally, the report estimated that Canada had provided an estimated average of $83.17 million annually from FY 2006-2007 to 2010-2011 in Official Development Assistance to support developing countries' efforts under the CBD.

One of the eight **Millennium Development Goals** adopted by the United Nations in 2000 is to ensure environmental sustainability (MDG 7). Progress on MDG 7 is measured by 4 targets and 10 indicators that address the components of the natural environment that support human well-being and eradicate poverty. Canada continues to work towards meeting MDG 7 at home. Where there are gaps and persistent problems, Canada has plans to act and improve on the current status.

In regards specifically to the targets related to biodiversity, the MDG 7 includes the target "Reduce biodiversity loss, achieving, by 2010, a significant reduction in the rate of loss", as well as the indicators "Proportion of land area covered by forest and proportion of species threatened with extinction", "Proportion of fish stocks within safe biological limits", and "Proportion of terrestrial and marine areas protected". Information on each of these indicators noted or some variation of them are available in the previous sections of this report.

Canada assesses all of its development assistance activities for potential risks and opportunities with respect to environmental sustainability and works with its partner countries to ensure that they have the capacity to do the same. This support includes enhancing partners' abilities to manage natural resources and address issues such as desertification and climate change. Foreign Affairs, Trade and Development Canada (DFATD) protects and enhances biodiversity through its food security programming by supporting sustainable seed banks and agricultural research.

Appendix I - Information Concerning the Reporting Party and Preparation of the Fifth National Report

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Process of preparation of the national report

As National focal point for the CBD, Environment Canada led the preparation of Canada's 5th National Report, collaborating closely with the Federal-Provincial-Territorial Biodiversity Working Group.

Environment Canada drew from input received through the public engagement process that was used to develop the proposed national goals and targets, including a multi-stakeholder workshop in March 2013. Additional examples of initiatives being undertaken were gathered by direct outreach to intergovernmental networks, Aboriginal governments, non-government experts and stakeholders. National Aboriginal Organizations, several industry organizations and environmental non-government organizations provided comments and feedback on a draft of the report in February 2014.

Appendix II – References and Further Sources of information

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Appendix III - National implementation of the Global Strategy for Plant Conservation

Canada submitted a supplement to its Fourth National Report which included updated information on the 16 targets of the Global Strategy for Plant Conservation (GSPC). Here we report progress toward a subset of the targets of the GSPC in Canada since the Fourth National Report. It should be noted that the GSPC has been updated since the Fourth National Report, and that the individual targets have been re-written as a result. Staff from Royal Botanical Gardens (Hamilton and Burlington, Ontario) participated in consultations with the Global Partnership for Plant Conservation during this process.

Objective I: Plant diversity is well understood, documented and recognized

Target 1: An online … flora of all known plants.

Canadian institutions continue to participate in the development of bioinformatics data sources that support Target 1. Under Canadensys, Canada's local node for GBIF, 12 Canadian herbaria now have their catalogues available on-line. Living plant collection date for five botanical gardens is now also within the Canadensys system.

The recent Council of Canadian Academies report "Canadian Taxonomy: Exploring Biodiversity, Creating Opportunity" described in detail the role that provincial Museums and other collection facilities play in the documentation and conservation of natural history specimens. Many botanical gardens, universities, and museums across Canada continue to engage in research and documentation of both plant taxonomic diversity and ecological distribution. For example, the botany department of the Manitoba Museum is undertaking research on a range of rare plant species, and including pollinator faunal data. This contributes to both Targets 1 and 2.

The Canadian Institute of Ecology and Evolution (CIEE) (Department of Biological Sciences, University of Calgary) has established a working group entitled “Canada’s phylogenetic diversity in a changing world,” which has several plant-oriented working goals, including to compile the available information of flowering plants and butterflies in BC ecoregions, characterize the phylogenetic diversity of both trophic systems and examine latitudinal and elevational patterns, Identifying gaps and emerging research questions, use predictive modeling techniques to examine range shifts due to projected climate change in these species, and Identify mismatches between butterflies and their host plants and calculate the phylogenetic diversity at risk in butterflies due to migrational mismatches with their host plants.

The Biodiversity Institute of Ontario (BIO) at University of Guelph is implementing the DNA Barcoding protocols developed at the university specifically in reference to the flora of Ontario.

Objective II: Plant diversity is urgently and effectively conserved

Target 5: At least 75 % of the most important areas for plant diversity of each ecological region protected with effective management in place for conserving plants and their genetic diversity.

An implementation proposal in response to the GSPC has been prepared by Royal Botanical Gardens, which calls for collaboration across agencies to consider whether an Important Plant Area network should be established in Canada.

Objective IV: Education and awareness about plant diversity, its role in sustainable livelihoods and importance to all life on earth is promoted

Target 14: The importance of plant diversity and the need for its conservation incorporated into communication, education and public awareness programmes.

Botanical gardens and arboreta across Canada continue to incorporate plant diversity and conservation issues into their education programming and exhibits. For example, Montreal Botanical Gardens reports that it is supporting the SEDNA mission by holding a Base Camp in the Biodiversity Centre on site. Until 2015, the Base Camp / 1000 Days for the Planet mission will be in touch with Jean Lemire and the Sedna IV crew as they sail around the world, to report on the status of biodiversity, educate us about the work of passionate researchers who want to save biodiversity and encourage us to take part in the action ourselves by becoming ambassadors of biodiversity. For the exhibition space, signed by the creative collective Vous êtes ici, artists and artisans were asked to incorporate their unique and personal perspective into its works and furniture.

Objective V: The capacities and public engagement necessary to implement the Strategy have been developed

Target 15: The number of trained people working with appropriate facilities sufficient according to national needs, to achieve the targets of this Strategy.

The national implementation proposal for the GSPC referenced above included an assessment of national plant conservation capacity and gaps as one of its recommendations. This recommendation is being considered for further development by the Canadian Botanical Conservation Network.

Target 16: Institutions, networks and partnerships for plant conservation established or strengthened at national, regional and international levels to achieve the targets of this Strategy.

The national implementation proposal for the GSPC identified the development of a "National Partnership for Plant Conservation" as a project and deliverable-focused re-development of the existing Canadian Botanical Conservation Network. In December 2013 the members of the network agreed to the proposal in principle, which is now being implemented.