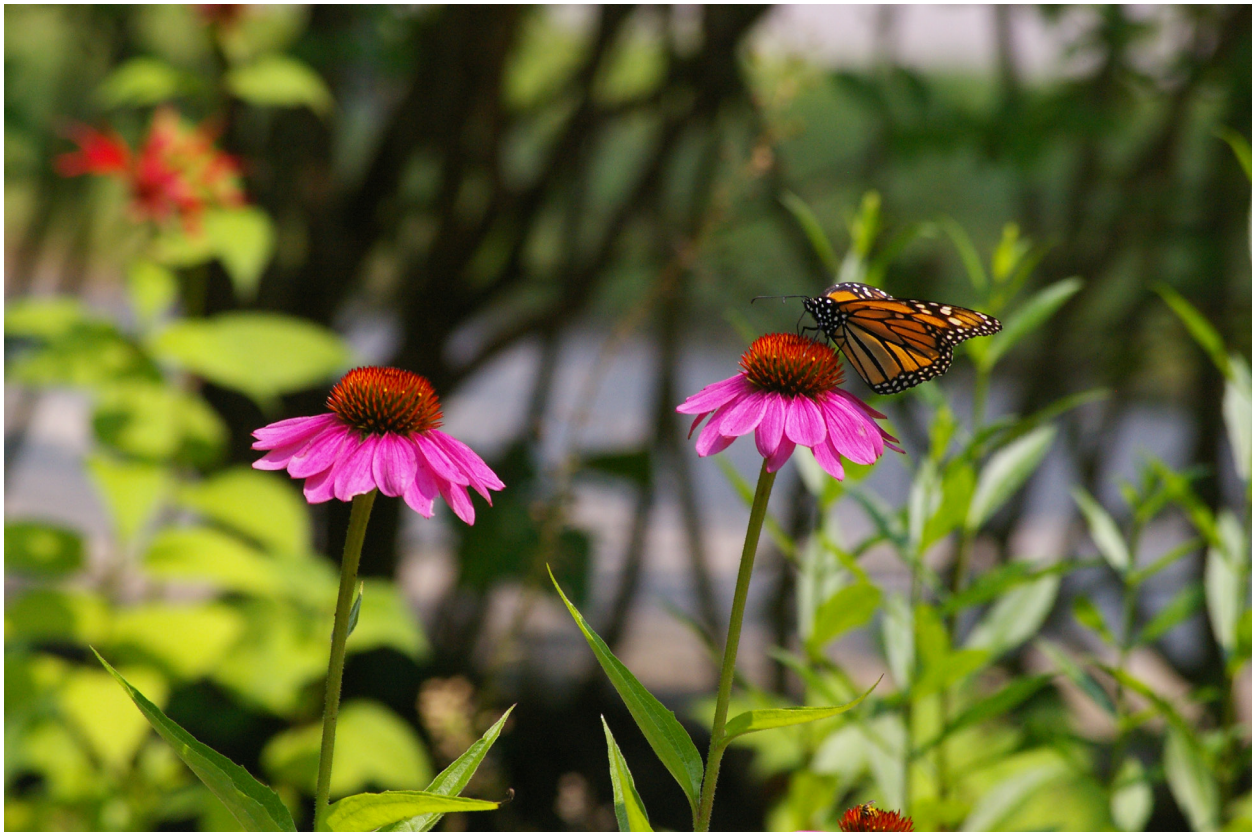




CANADA'S CLIMATE CHANGE
ADAPTATION PLATFORM

Equipping Canadians for a Changing Climate

Biodiversity Adaptation Working Group



Adaptation State of Play Report
December 2018

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Introduction and Report Approach

Biodiversity is defined by the Convention on Biological Diversity as “*the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems.*”¹

Adaptation to climate change, as defined by the IPCC (2007), is an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities.²

A changing climate presents a wide range of threats globally which is why the United Nations has identified climate change as one of the major challenges of the twenty-first century.³ In Canada, we are already experiencing shifting weather patterns that threaten food production, thawing permafrost that impacts infrastructure, and rising water levels that increase the risk of flooding. Our economy, infrastructure, health and social well-being are at risk, as are our ecosystems and all the species that depend on them. Without drastic action today, adapting to these impacts in the future will be more difficult and costly. Recognizing that climate change will also bring opportunities is key to adapting for the future.

To address climate change adaptation in Canada, Canada’s Climate Change Adaptation Platform was formed in 2012.⁴ The Adaptation Platform has assembled Working Groups that include representatives from federal, provincial and territorial governments, industry, academia, Indigenous communities and nongovernmental organizations, to identify risks and opportunities associated with a changing climate. Each Working Group brings expertise and/or a common interest in specific issues or sectors – members contribute their expertise towards establishing and directing priorities. The objective of the Biodiversity Adaptation Working Group is to provide a forum to advance biodiversity conservation and adaptation to climate change in Canada.

The goal of the *Biodiversity Adaptation Working Group State of Play* report is to:

1. Provide the Working Group with a common understanding of climate change-related issues and concerns affecting biodiversity in Canada
2. Provide an overview of the current state of biodiversity conservation activities, including gaps and opportunities

The key findings from the report will provide a common baseline for moving forward, and will provide a basis for the Working Group’s 2018-22 Work Plan.

Although the report focuses primarily on adaptation, the Working Group recognizes the fundamental role of climate change mitigation to reduce greenhouse gas emissions in combination with adaptation to enhance resilience. Maximizing climate change adaptation and mitigation through biodiversity-based actions is critical to delivering nature-based climate solutions.

The methodology for producing the report included research and targeted interviews with subject matter experts from the Working Group as well as sector experts across Canada. To inform the content of the report, interviewees were asked about:

- climate change threats to biodiversity
- actions that are being taken to address threats (projects, initiatives or innovations)
- opportunities for climate change adaptation to benefit biodiversity
- threats to biodiversity as a result of climate change adaptation
- legislation that impacts biodiversity in a changing climate
- lessons learned in climate change adaptation
- Biodiversity Adaptation Working Group needs going forward

The interview responses were then synthesized to form the basis of the report. Although not comprehensive, the report is a launching point for the Working Group to collaborate across sectors to ensure that biodiversity considerations are at the forefront of Canada's climate change adaptation and mitigation planning and implementation activities.

Biodiversity in Canada

Conservation to Date

Canada was the first developed country to ratify the 1992 United Nations Convention on Biological Diversity⁵ and the Canadian Biodiversity Strategy⁶ was endorsed by federal, provincial and territorial Ministers in 1996. All jurisdictions jointly developed Canada's Biodiversity Outcomes Framework⁷, which complements the Strategy and was adopted in 2006. In addition, 2020 Biodiversity Goals and Targets for Canada⁸ in the Strategic Plan for Biodiversity 2011-2020⁹ continue to guide further actions. Both Canada's 4th National Report to the Convention on Biological Diversity (2009)¹⁰ and Canada's 5th National Report to the Convention on Biological Diversity (2014)¹¹ provide fairly extensive (though not exhaustive) and detailed overviews of initiatives in Canada that support biodiversity conservation and sustainable use. These initiatives include:

- Parks and protected areas
- Species at risk recovery planning
- National, provincial, territorial, regional and municipal biodiversity strategies
- Ecosystem-based land-use planning initiatives
- Habitat stewardship programs
- Environmental non-governmental organizations protection and stewardship activities
- Environmental Farm Plans for sustainable farming practices
- Forest certification for sustainable forest management
- Resource extraction sectors incorporating biodiversity concerns into business plans
- Citizen Science stewardship and monitoring activities

Canada will submit its next national report to the Convention on Biological Diversity by December 2018 – the report will include an assessment of progress on each of the 19 biodiversity conservation targets.

Canada has federal legislation and many regulations in place for biodiversity conservation. Significant investments have been made to protect natural areas through Canada's Natural Areas Conservation Program¹², as well as to conserve and restore wetlands, through the North American Waterfowl Management Plan¹³. The provinces of Ontario and Quebec have developed biodiversity strategies and most provinces and territories have strengthened or updated legislation and policies for protecting wildlife and recovering species at risk. The federal Habitat Stewardship Program¹⁴ and Ontario's Species at Risk Stewardship Fund¹⁵ are examples of programs intended to assist the recovery of species at risk. However, most programs do not make reference to biodiversity in a changing climate.

Many municipalities across Canada have incorporated biodiversity protection and conservation into their plans, including the densely populated cities of Vancouver, Toronto and Montreal. At the individual level, an increasing number of Canada's farmers are adopting Environmental Farm Plans to implement practices, such as planting shelterbelts and managing riparian buffers that increase diversity on their farms. An increasing number of Canadians are participating in Citizen Science biodiversity monitoring initiatives such as the Breeding Bird Atlas¹⁶ and Bumble Bee Watch¹⁷.

A greater emphasis is being placed on incorporating Indigenous and Traditional Knowledge in biodiversity conservation and land-use management plans across all levels of government, non-governmental organizations and the private sector in Canada. The collective knowledge, leadership and land stewardship of Indigenous communities provide important insights that complement scientific research. Community-based adaptation actions that are led by Indigenous communities will contribute to local, national and global climate change adaptation solutions. Building resilience in the face of climate change is fundamentally about food, water and energy security and independence, where Indigenous communities are self-sufficient and are not dependent on importing what is needed for their survival and expression.¹⁸

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Marine and coastal biodiversity conservation and freshwater initiatives include the establishment of marine protected areas¹⁹ and Great Lakes Watershed biodiversity initiatives, an example of the latter being the Lake Simcoe Protection Plan²⁰.

In addition, there is a move towards quantifying in economic terms the benefits and costs of the protection or loss of the ecosystem services that biodiversity provides – for example, the importance of natural infrastructure, such as wetlands, to help reduce the impacts of climate change.

Natural Infrastructure – Why Wetlands Matter

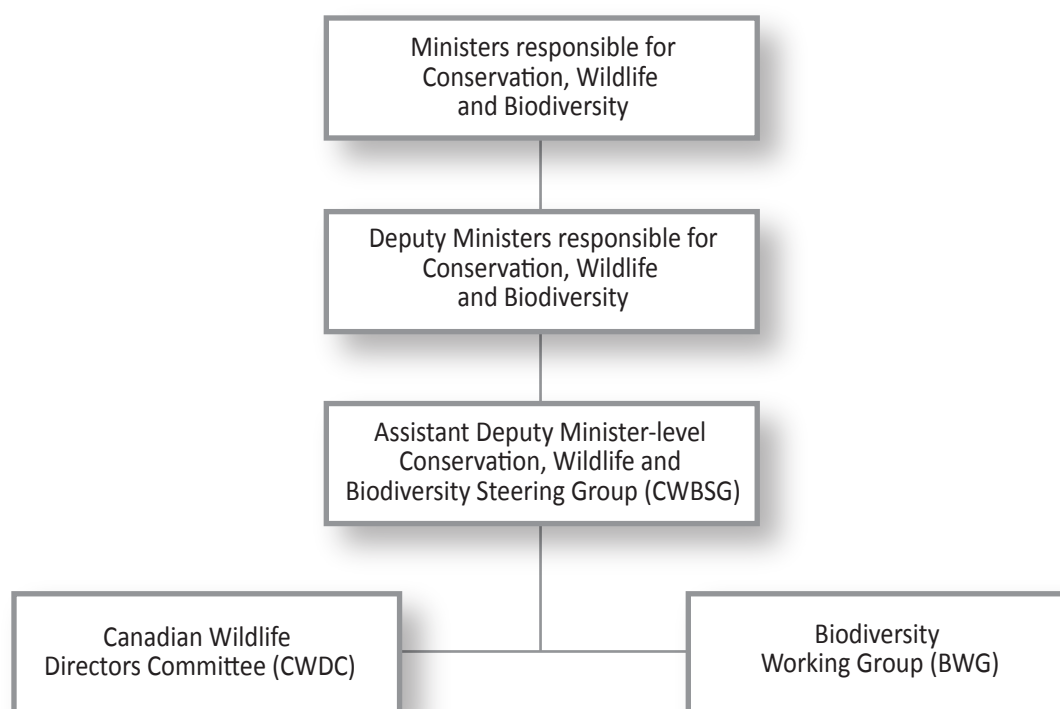
Wetlands protect us from water pollution by cleaning our water. They protect us from flooding by reducing water sent downstream. They protect us from drought by holding water when conditions are dry. They protect us from climate change by storing carbon.²¹

Governance

Canada's Federal-Provincial-Territorial (FPT) Assistant Deputy Ministers' (ADM) Biodiversity Steering Group (CWBSG) delivers Ministerial priorities and governs Director and working-level FPT committees (Canadian Wildlife Directors Committee and the Biodiversity Working Group*) to advance national conservation, wildlife and biodiversity issues. The CWBSG was originally formed in response to a 2006 request from FPT Deputy Ministers for more ADM-level oversight of shared national work on biodiversity. The purpose of the CWBSG is to engage in strategic, high-level discussions on cross-cutting issues in order to provide advice to FPT Ministers responsible for conservation, wildlife and biodiversity. The CWBSG serves as the primary forum for advancing work on the priority areas identified by FPT ministers, as well as on other issues identified in the 2020 Biodiversity Goals and Targets for Canada.

* *Note: The Biodiversity Working Group is limited to federal, provincial, territorial governments and operates independent of the Biodiversity Adaptation Working Group. The latter focuses on biodiversity and climate change adaptation, and includes members from relevant organizations across Canada.*

Federal-Provincial-Territorial Engagement Mechanisms on Conservation, Wildlife and Biodiversity



Status and Trends

Numerous assessments have been conducted in Canada over the past decade to examine the vulnerability of ecosystems and biodiversity to climate change. These assessments have included government and non-governmental studies of parks and protected areas, water resources and the forest sector. Other assessments have examined how changes in ecosystem services affect socio-economic well-being and how to assess the cultural implications of changes to ecosystem services.²² The status and trends of ecosystem services have not been assessed at the national scale. Such an assessment could build on extensive existing physical and social scientific data but would require more data for many regions of the country. Importantly, it would also require a collaborative strategy to integrate the data.

The World Wildlife Fund report, *Living Planet Report Canada 2017 Index* shows that half of our monitored vertebrate species (451 out of 903) have declined between 1970 and 2014.

Recent estimates indicate that there are about 80,000 known species in Canada, excluding viruses and bacteria. These species are divided among five different kingdoms:

- protozoa kingdom (about 1% of the known species in Canada)
- chromist kingdom (about 4% of the known species in Canada)
- fungi kingdom (about 16% of the known species in Canada)
- plant kingdom (about 11% of the known species in Canada)
- animal kingdom (about 68% of the known species in Canada).²³

However, many of these species are in decline. The World Wildlife Fund report, *Living Planet Report Canada 2017 Index* shows that half of our monitored vertebrate species (451 of 903) are in decline. And of those, the index shows an average decline of 83 per cent.²⁴

Declines in biodiversity are largely the result of human actions. The principal pressures that directly exacerbate biodiversity loss include habitat loss, climate change, pollution, unsustainable harvest, invasive species and the cumulative and cascading effects of all of these factors combined.²⁵

Current Status of Wildlife Species by Group in Canada according to the World Wildlife Fund's Living Planet Index²⁶:

Mammals – monitored populations have shrank by 43 per cent on average, between 1970 and 2014 (based on 549 monitored populations of 106 species).

Fish – populations have dropped 20 per cent on average between 1970 and 2014 (based on data from 2,527 monitored populations of 365 species).

Birds – overall populations increased by 7 per cent on average between 1970 and 2014; however, some bird groups – grasslands birds, shorebirds, ducks and geese, hawks and owls – show widely differing trends.

Amphibians and Reptiles – populations declined by 34 per cent on average between 1970 and 2014 (based on data from 139 monitored populations of 46 species).

Current Status by Biomes in Canada according to Canada's 5th National Report to the Convention on Biodiversity²⁷:

Forests – nationally, the extent of forests has changed little since 1990; however forest structure (including species composition, age classes and size of intact forest patches) was changed substantially over the past century due to human influence, especially since the advent of mechanized harvesting, which brought with it an expansion of road networks.

Grasslands – prior to the 1990s, 97% of tallgrass/savannah had been lost in southern Ontario, 70% in the Prairies and 19% of bunchgrass/sagebrush had disappeared in BC.

Wetlands – high loss of wetlands has occurred in southern Canada and in coastal areas throughout Canada, and loss and degradation continue.

Lakes and Rivers – seasonal changes in magnitude of stream flows, increases in river and lake temperatures, decreases in lake levels and habitat loss and fragmentation continue to occur.

Coastal – estuaries, salt marshes and mud flats are believed to be healthy in less developed coastal areas, whereas the extent and quality of coastal ecosystems are declining in developed areas as a result of habitat modification, erosion and rising sea levels.

Marine – over the past 50 years, marine biodiversity, driven by a combination of physical factors and human activities, such as oceanographic and climate variability and overexploitation, has declined. While certain marine mammals have recovered from past overharvesting, many commercial fisheries have not.

Ice across Biomes and Permafrost – declining extent and thickness of sea ice, warming and thawing of permafrost, accelerating loss of glacier mass and shortening of lake-ice seasons have been occurring across Canada's biomes. Impacts, apparent now in some areas and likely to spread, include negative effects on species and food webs.

The international governing body on biodiversity, the Convention on Biological Diversity, has set targets for improving biodiversity around the world in an attempt to halt or reverse declining biodiversity trends. Canada is contributing to the achievement of the global targets through its 2020 Biodiversity Goals and Targets for Canada, but efforts need to be expedited to account for the impacts of climate change. Improving baseline knowledge and a coordinated ecosystem-based conservation approach will be critical to achieving Canada's biodiversity goals.

Legislation, Regulations and Policy

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.²⁸

Canada has several national legislative frameworks for advancing biodiversity conservation. These include:

- *Species at Risk Act*²⁹ – one of the main conservation tools to protect species at risk, maintain healthy ecosystems and preserve Canada’s natural heritage
- *Migratory Birds Convention Act*³⁰ – helps to protect and conserve migratory birds, as populations and individual birds, and their nests
- *Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act*³¹ – helps to fulfill Canada’s commitments under the *Convention on International Trade in Endangered Species*³² by controlling illegal trade in species and safeguarding Canadian ecosystems from the introduction of species considered to be harmful
- *Canada Wildlife Act*³³ – allows for the conservation and study of wildlife and the creation of National Wildlife Areas

In addition to legislative frameworks, Canada has multiple regulations that provide legally enforceable mechanisms to ensure that scientific research or commercial activities are undertaken in an environmentally sustainable manner. Some of these regulations require reporting, monitoring, research and information sharing.

Work continues across all levels of government 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 aim to apply an ecosystem approach to species recovery through joint stewardship initiatives.

Habitat conservation is another key area and opportunity for including biodiversity conservation. In the case of wetlands, New Brunswick, Prince Edward Island, Nova Scotia and Quebec are the only provinces with comprehensive wetland protection legislation. However, Ontario’s Wetland Conservation Strategy³⁴ references a no net loss of all wetlands by 2025 – this will benefit biodiversity and create value through natural infrastructure. The Yukon Territory is developing a wetland policy, the Province of Manitoba has committed to developing a Boreal Wetlands Conservation Policy that would include a No-Net Loss approach, and the *North American Wetlands Conservation Act*³⁵ facilitates the protection and restoration of natural infrastructure for climate resilience and ecosystem services. In addition, Quebec has several key pieces of recent legislation that integrates climate change adaptation considerations for biodiversity – Bill 132³⁶ *respects the conservation of wetlands and bodies of water*, and the update to Quebec’s *Environmental Quality Act*³⁷.

With regard to forestry, there is significant work led by the Canadian Council of Forest Ministers³⁸ on Climate Change Adaptation in Forestry Management. Jurisdictions have varying policy and programs in place to adapt to climate change impacts. For example, the Province of British Columbia has undertaken a long-term assisted migration adaptation trial to address the vulnerability of tree species and ecosystems to shifting climatic envelopes. Industry and governments are also conducting vulnerability assessments to identify climate change risks, and the appropriate adaptation strategies needed to conserve biodiversity.

The Northwest Territories is modernizing two lands acts and is currently engaged in discussions to merge their Protected Areas legislation, *Waters Act*, *Forest Management and Protection Act* and *Environmental Rights and Protection Acts*. It is not clear whether the consolidated legislation will identify climate change adaptation for biodiversity but at the very least there is an opportunity to have it included.

Policies to support biodiversity and conservation

The Convention on Biological Diversity is a global and national instrument for promoting and guiding efforts to conserve biodiversity. As part of Canada's commitment under the Convention, the Canadian Biodiversity Strategy was developed to determine the measures which were required to meet the obligations of the Convention and to enhance coordination of national efforts aimed at the conservation of biodiversity and the sustainable use of biological resources.

The Strategy clearly recognizes that governments cannot act alone to ensure the conservation of biodiversity and the sustainable use of biological resources and therefore, invites and encourages all Canadians to take action in support of the Strategy. Canada's biodiversity goals and targets for 2020 complement the Strategy and the Biodiversity Outcomes Framework, and focus on Canada's biodiversity priorities in the coming years. They guide further action on the conservation and sustainable use of living resources in Canada and provide the basis for measuring and reporting on progress.

Several provinces and territories have introduced biodiversity strategies and policies and have developed strategic plans for their jurisdictions; and at the federal level, the Federal Sustainable Development Strategy for Canada 2016-2019³⁹ details actions for protecting nature.

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

- The Government of Canada is working with partner organizations and specialists to develop tools and approaches to better understand and support climate change adaptation in parks and protected areas in Canada. A series of regional reports were produced by Parks Canada, summarizing historical climate trends and future climate projections at Parks Canada heritage places, as well as climate change impacts from recent and forecasted changes;
- The Canadian Parks Council Climate Change Working Group, co-chaired by Parks Canada and Government of Northwest Territories, is providing a forum for cross-jurisdictional sharing of tools, information and best practices for mainstreaming climate change decision-making into park and protected area management planning and operations, and promoting the concept of parks and protected areas as natural solutions through new approaches, tools, and communication opportunities. The Working Group has also developed a Climate Change Adaptation Framework for Parks and Protected Areas, which is now being applied at several Parks Canada heritage places;
- Canadian Forest Service's Forest Change program provides information about the impacts of climate change on Canada's forests and on how to adapt to changing climate conditions. The initiative reports on indicators that reflect past trends in, and future projections of, changes across Canada. It also provides adaptation tools and resources for forest managers.

Policies that support biodiversity and conservation through climate change action

Through the adoption of the Paris Agreement in December 2015, the international community agreed that tackling climate change is an urgent priority. To implement commitments Canada made under the Paris Agreement, First Ministers released the Vancouver Declaration on Clean Growth and Climate Change⁴⁰ on March 3, 2016, which led to the development of a Pan-Canadian Framework on Clean Growth and Climate Change⁴¹.

The Pan-Canadian Framework on Clean Growth and Climate Change (PCF) is the federal, provincial, and territorial plan to reduce emissions, grow the economy and build climate resilience. Adaptation and Resilience is a key pillar of the PCF, and the Adaptation and Climate Resilience Working Group Report⁴² which informed the PCF underscored the significant risks that climate change impacts pose to the natural environment, and included an area for action on promoting healthy ecosystems and healthy people by advancing ecosystem resilience as an adaptation solution.

Opportunities for improving coherence

Recognizing that there are multiple acts, regulations, frameworks and strategies to protect and enhance biodiversity and ecosystem health in Canada, opportunities exist for improving or contributing to existing or new legislative, regulatory and policy frameworks.

For example, the Government of Canada has tabled legislation that proposes changes to the current *Canadian Environmental Assessment Act*⁴³ which may present opportunities for integrating climate change and biodiversity considerations into the environmental impact assessment process.

Despite the fact that existing legislation such as the *Species at Risk Act* does not explicitly mention climate change, this has not prevented scientists and others from making linkages when assessing the status of species and taking climate change into consideration. Strengthened coordination between the biodiversity conservation community and the climate change adaptation community could help to advance this integration.

Further efforts can be made to implicitly consider the impacts of climate change on biodiversity in legislative and policy frameworks in Canada. There is an urgent need for strengthened coordination and the translation of scientific knowledge and Indigenous knowledge to support decision making.

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The Importance of Biodiversity

Biodiversity is fundamental to *all* life on earth, including human life. From the organisms in our soil to the birds and insects that pollinate our plants and agricultural crops, it is the interactions of life forms within the environment that make Earth unique among all of the planets. It is not only important to life on the planet, it is life on the planet. Without biodiversity, there is no life.

As the second largest country in the world – 10 million square kilometres along with thousands of kilometres of coastline – and with its range of ecosystems and climates, from Arctic tundra to the rain forest-like tree top canopies of BC's coastal forests, Canada is rich in biodiversity. Unfortunately, Canadians often fail to make the connection between biodiversity and ecosystem services, and take for granted the fundamental connection to clean air and water, food supply and security, and a sustainable economy.

The Millennium Ecosystem Assessment defines “ecosystem services” as “the benefits people derive from ecosystems”. Besides provisioning services or goods like food, wood and other raw materials, plants, animals, fungi and micro-organisms provide essential regulating services such as pollination of crops, prevention of soil erosion and water purification, and a vast array of cultural services, like recreation and a sense of place.⁴⁴

The Economics of Ecosystems and Biodiversity⁴⁵ identify these ecosystem services as:

- a) Provisioning services: food, shelter, medicines, fresh water, clean air, biochemicals and energy
- b) Regulating services: flood control, erosion prevention, carbon sequestration, pest and disease control, crop pollination and climate regulation
- c) Supporting services: nutrient cycling, soil formation, seed dispersal, pollination and primary production
- d) Cultural services: spiritual, cultural, inspirational, recreational, educational and scientific discovery

As indicated earlier in the report, the status and trends of ecosystem services have not been assessed at the national scale in Canada. The undertaking of such an assessment could help position biodiversity conservation as a high priority in all climate change adaptation strategies.

Climate Change and Biodiversity

How will climate change affect biodiversity?

The impacts of climate change on society are occurring earlier and more frequently than predicted.⁴⁶

Ecosystems are already showing negative impacts under current levels of climate change... which is modest compared to future projected changes.... In addition to warming temperatures, more frequent extreme weather events and changing patterns of rainfall and drought can be expected to have significant impacts on biodiversity.⁴⁷

In Canada, the rate of warming has increased at nearly double the global average (approximately 0.85°C, from 1880 to 2012).⁴⁸ These temperature changes have had both direct and indirect impacts on biodiversity in terrestrial, freshwater and marine systems. But climate change means much more than just warmer weather. Shifting patterns of rainfall and snowfall, shrinking glaciers, declining snow cover and sea ice extent, rising sea level and changes in extreme weather events are all consequences of a changing climate. These changes present unprecedented threats to biodiversity.

One of the challenges is whether species can adapt fast enough to changing ecosystems. Even small changes in the abundance of species can have cascading effects on ecosystem composition and structure and the services those ecosystems provide. Some species may benefit from climate change but it is expected that many species have not had or will not have time to adapt to changing ecosystems, and will be negatively impacted as a result.

The key threats to biodiversity include (but are not limited to) habitat loss and fragmentation, invasive species, pollution, increasing human population and overharvesting. Climate change can now be added to those threats and can also act as an accelerator for some of those threats. Some key climate change threats include:

1. Climate is a major factor in the distribution of species across the globe; changes in temperature and precipitation will have cascading effects on food webs. The geographic location of climatic envelopes will shift significantly, possibly even to the extent that species can no longer survive in their current locations. Problems will arise when there is asynchrony between the timing of closely-linked phenological events, such as the emergence of insects and the arrival of migratory species dependent upon those food sources for their breeding success.
2. Altered precipitation regimes can result in too little water for plants and animals, leading to direct or indirect impacts on species such as dehydration, increased disturbance from disease, pests or wildfire or even death. Conversely, too much water from extreme storm events may cause catastrophic floods, damaging both ecosystems and the human communities living downstream. These events are increasing in frequency, intensity, scale and geographic scope, well beyond the historic norm.
3. The increased frequency, intensity and extent of wildfires due to warming and increased drought conditions may push conditions well beyond the tolerance limits of fire-adapted species and ecosystems, and introduce increased risk to fire-sensitive species and ecosystems.
4. Invasive Alien Species are defined as harmful organisms whose introduction or spread threatens Canada's environment, economy, or society.⁴⁹ Our changing climate is enabling the spread of invasive alien species new regions where they are not native – this poses significant growing threats in Canada as the resultant ecological impacts are often irreversible. Once established they are extremely difficult and costly to control and eradicate.

5. Reductions and loss of sea ice, permafrost and freshwater ice cover will have increased effects on both aquatic and terrestrial life. These impacts are of particular concern for species that are dependent on ice cover for certain periods of the year, or to meet critical resource requirements.
6. Climate impacts may also accelerate habitat loss, degradation or fragmentation. Enhancing habitat connectivity is one of the greatest conservation needs for human-dominated landscapes. Just like humans rely on transportation corridors, wildlife also needs to travel across the landscape.

The climate has always been changing – it is not static and neither are earth's ecosystems. However, human-caused climate change is expediting the process with dramatic implications for all species, including humans. Along with the challenges, there will be opportunities to work together toward sustainable solutions – but action needs to happen now.

How will human climate change adaptation efforts affect biodiversity?

Climate change seriously threatens biodiversity, yet having healthy ecosystems is a key strategy for enabling ecosystems and species, including humans, to be more resilient and adapt. As a result, there are some climate adaptation initiatives that target improved ecosystem health as a primary or secondary objective; however, there are many adaptation initiatives and actions that do not consider ecosystem health as part of their decision making process, and may therefore be harmful to biodiversity objectives.

Potential Positive Impacts

Natural or Green Infrastructure (versus built or grey) – Investments in natural infrastructure may be more cost effective than built infrastructure while also benefiting biodiversity by providing habitat. Currently, the majority of coastal and municipal climate change adaptation and mitigation efforts focus on built infrastructure which does not benefit biodiversity. For example, the construction of built infrastructure such as seawalls to address rising sea levels can negatively impact coastal species and ecology. The protection or restoration of natural shorelines which can adapt to changing sea levels may meet both biodiversity and adaptation objectives.

Invasive Alien Species Management Plans – Intervention or management plans that address invasive species due to climate change should benefit local biodiversity (i.e., reduced competition for food or habitat or degradation of habitat; e.g., dog-strangling vine is rapidly spreading and choking out native species which negatively impacts entire ecosystems.)

Potentially Negative or Unknown Impacts

Green Energy – The emphasis on green energy at all levels of government is a positive move towards meeting Canada's greenhouse gas emissions targets, which in turn will benefit biodiversity by reducing water and air pollution. However, it also may have negative impacts:

- Solar farms may take up productive agricultural lands and wildlife habitats
- Wind farms have been shown to cause bat and bird mortalities when built along bird migration corridors
- Use of agricultural farmlands for production of ethanol for gas can negatively affect wildlife habitat
- Hydrological dams flood large areas of natural habitat and can prevent or hinder aquatic species migration

Assisted Migration – The deliberate action of moving plant or wildlife species to a more suitable location to ensure better survival rates is a practice that is gaining attention and interest in the conservation community. Given the uncertainty of how species will adapt and migrate without intervention, as well as the uncertainty in how species assemblages and ecosystems will shift due to changing climate envelopes, it becomes difficult to ensure that we are moving the right species to the right locations. The uncertainty of how successfully species will survive and thrive in their new location is matched with the uncertainty of how the new location will respond to their arrival – what if we create the perfect conditions for ecosystem collapse by introducing the wrong species?

Canada's Assistant Deputy Ministers responsible for conservation, wildlife and biodiversity in Canada have recommended that Canada's climate change response be designed in such a way to be mutually beneficial in the context of climate change and biodiversity conservation.⁵⁰

How does biodiversity contribute to climate change adaptation?

The conservation and sustainable use of ecosystems and the biological resources that maintain them is expected to moderate some of the negative impacts of climate change. By conserving biodiversity and enhancing its resilience, we improve the adaptive capacity of our ecosystems to cope.

While the business case for biodiversity is solid, there is a lack of awareness and understanding of existing evidence and support, as well as a reluctance to integrate and incorporate biodiversity and ecosystem services into policy and decision making.

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In their *Biodiversity and Climate Change Submission* report, Canada's federal, provincial, and territorial Assistant Deputy Ministers responsible for conservation, wildlife and biodiversity have identified the following three overarching messages:

- Biodiversity and the services that it provides are essential for human health and well-being.
- Healthy, biologically diverse ecosystems can increase climate resilience by reducing the vulnerability of communities to climate change and increasing their capacity to recover from climate change impacts.
- Adaptation and mitigation approaches that support the sustainable management, conservation, and restoration of biodiversity provide long-term solutions to climate change and help to ensure that people continue to benefit from the ecosystem services that are supported by healthy and diverse terrestrial and aquatic ecosystems.⁵¹

What is the cost of losing biodiversity?

The importance of biodiversity and the natural world is indisputable – ecosystem services contribute to human health and a productive and resilient environment. In spite of the ecological, cultural and economic importance of these services, ecosystems and the biodiversity that underpins them are still being degraded and lost at an unprecedented scale. One major reason for this is that the contribution of ecosystems to human welfare is still underestimated and not fully recognized in most planning and decision making, in other words, the benefits of their services are not, or only partly, captured in conventional market economics.⁵² The challenge is measuring and conveying the economic value of biodiversity to instill its important role in the minds of all Canadians and all sectors – especially those sectors that impact the landscape. Increasingly, there is a stronger body of evidence that reinforces the social, cultural, economic and ecological benefits of biodiversity and the costs Canadians face when it is degraded or disappears.

For example, pollinators play a huge role in Canada's agricultural sector – many crops are sustained by pollinators. The estimated value of honey bees alone to crop pollination in Canada is over \$2 billion.⁵³ Despite the critical importance of pollinators to the economy and the environment, research around the world is showing disturbing declines in pollinator populations due to a number of interacting stressors including disease and pests, exposure to pesticides, reduced habitat and climate change.⁵⁴

Biodiversity supports many other industries as well – forestry, fishing, ranching, mining, tourism and more – and, it is the foundation for healthy communities on many levels – recreational opportunities, flood reduction, cleaner water, to name just a few. In Alberta, many ranchers know that conserving biodiversity through various best management practices means better grazing lands for their cattle translates into a healthier and more robust commodity – i.e., biodiversity is good for business.

In the long term, it is much more economical and effective to conserve and protect healthy intact habitats, such as wetlands, rather than implementing ambitious restoration or re-creation projects in attempts to return the habitat to its original state – which in a changing climate may become harder to qualify and quantify.

For example, soil erosion caused by high winds and water run-off in the St. Lawrence River, Great Lakes and Fraser River Basins has cost the agricultural sector hundreds of millions of dollars in rehabilitation programs. Preventative planning and actions that keep ecosystems intact is the best option avoiding the high costs of rebuilding them.

Biodiversity conservation should be positioned as part of the solution – the “natural solution.”

This evidence reinforces the great role that biodiversity plays in ensuring a sustainable future. Biodiversity conservation should be positioned as part of the solution – the “natural solution.” Because climate change is already having an impact on biodiversity and it is projected to become a progressively more significant threat in the coming decades, the business case for natural solutions needs to be developed. Biodiversity and its associated ecosystem services will not only help climate change adaptation, they are essential to climate change adaptation.

Focus on Protected and Conserved Areas

Protected and conserved areas: a natural solution to climate change⁵⁵

Protecting and restoring healthy, resilient ecosystems is a “natural solution” for climate change.

Protecting biodiversity means conserving species

Protected areas are safe havens for species. They provide space for plants and animals to persist, adapt or migrate as their habitats change with the climate.

Protecting biodiversity means more clean water and air

Even if you live far from a protected area, you benefit from its ecosystem services. Banff National Park, for example, protects the Bow River Basin watershed – and clean drinking water for 1.2 million people. Such protection becomes even more important during extreme weather events, such as droughts and floods, brought about by climate change.

Biodiversity plays an important role in carbon dynamics

Through photosynthesis, vegetation in natural ecosystems can capture and store carbon dioxide, a major greenhouse gas. Trees in forests and phytoplankton in oceans do a great job at this, but they’re not the only carbon “sinks.” Wetland plants in salt marshes along Canada’s coast appear to store as much carbon per hectare as many forested lands. As with all ecosystems, protected areas can also be carbon “sources”, due to carbon release from natural processes such as decomposition or wildfire. Understanding this balance is important to greenhouse gas accounting and guiding management actions.

Protecting, restoring and sustainably managing biodiversity means more climate resilience

Conserving biodiversity keeps ecosystems in a resilient desired state. Diverse ecosystems are generally better able to cope with the impacts of climate change. A healthy forest with many tree species, for example, can recover better from insect pests.

Ecological networks are key

Plants and animals, like people, are stronger in a community. Protecting habitat and improving ecological connectivity will not only help species migrate and adapt to changing climatic conditions, but can reduce other stresses such as fragmentation and invasive species.

Conservation areas are living laboratories

Scientists in conservation areas monitor changes in ecosystems – including melting glaciers, shifting migration patterns and trends in wildfires, thus contributing to the big picture on climate change. Protected spaces provide the clearest signal of how climate change will impact biodiversity, without all the additional impacts from human activities.

Indigenous Knowledge gives us a more complete view of climate change

The knowledge of Indigenous peoples is a well that runs countless generations deep. Learning from Indigenous peoples strengthens our understanding of climate change and biodiversity and guides us in our choice of adaptation strategies.

Biodiversity inspires people

Our biodiversity inspires us to do something about climate change – and gives us the knowledge we need to make a difference.

Indigenous Protected and Conserved Areas

The Indigenous Circle of Experts (ICE) comprises Indigenous and non-Indigenous citizens of Canada who have worked together to make progress on Pathway to Canada Target 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.” The following information derives from their Report: We Rise Together: Achieving Pathway to Canada Target 1 through the creation of Indigenous Protected and Conserved Areas in the spirit and practice of reconciliation.⁵⁶

Indigenous Protected and Conserved Areas (IPCAs) is the term chosen by ICE to describe a variety of land protection initiatives in the Canadian context. Examples include Tribal Parks, Indigenous Cultural Landscapes, Indigenous Protected Areas and Indigenous conserved areas.

In the Canadian context, IPCAs represent:

- a modern application of traditional values, Indigenous laws and Indigenous knowledge systems,
- an exercise in cultural continuity on the land and waters,
- a foundation for local Indigenous economies, opportunities to reconnect to the land and heal both the land and Indigenous peoples,
- an acknowledgement of international law, such as Canada’s Treaties, UNDRIP, CBD and other relevant instruments and commitments,
- an opportunity for true reconciliation to take place between Indigenous and settler societies, and between broader Canadian society and the land and waters, including relationships in pre-existing parks and protected areas, and
- an innovative expression of Section 35 (Constitution Act 1982).

Indigenous governments are responsible for setting the conservation standards for IPCAs. As such, they must have full scope to design their IPCAs to meet their individual and diverse needs. While IPCAs embody a common goal for conserving the ecological and cultural values important to Indigenous peoples, the priorities and objectives of individual IPCAs may vary greatly. As such, they may take various shapes and forms based on the objectives for the area. But they share some commonalities.

IPCAs should:

- promote respect for Indigenous knowledge systems
- respect protocols and ceremony
- support the revitalization of Indigenous languages
- seed conservation economies if possible
- conserve cultural keystone species and protect food security
- adopt integrated, holistic approaches to governance and planning

When protected and conserved areas across Canada increase, more lands and waters are relieved of the stresses of unsustainable human and industrial development.

IPCAs are first and foremost designed to benefit Indigenous communities, but they have considerable potential to benefit all Canadians. When protected and conserved areas across Canada increase, more lands and waters are relieved of the stresses of unsustainable human and industrial development. The result is biodiversity conservation and healthier ecosystems, which in turn benefit all Canadians in the form of clean air and water, improved human health, and the mitigation of risks from climate change and disease. In this way, IPCAs can be expected to provide a variety of ecosystem services for generations to come.

Current State of Climate Change Adaptation and Biodiversity

The following section highlights the results of interviews with the Biodiversity Adaptation Working Group and other recommended subject matter experts from across Canada. As indicated in the introduction of the report, the interviews focussed on the following questions:

- climate change threats to biodiversity
- actions that are being taken to address threats (projects, initiatives or innovations)
- opportunities for climate change adaptation to benefit biodiversity
- threats to biodiversity as a result of climate change adaptation
- legislation that impacts biodiversity in a changing climate
- lessons learned in climate change adaptation
- Biodiversity Adaptation Working Group needs going forward

Key ideas and comments from the interviews were synthesized into four main themes, with a fifth theme emerging through Working Group discussions following the first draft:

1. Science – knowledge needs and research priorities
2. Partnerships – potential for collaboration
3. Communications – messaging needs and opportunities
4. Policy, Programs and Funding – legislation, landscape-level initiatives and resources
5. Indigenous Leadership – the integral role of Indigenous peoples

The content for each theme has been condensed under Strengths, Weakness and Opportunities in the form of thoughts, suggestions, and ideas from interviewed Experts. Each of the themes identifies important insights for planning future work on climate change adaptation and biodiversity in Canada. Please note that the opinions and ideas documented in this section do not signify agreement across the Biodiversity Working Group – they reflect the diverse perspectives of the subject matter experts themselves. In the case of the fifth theme on Indigenous Leadership, a targeted literature review was conducted on Indigenous Leadership and Biodiversity Adaptation, and the content is derived from these key sources.

Duplication: Note that some comments are relevant in more than one section and therefore appear more than once.

Results from Subject Matter Expert Interviews

THEME 1: Science

Overarching key message: There is a need for more cohesive and coordinated biodiversity research on climate change impacts and adaptation.

| Strengths | Weaknesses |
|--|--|
| <ul style="list-style-type: none">• There is a wealth of scientific information and data to build on – from professional scientific work to Citizen Science programs to Indigenous and Traditional Knowledge.• Indigenous peoples can provide leadership in their capacity as stewards of the land and in the sharing of Indigenous knowledge.• With the benefit of shared research, models and best management practices, and if we are proactive, we can adapt.• Industry is working with leaders and academics in the field of climate change – their knowledge could be helpful to many conservation partnerships.• By identifying and addressing factors that can effectively be managed, we may reduce the impacts of those factors that we cannot manage.• Ecosystem services are part of the climate change solution. | <ul style="list-style-type: none">• Baseline data needs to be improved and better shared. There are different government departments amassing data and mapping – efforts need to be more coordinated within government and collaborative with external partners.• There is a strong need for coordinated research to measure and understand biodiversity and biological outcomes, as well as data and modeling to make predictions into the future, to inform decision making and evaluate programs and projects.• More open source data (GIS) and facilitation of sharing of data amongst the conservation and development communities is needed.• There is a huge body of knowledge at all levels of government, but not a clear picture of how it interrelates.• The links between science and policy need to be improved.• Canada lacks a national biodiversity monitoring approach.• Biodiversity covers a broad spectrum across jurisdictional boundaries – instead of focussing on one issue, there should be collaborative conservation efforts with all groups and interests affecting the landscape.• There is little guidance available on integrating climate change adaptation strategies into contemporary conservation planning frameworks.• We need to better understand the impacts of climate change on biodiversity in urban, rural, non-protected but relatively untouched (e.g., boreal) and protected and conserved landscapes.• We need a system or common approach for valuing natural assets and ecosystem services; i.e., determine the economic, health, social and cultural benefits they provide and the consequences or costs associated if we remove some of those values from the landscape.• It is difficult to determine the value of ecosystems and the services that they provide. For example, the benefits to mental health or cultural heritage are difficult to quantify but invaluable to a community.• Restoring landscapes to their original state is going to be difficult, if not impossible, to achieve in a changing climate.• There is insufficient funding and resources to implement priority research projects that will achieve desired resiliency outcomes.• We need to think about ecosystem resilience and include an adaptation lens in our management approach, particularly the way we manage single species.• To preserve entire ecosystems we need to study and manage them more holistically.• Climate change adaptation is about how we do business today and making it work without taking all that we possibly can out of the land and exacerbating conditions. |

- Management actions that led to recovery in the past may not have the same desired effect in the future.
- It will be increasingly difficult to look backwards to know what will happen in the future.
- A major collaborative investment in science and data is required. We need comprehensive habitat and biodiversity inventories; i.e., there are some habitat inventories but there is not a wetland inventory, and some areas like the boreal are not fully mapped.
- The meaningful and respectful co-development scientific information and Indigenous knowledge to inform decision making and adaptation action should be strengthened.
- We need scientists to help us understand how we can ensure landscapes have ecological integrity, which means that they will be able to adapt to climate change and be functional ecosystems, even if they are no longer the ecosystems with which scientists have become accustomed.

Opportunities

- “No Regrets” actions are important and effective regardless of climate change. These include putting adaptation measures into place because even without any climate change impacts, there will be benefits. For example, conserving wetlands is good for biodiversity even without climate change.
- Form interdisciplinary and multi-sector partnerships early in the research and conservation processes.
- Identify senior-level champions to support foundational research as well as the implementation of pilot projects at the organizational level.
- Identify and understand current impacts and anticipate future scenarios.
- Prioritize key climate change threats and adaptation responses that are needed to enhance ecosystem resilience.
- Seek best practices across the country regarding integrated approaches for climate change impacts and adaptation.
- Biodiversity and climate change adaptation is an emerging issue and resource planners and users will need new tools and resources to identify and assess risks – the Biodiversity Adaptation Working Group could be instrumental in developing and evaluating these tools and resources.
- Organizations that conduct species research and conservation, such as Bird Studies Canada and Ducks Unlimited Canada, may add value to the Biodiversity Adaptation Working Group’s efforts.
- Conduct an analysis of how ecosystem services help different Ministers and departments meet their mandates.
- The recent Auditor General report on climate change in the Northwest Territories frames the issues and needs very well; one of the report’s main areas of examination was biodiversity and wildlife adaptation efforts.

THEME 2: Partnerships

Overarching key message: There is a need to leverage the diversity of potential partners in biodiversity adaptation, and take a more multi-disciplinary approach to identifying solutions.

| Strengths | Weaknesses |
|--|--|
| <ul style="list-style-type: none"> Many groups are in strong positions to deliver climate change adaptation initiatives, including governments, academia, non-governmental organizations, and Indigenous peoples at the national, provincial and regional levels involved in species- and habitat-specific initiatives. Partnerships are at the foundation of conservation – the partnership model, particularly for on-the-ground activities, has proven effective. There is good forward thinking from non-governmental organizations – this could be a great opportunity for governments and industry to benefit. Biodiversity conservation is part of climate change adaptation solutions across all sectors and silos. Industry is working with leaders and academics in the field of climate change – their knowledge could be helpful to many conservation partnerships. Non-governmental organizations are working with Indigenous and community leaders and academics in the field of conservation and climate change – their knowledge could be helpful to many adaptation partnerships. Interdisciplinary collaboration is essential and will benefit governments, sectors and biodiversity. | <ul style="list-style-type: none"> Certain regions of Canada are better represented by the Biodiversity Adaptation Working Group State of Play Report, e.g., from Quebec westward. Certain organizations and sectors are not well represented in the Biodiversity Adaptation Working Group State of Play Report (e.g. the Alberta Biodiversity Monitoring Institute, Saskatchewan’s Water Security Agency, the University of Prince Edward Island’s Climate Change Lab and other academic research groups, etc.). The federal government should work with provincial, territorial and municipal governments to develop a strategy for addressing climate change adaptation needs for biodiversity – there are mechanisms in place to support this work that could be leveraged. There is a huge body of knowledge at all levels of government, but not a clear picture of how it interrelates. Canadian governments are not well positioned to work closely with environmental conservation organizations, industry, academia, landowners and all Canadians. It is not well understood across departments how ecosystem services help different Ministers and departments meet their mandates – this could also be said for industry. Duplication of efforts will continue to occur if a more coordinated, multi-sector approach is not taken. Non-climate stresses, such as habitat fragmentation and invasive species, persist and need to be reduced. Need to address all ecological systems – terrestrial, freshwater and marine ecosystems and work with the relevant sectors to identify solutions. Challenges exist with migratory species; i.e., conservation occurs in Canada but a more holistic and multi-jurisdictional international approach is required for migratory species. |

Opportunities

- Biodiversity covers a broad spectrum across jurisdictional boundaries – instead of focussing on one issue, there could be collaborative efforts with all groups affecting the landscape.
- We have the opportunity to strengthen biodiversity conservation networks.
- Interdisciplinary and multi-sector partnerships need to be formed early in the research and conservation process.
- There are potential leadership opportunities, including ecosystems (natural infrastructure) as an adaptation solution, between governments and businesses.
- Maximize partnerships with Indigenous governments and organizations. Indigenous peoples are key partners in biodiversity conservation and climate change adaptation.
- Work with sectors to adapt their existing programs with biodiversity conservation and climate change in mind.
- Encourage and foster multi-stakeholder collaboration works through knowledge consortiums that include industry, environmental non-governmental organizations, provinces and territories, and Indigenous organizations.
- Work closely with provinces to develop a biodiversity and adaptation strategy. Work with other Adaptation Platform Working Groups, government departments and sectors to convey biodiversity benefits and ecosystem services.
- Work with other government departments, like Statistics Canada, to convey natural capital and ecosystem services values and economic benefits.
- Work more closely with conservation groups such as the Green Budget Coalition.
- Organizations that conduct species research and conservation, such as Bird Studies Canada and Ducks Unlimited Canada, may add value to the Biodiversity Adaptation Working Group's efforts.

THEME 3: Communications

Overarching key message: There is a need to overcome barriers in communicating the value of biodiversity for adaptation, particularly in terms of ecosystem services.

| Strengths | Weaknesses |
|---|---|
| <ul style="list-style-type: none">• Biodiversity has a fundamental role in supporting all life on earth – all living organisms, including humans, rely on and benefit from biodiversity.• Ecosystem services are part of the climate change solution both in landscape conservation and as a communications tool.• Biodiversity conservation is part of climate change adaptation solutions across all sectors and silos.• Most of the Adaptation Platform Working Groups refer to biodiversity conservation in their State of Play reports (e.g., Forestry, Coastal, Energy, Northern, etc.).• There are many existing programs and projects in Canada that, directly or indirectly benefit biodiversity conservation.• Canada has many Citizen Science programs underway that collect and share biodiversity information. | <ul style="list-style-type: none">• The terms “biodiversity” and “adaptation” are not well understood.• Not everyone uses the same terminology in their conservation approaches.• Some research, conservation and adaptation efforts may be duplicated due to a lack of coordination. |
| Opportunities | |
| <ul style="list-style-type: none">• Need to communicate how biodiversity contributes to climate change adaptation.• Share success stories, best management practices and examples, which may include challenges and failures.• Develop education and awareness campaigns designed to demonstrate biodiversity benefits to farm profitability, and sustainability.• Improve communications with all conservation and adaptation groups and share the great work that is underway by Natural Resources Canada, the Biodiversity Adaptation Working Group and others, and communicate success stories as well as lessons learned.• Broadly promote Citizen Science activities to more Canadians – this engagement and its potential results contribute to a more comprehensive understanding of how our climate is changing.• Incorporate technology and application development – many Citizen Science programs, such as the Commission for Environmental Cooperation’s Learning Environmental Observer Network, use mobile applications to record changes in species behaviour and abundance as well as changing habitat conditions caused by climate change impacts like increased drought, invasive species or forest fires.• Potential leadership on communications from other organizations, like the Canadian Parks and Wilderness Society.• Explore opportunities where adaptation and mitigation benefits overlap. | |

THEME 4: Policy, Programs and Funding

Overarching key message: There is a need to integrate biodiversity into climate change policies, programs and funding – and a need to integrate climate change into biodiversity policies, programs and funding.

| Strengths | Weaknesses |
|---|--|
| <ul style="list-style-type: none"> • New funding available for national, provincial, territorial and Indigenous collaboration to meet Canada's Biodiversity 2020 goals. • It is more cost effective to conserve ecosystems than to restore them. • Natural solutions that reduce the impacts of climate change are often cheaper than traditional infrastructure to build, restore and maintain. These can enhance biodiversity and ecosystem health, while also protecting communities. • Ecosystem services are part of the climate change solution. • Biodiversity conservation is part of climate change adaptation solutions across all sectors and silos. • Industrial sectors could be well positioned, through initiatives like the Mining Association of Canada's Towards Sustainable Mining Initiative, to incorporate climate change adaptation for biodiversity into their existing tools and models. • Some sectors, such as individual farm businesses, have been more determined to adapt measures for extreme weather preparedness than others. A farmer's investment in biodiversity projects can result in production benefits (profitability and sustainability) and lessen climate change-related losses. Those that have adopted best management practices, like rotational grazing and cover crops, have been less impacted by climate change. • There are many existing programs and projects in Canada that, directly or indirectly, benefit biodiversity conservation. | <ul style="list-style-type: none"> • There is inadequate funding and resources to deliver adaptation programs to achieve desired resiliency outcomes. • Investments to address information gaps as they relate to biodiversity/climate change are lacking. • Duplication of efforts will continue to occur if a more coordinated, multi-sector approach is not taken. Non-climate stresses, such as habitat fragmentation and invasive species, persist and need to be reduced. • Need to address all ecological systems – terrestrial, freshwater and marine ecosystems and work with the relevant sectors to identify solutions. • Canada may not fully meet all of its Biodiversity 2020 targets. • Biodiversity conservation needs to be a higher priority of the federal government (Biodiversity 2020 Goals) as part of Canada's commitment to the United Nations Convention on Biological Diversity. • Adaptation activities can take a long time to implement so it is important to put in place monitoring and survey frameworks to be able to assess and report on the success of adaptation measures over time. • Project outcomes need to be more quantitative. • If we do nothing, we are possibly going to lose more than species – there is the potential that some of the basic functions of ecosystems that humans depend on will be lost. • Species recovery must not become the main driver of conservation. • Challenges exist with migratory species; i.e., conservation occurs in Canada but a more holistic and multi-jurisdictional international approach is required for migratory species. • Climate change is complicating the definition of "invasive alien species" due to shifting ranges. • There is an over emphasis on managing landscapes for climate change mitigation values (i.e. greenhouse gas emission reduction) without always considering the resilience of the ecosystem or the biodiversity impacts. We need to be careful that our climate mitigation solutions don't undermine these equally important other values. • We have few tools that really allow us to implement landscape level solutions needed for biodiversity conservation and adaptation, most of them don't integrate landscape level resilience and adaptation questions. • Missed opportunity if conservation investments are not made before restoration is required. • There is increasing competition for funding and other resources. • Need to develop the business case for funding adaptation actions. • Funding resources tend to be more directed to mitigation. • Governments and non-profits have limited resources so they must spend money smartly and drive multiple values from it. |

Opportunities

- An analysis of how natural capital restoration benefits different Ministers and departments meet their mandates may help deliver resources for on-the-ground work.
- Build on effective current programs to benefit biodiversity in a changing climate and advocate for major new investments in conservation partnerships.
- Measuring effectiveness of projects and initiatives, as well as learning from experiences and reporting results, would increase knowledge and further advance this kind of work.
- Advocate for dedicated federal natural infrastructure fund and other funding.
- Link to current strategies such as Canada's Biodiversity 2020 and complement the goals of such strategies.
- Work with other Adaptation Platform Working Groups that reference biodiversity conservation in their State of Play reports and encourage Working Groups that have not included biodiversity to do so.
- Involve all Canadians in biodiversity conservation and climate change adaptation initiatives, not just those working in land management; e.g. native tree planting in gardens, etc.
- Incorporate climate change as a threat more explicitly in Committee on the Status of Endangered Wildlife in Canada and Species at Risk frameworks (currently under consideration).
- Increased funding and national, provincial, territorial and Indigenous collaboration to meet our targets of 17% protection by 2020; and consideration of additional targets beyond that timeline that include connectivity.
- If resources are invested in infrastructure projects, including natural infrastructure, biodiversity and climate change adaptation and resiliency should be part of the investment.
- Conduct an analysis of how ecosystem services help different Ministers and departments meet their mandates.
- Explore opportunities where adaptation and mitigation benefits overlap.
- Climate change adaptation is about how we do business today and making it work without taking all that we possibly can out of the land and exacerbating conditions.

THEME 5: Indigenous Leadership

Overarching key message: There is a need to centre Indigenous voices and respectfully and authentically integrate Indigenous leadership.

| Strengths | Weaknesses |
|--|--|
| <ul style="list-style-type: none">Indigenous peoples have a strong cultural connection to the land, water and air. While this increases their exposure and sensitivity to climate change impacts, it is also a source of strength, understanding and resilience.⁵⁷Indigenous communities and the holders of Traditional Knowledge have a long history of and deep understanding about adapting to changes in climate and the land. With support, they can contribute to the development of new and innovative solutions that benefit all Canadians and act as wayfinders on the path to resilience.⁵⁸Indigenous knowledge systems, while defined by those who practice and are guided by them, are passed from generation to generation through culture, song, language, dance, ceremony and witnessing. They draw upon the ever-changing natural world. As such, they change over time, bringing forward new understandings regarding the Earth's ecology.⁵⁹Across Canada, teams of Indigenous Guardians are working to conserve and manage their lands. They monitor wildlife, patrol protected areas and reduce the impacts of climate change. In the process, they honor their cultural traditions and train the next generation of leaders. Guardians monitor caribou and other endangered species, manage invasive species, and work to protect the boreal nesting grounds for billions of migratory birds.⁶⁰ | <ul style="list-style-type: none">Indigenous peoples are among the most vulnerable to climate change and experience unique challenges. A range of factors, largely related to historical legacies, contribute to this vulnerability, including: exposure to isolated and hazard-prone areas; reliance on the natural environment for livelihoods; socioeconomic challenges, including disproportionate fiscal and population pressures; sub-standard infrastructure and limited access to professional services, such as land-use planning and asset management expertise. Indigenous communities also face challenges of access to climate change adaptation resources, programs and tools.⁶¹Federal, provincial and territorial governments must recognize the critical role of Indigenous wisdom and knowledge in managing complex ecosystems and addressing conservation- and protection-related challenges. They must also thoroughly understand Indigenous knowledge systems if authentic knowledge sharing and learning are to be truly reciprocal. Therefore, there is a need for governments at all levels to build their internal capacity to grasp and value Indigenous knowledge systems.⁶² |

Opportunities

- Governments will work with regional partners [to implement the Pan-Canadian Framework on Clean Growth and Climate Change], including with Indigenous peoples through community-based initiatives, to build regional capacity, develop adaptation expertise, respectfully incorporate Traditional Knowledge and mobilize action.⁶³
- Canada's Adaptation Platform and regional consortia and centres support the sharing of expertise and information among governments, Indigenous peoples and communities, businesses and professional organizations and support action on joint priorities.⁶⁴
- The Indigenous Circle of Experts (ICE) believes federal, provincial and territorial governments must take an integrated approach to meeting their domestic biodiversity goals and contributing to the global good. The 20 Aichi Targets and 19 related Canadian biodiversity targets are intended to work together. This approach aligns with Indigenous worldviews and thinking that have conserved biodiversity effectively for millennia.⁶⁵
- The Indigenous Circle of Experts (ICE) recommends that federal, provincial, territorial and Indigenous governments collaborate with educational institutions to support and encourage further research and capacity-building in Indigenous Protected and Conserved Areas (IPCAs), such as with respect to the impacts and mitigation of climate change. IPCAs can be "beacons of teachings": spaces for higher education research focusing on the recovery and revitalization of Indigenous knowledge systems and rooted in the guidance and teaching of Elders.⁶⁶
- By using traditional Indigenous skills and providing opportunities to learn other skills, a conservation economy can provide meaningful livelihoods and ultimately support healthy communities. Naturally diverse environments, combined with vibrant cultures and histories, create long-term sustainable employment potential for local and regional residents by maximizing existing skills and knowledge, providing new skills, and adequately supporting families now and into the future.⁶⁷
- Indigenous communities are first to experience the effects of climate change yet contribute the least [in terms of greenhouse gas emissions]. Therefore, Indigenous solutions need to be at the forefront. [We need to] uplift Indigenous worldviews and experiences within climate discussions. Indigenous knowledge is key to finding sustainable and effective climate solutions.⁶⁸
- Indigenous wisdom and knowledge are embedded in Indigenous practices for managing complex ecosystems and for addressing conservation- and protection-related challenges. Ideally, Indigenous knowledge systems and western science should be valued and respected equally, should inform and complement each other, and should be combined into a seamless approach.⁶⁹
- First Nations (Indigenous peoples) are in a unique position to be leaders in climate change initiatives because of our knowledge of the sacred teachings of the land, and must be situated as agents of change in climate action, rather than as passive recipients of climate change impacts.⁷⁰

Conclusion

As stated in the Introduction, the goal of the *State of Play: Biodiversity* report is to:

1. Provide the Working Group with a common understanding of climate change related issues and concerns affecting biodiversity in Canada
2. Provide an overview of the current state of biodiversity conservation activities, including gaps and opportunities

Five key overarching messages have emerged from the State of Play Report:

1. Science: There is a need for more cohesive and coordinated biodiversity research on climate change impacts and adaptation.
2. Partnerships: There is a need to leverage the diversity of potential partners in biodiversity adaptation, and take a more multi-disciplinary approach to identifying solutions.
3. Communications: There is a need to overcome barriers in communicating the value of biodiversity for adaptation, particularly in terms of ecosystem services.
4. Policy, Programs and Funding: There is a need to integrate biodiversity into climate change policies, programs and funding – and a need to integrate climate change into biodiversity policies, programs and funding.
5. Indigenous Leadership: There is a need to centre Indigenous voices and respectfully and authentically integrate Indigenous leadership

These key findings provide a common baseline for moving forward on biodiversity and climate change adaptation, and will provide a basis for the Biodiversity Adaptation Working Group's 2018-22 Work Plan.

Appendix A: Biodiversity Adaptation Working Group Members – March 2018

| | |
|----------------------------------|---|
| Elizabeth Nelson (Current Chair) | Parks Canada |
| Curtis Scurr | Assembly of First Nations |
| James Quayle | BC Parks |
| Reg Melanson | Canadian Business and Biodiversity Council |
| Florence Daviet | Canadian Parks and Wilderness Society (CPAWS) |
| Erin Down | Environment and Climate Change Canada (Canadian Wildlife Service) |
| Lesley-Anne Dams | Environment and Climate Change Canada (Strategic Policy) |
| Denise Joy | Fisheries and Oceans and Canada |
| Murray Smith | Fisheries and Oceans and Canada |
| Kate Lindsay | Forest Products Association of Canada |
| Andrew de Vries | Mining Association of Canada |
| Phyllis Dale | Natural Resources Canada (Canadian Forest Service) |
| Dominique Auger | Natural Resources Canada (Climate Change Impacts and Adaptation) |
| Suzanne Carrière | NWT Department of Environment and Natural Resources (Wildlife Division) |
| Steve Hounsell | Ontario Biodiversity Council |
| Robert Siron | Ouranos |
| Scott Parker (former Co-Chair) | Parks Canada |
| Delaney Boyd (former Co-Chair) | Saskatchewan Ministry of Environment (CIS Branch) |
| Emily Giles | WWF-Canada |

Former members and alternates who contributed to this report:

| | |
|---------------|---|
| Drew Black | Canadian Federation of Agriculture |
| Bryan Poirier | Environment and Climate Change Canada (Canadian Wildlife Service) |
| Tara Shea | Mining Association of Canada |
| Julia Thomas | Parks Canada |
| Dinah Tambalo | Saskatchewan Ministry of Environment (CIS Branch) |
| Susan Evans | WWF-Canada |

Appendix B:

Examples of Projects to Address Biodiversity in a Changing Climate

The following are examples of initiatives, innovations, research and tools undertaken by communities, provincial, territorial and federal governments, private sector, academia and others across Canada for the benefit of biodiversity conservation in a changing climate.

Arctic Council

The Arctic Migratory Birds Initiative Work Plan 2015-2019

To improve the conservation status and secure the long-term sustainability of declining Arctic breeding migratory bird populations.

Species: Shorebirds

Region: Global/Canada

For more information: https://oaarchive.arctic-council.org/bitstream/handle/11374/1446/CAFF_AMBI_Doc1_Work_Plan_2015-2019_AC_SAO_CA04.pdf?sequence=1&isAllowed=y

British Columbia Parks

Living Lab Program – Various Research Projects

The Living Lab Program promotes B.C.'s protected areas as places to learn about the effects of climate change, how to mitigate (lessen) the effects, and how to share this information. The program encourages research in protected areas. B.C.'s protected areas are less developed than much of the rest of the province, so parks can help us understand how undeveloped ecosystems react to climate change. Research in parks can also tell us how land and water connectivity between parks will make a difference for species as the climate changes. This kind of information will help when making decisions on what actions to take both inside and outside parks.

For more information: <http://www.env.gov.bc.ca/bcparks/partnerships/living-labs/>

Climate Change Adaptation Community of Practice (CCACoP)

Interactive online community dedicated to advancing knowledge and action in the area of climate change adaptation.

The CCACoP serves as a location where researchers, experts, policy-makers and practitioners from across Canada can come together to ask questions, generate ideas, share knowledge, and communicate with others working in the field of climate change adaptation. One of the main goals of the CCACoP is to support all Canadian provinces and territories in their efforts to incorporate climate change adaptation into planning and policies.

Region: Ontario/National

For more information: <https://ccadaptation.ca/en/landing>

Commission for Environmental Cooperation

Arctic Shorebird Habitat: Climate Change Resilience Analysis

To model Arctic migratory shorebird habitat needs for red knots and semi-palmated sandpipers

Biome or Habitat Type: Tundra

Region: Arctic

For more information: <http://www.cec.org/our-work/projects/arctic-migratory-birds-initiative-ambi-%E2%80%93-america%E2%80%99s-flyway-action-plan>

Commission for Environmental Cooperation

Blue Carbon Project

To advance the conservation and restoration of coastal blue carbon habitats by improving data, mapping and approaches to carbon mapping and storage

Biome or Habitat Type: marine coastal habitats

Region: North America

For more information: <http://www3.cec.org/islandora/en/item/11723-blue-carbon-in-tidal-wetlands-pacific-coast-canada-examples-from-pacific-rim>

Canada Example: <https://www.squamishwatershed.com/blue-carbon-project.html>

Commission for Environmental Cooperation

Ecosystem Function and Traditional Knowledge

Under its 2015-2016 project, Using Ecosystem Function and Traditional Knowledge Together to Build Resilience and Adapt to Climate Change in North America, the CEC facilitated the exchange of tools, methodologies and assessments developed in Canada, Mexico and the United States to support the development of ecosystem-based local adaptation in communities vulnerable to the effects of climate change.

Region: Global/Canada

For more information: <http://www3.cec.org/islandora/en/item/11768-ecosystem-function-and-traditional-ecological-knowledge-building-resilience-and>

Commission for Environmental Cooperation

Marine Protected Areas Project – Rapid Vulnerability Assessment Tool

To help marine protected area managers evaluate the implications of climate change for the habitats of their sites.

Biome or Habitat Type: Marine Protected Areas

Region: North America

For more information: <http://www3.cec.org/islandora/en/item/11733-north-american-marine-protected-area-rapid-vulnerability-assessment-tool-en.pdf>

Conservation Ontario

Climate Change: Building Resiliency for Healthy Watersheds and People

To assist Ontario's conservation authorities respond to climate change impacts, including biodiversity

Biome or Habitat Type: All habitats

Region: Ontario

Convention on Biological Diversity

Aichi Target Guides

Biome or Habitat Type: All habitats

For more information: <https://www.cbd.int/sp/targets/>

Ducks Unlimited Canada

Canadian Wetlands Roundtable

Workshops on wetlands and climate change (stakeholder and government participants)

Biome or Habitat Type: Wetlands

Region: National

Ducks Unlimited Canada

Conducting, supporting and aggregating peer reviewed science on the relationship between peat and mineral-based wetlands and their impacts on climate change adaptation and mitigation.

Biome or Habitat Type: Wetlands, Grasslands, Associated Upland Habitats, Boreal Forest

Region: Prairies, Western Boreal Forest

Ducks Unlimited Canada

Generating baseline wetland inventories throughout portions of the boreal for better monitoring and investigating establishing benchmarks of distributions of habitats and biodiversity to identify landscapes that are more sensitive to climate-induced changes.

Biome or Habitat Type: Wetlands

Region: National

Ducks Unlimited Canada

Delta Marsh Project

Project Description: Common carp exclusion gates installed at seven entry points resulting in vegetation stabilization and biodiversity enhancement; DUC rebuilt multiple earthen dykes after severe flooding, high water and ice damage breached the barrier between the marsh and Lake Manitoba.

Biome or Habitat Type: Wetlands

Region: Prairies, Western Boreal Forest

Ducks Unlimited Canada

Ecological goods and services study on the effects of wetland drainage in a tributary of the Souris and Assiniboine rivers in Western Manitoba

Biome or Habitat Type: Wetlands

Region: Broughton's Creek, Western Manitoba

Ducks Unlimited Canada

Ecological goods and services study on the effects of wetland drainage in a tributary of the Assiniboine River in east-central Saskatchewan

Biome or Habitat Type: Wetlands

Region: East-central Saskatchewan

Environment and Climate Change Canada, Wildlife Research Division

Boreal Caribou Study

To examine the impact of climate change on fire regime and how this will impact caribou herds

Biome or Habitat Type: Boreal Forest

Region: Northern Canada

Environment and Climate Change Canada, Wildlife Research Division

Polar Bear Study

Polar bears are augmenting their diets to include eating seabird eggs – toxins often accumulate in eggs – and are these toxins now ending up in polar bears. Research is being undertaken to understand these impacts.

Biome or Habitat Type: Tundra

Region: Northern Canada

Environment and Climate Change Canada, Wildlife Research Division

Proeced Areas Network

To ensure that corridors are in place to provide resiliency, redundancy and connectivity to allow species to adapt to a changing climate.

Biome or Habitat Type: All habitats

Region: Canada

Environment and Climate Change Canada, Wildlife Research Division

Peary Caribou Study

Project Description: Modelling to look at the impact of severe weather events on availability of Peary caribou.

Biome or Habitat Type: Boreal Forest and Tundra

Region: Northern Canada

Environment and Climate Change Canada, Wildlife Research Division

Great Lakes Coastal Wetlands

Project Goal: Use radar and satellite imagery to determine size changes on wetland extent and character as a vulnerability assessment to inform conservation initiatives

Biome or Habitat Type: Wetlands

Region: Ontario

Fisheries and Oceans Canada

Aquatic Climate Change Adaptation Services Program

Project Description: Research projects to expand understanding of how climate change will impact the delivery of the Department's programs and policies and the development of applied-science adaptation tools and strategies to enable the integration of climate change considerations into the delivery of those programs and policies.

Biome or Habitat Type: Marine and fresh water

Region: Canada

Fisheries and Oceans Canada

Modelling tool for biogeochemical changes prediction and incorporation of climate change into the implementation of an MPA Network in the Gulf of St. Lawrence

Project Goal: To refine and validate a climate modelling tool to provide geographically detailed projections of future changes in biogeochemical conditions for the Gulf of St. Lawrence, Scotian Shelf and the Gulf of Main

Biome or Habitat Type: Marine Protected Areas

Region: Gulf of St. Lawrence

Fisheries and Oceans Canada

Program for Ecosystem-Based Research and Advice

Research projects and scientific tool development which support national priorities for managing ecosystems in our domestic waters

Biome or Habitat Type: Marine

Region: Canada

Fisheries and Oceans Canada

Understanding the impact of a changing climate on interactions between Pacific sardine and Pacific herring populations in British Columbia

Project Goal: To provide the information necessary to explore the effect of future climate change predictions on habitat overlap and the potential for competition between these species.

Biome or Habitat Type: Marine

Region: West Coast

Fisheries and Oceans Canada

Incorporating Climate Change into Marine Protected Area Network Planning

Project Goal: Develop methods for incorporating climate change considerations into the planning process for setting up MPAs

Biome or Habitat Type: Marine Protected Areas

Region: Canada

Friends of the Greenbelt

A Green Infrastructure Guide for Small Cities, Towns and Rural Communities

Project Goal: To support small cities, towns and rural settlements with the integration of green infrastructure into their communities.

Region: Urban areas

For more information: http://www.greenbelt.ca/report_green_infrastructure

Green Shores Program

To improve benefits and alignment of human development and coastlines, the Stewardship Centre for BC has developed the Green Shores program to promote restorative and protective practices of natural shorelines in residential, commercial and public spaces. Instead of using artificial barriers, developers are encouraged to mimic nature in landscape design.

Region: BC Coastline

For more information: http://stewardshipcentrebc.ca/Green_shores/

Intact Centre for Climate Adaptation

Climate Change Adaption: A Priorities Plan for Canada

Project Description: Identifies key threats and recommended actions for a number of different sectors and interests to reduce the effects of climate change and enhance resilience. Chapter 2 addresses climate change threats to biodiversity and recommended actions. Chapter 3 addresses Freshwater Resources.

Biome or Habitat Type: All habitats

Region: National

For more information: <https://uwaterloo.ca/environment/sites/ca.environment/files/uploads/files/CCAP-Report-30May-Final.pdf>

Intact Centre for Climate Adaptation

Natural Infrastructure Preservation

Project Description: Quantifying the economic value of natural infrastructure preservation to limit flood risk.

Biome or Habitat Type: Wetlands

Region: National application; research based in southern Ontario

For more information: <http://www.intactcentreclimateadaptation.ca/wp-content/uploads/2017/07/When-the-Big-Storms-Hit.pdf>

International Council for Local Environmental Initiatives

Finding the Nexus: Exploring Climate Change Adaptation and Biodiversity

Provides guidance and key information on how climate change adaptation can be linked to important municipal issues such as climate change mitigation, biodiversity, public health, water, urban planning and economic development

Biome or Habitat Type: All Habitats

Region: National

For more information: <http://www.icleicanada.org/>

Memorial University, St. Johns

Studying Invertebrates' Ability to Adapt to Climate Change

Project Goal: To determine if invertebrates could survive the pressure if they migrate to deeper water because of climate change

Biome or Habitat Type: Marine

Region: Newfoundland and Labrador

Nature Conservancy of Canada

Climate Change Checklist

Biome or Habitat Type: All habitats

NatureServe Canada

Climate Change Vulnerability Index

Project Description: Identification of plant and animal species that are particularly vulnerable to the effects of climate change

Biome or Habitat Type: All habitats

Region: Canada

For more information: <http://www.natureserve.org/conservation-tools/climate-change-vulnerability-index>

Northwest Territories Government

Development of a Conservation Network

Project Goal: To manage lands so that landscape connectivity is maintained for all species

Biome or Habitat Type: All habitats

Region: Northwest Territories

Northwest Territories Government

Predicting Future Potential Climate-Biomes for the Yukon, Northwest Territories, and Alaska

Project Description: linking species-specific data and local details of landscape ecology to projected climate changes impacts, land managers can make informed decisions about how to adapt to a changing landscape

Biome or Habitat Type: All habitats

Region: Northwest Territories

Northwest Territories Government

Updating the Climate Change Strategic Framework

Project Goal: To update the 2006 NWT Biodiversity Action Plan with a new gap analysis to ensure actions for maintaining biodiversity in light of a changing climate are in place. Complete climate change forest vulnerability assessments in selected areas.

Biome or Habitat Type: All habitats

Region: Northwest Territories

For more information: <http://www.enr.gov.nt.ca/en/services/climate-change>

Office of the Auditor General of Canada Report ***Report 2—Adapting to the Impacts of Climate Change***

Project Description: Audit focused on federal progress in adapting to climate change

Biome or Habitat Type: All habitats

Region: National

http://www.oag-bvg.gc.ca/internet/English/parl_cesd_201710_02_e_42490.html

Ontario Biodiversity Council ***Communicating Biodiversity and Climate Change***

Project Description: A report that provides a framework for developing effective communications that can ultimately move the needle on educating and engaging the public on biodiversity conservation and its importance with regards to climate change.

Biome or Habitat Type: All habitats

Region: Ontario

For more information: <http://ontariobiodiversitycouncil.ca/communicating-biodiversity-climate-change/>

Ontario Biodiversity Council ***Ontario's Biodiversity Strategy (OBS) – Strategic Directions to 2020***

Project Description: Enhancing ecosystem resilience in a changing climate through habitat protection, restoration and stewardship by:

- Integrate biodiversity into provincial climate change strategies to achieve both adaptation and mitigation goals (OBS targets 11-14).
- Value, maintain, restore and enhance ecosystem services (OBS target 14).
- Develop and implement plans and strategies to protect and conserve biological diversity at the landscape and municipal levels through the establishment of natural heritage systems (OBS target 12).
- Expand the protected areas system (OBS target 13).

Biome or Habitat Type: All

Region: Ontario

For more information: <http://ontariobiodiversitycouncil.ca/obc-strategic-agenda/>

Ontario Centre for Climate Impacts and Adaptation Resources

A university-based resource hub for researchers and stakeholders searching for information on climate change impacts and adaptation.

Biome or Habitat Type: all biomes and habitats

Region: Ontario/National

For more information: <http://www.climateontario.ca/>

Ontario Ministry of Natural Resources and Forestry ***Naturally Resilient: Natural Resource Climate Adaptation Strategy***

Project Description: To ensure the Ministry is well positioned to reduce its vulnerabilities, fulfill its mandate, and address the impacts of climate change

Biome or Habitat Type: All habitats

Region: Ontario

Ontario Ministry of Natural Resources

Practitioners Guide to Climate Change Adaptation in Ontario's Ecosystems 2011

Project Description: The guide introduces the concepts of climate change adaptation, vulnerability, and risk. It also describes vulnerability and risk assessment tools and techniques, and a framework that can be used to support adaptive management in a rapidly changing climate. The guide seeks to assist natural resource managers to identify ways that climate change vulnerabilities and risks can be integrated into decision-making processes that include adaptation action plans, strategies, and policies.

Biome or Habitat Type: All biomes and habitats

Region: Ontario/National

Ontario Power Generation

Regional Biodiversity Program

Project Goal: To link biodiversity with climate change mitigation and adaptation. Projects are focused on:

- Restoring or creating habitats for terrestrial and aquatic species in decline;
- Enhancing the resilience of habitats and ecosystems to better cope with increasing threats, including climate change and invasive species; and
- Enhancing critical ecosystem services, such as flood attenuation or water quality improvement.

Biome or Habitat Type: Woodlands, wetlands, grasslands, lakes and rivers and urban biodiversity projects

Region: Ontario

For more information: <https://www.opg.com/communities-and-partners/biodiversity/pages/opg-regional-biodiversity-program.aspx>

Ouranos

Ecosystems and Biodiversity Program

The goal of the program is to develop knowledge and tools to support adaptation focused on ecosystems and biodiversity by facilitating research projects. Since 2010, over 25 projects have been completed or are in progress. Project Examples:

- Assessment of Climate Change Impacts on the Caribou, the Land, and the Naskapi Nation, and Identification of Priority Adaptation Strategies
- Corridors, Biodiversity and Ecosystem Services: An Ecological Network Designed to Maintain Connectivity and Manage Climate Change Resilience around Montreal
- Development of a Methodology and Sampling Framework for Monitoring Biodiversity in relation to Climate Change
- Economic Assessment of Ecological Goods and Services in a Changing Climate
- Hydrological, Economic and Spatial Analysis Tools for the Ecological Services of Wetlands in the St. Lawrence Lowlands: Adaptation to Climate Change
- The CC-Bio Project: Studying the Effects of Climate Change on Quebec Biodiversity
- Tools for Assessing Biological Invasion Risk in a Context of Climate Change

Region: Quebec

For more information: <https://www.ouranos.ca/en/program/ecosystems-biodiversity/>

PEI Partnership

Atlantic Climate Adaptation Solutions Association

Project Description: The website was developed to help Atlantic rural coastal communities plan for the effects of climate change; it includes two tools and resources.

Biome or Habitat Type: Coastal

Region: Atlantic Canada

For more information: <https://atlanticadaptation.ca/CCAT>

Province of British Columbia

Natural Resources Climate Change Adaptation

Project Description: Providing policy, knowledge and tools required to adapt natural resource management to a changing climate in B.C.

Biome or Habitat Type: All habitats

Region: British Columbia

Province of British Columbia

BC Agriculture and Food Climate Change Initiative

Project Description: Develop tools and resources to benefit BC's agricultural sector adapt to climate change

Region: British Columbia

For more information: <https://www.bcagclimateaction.ca/overview/about-us/>

Province of Quebec

2013-2020 Climate Change Action Plan – Quebec in Action, Greener by 2020

Report Description: The report is the Province's action plan for addressing climate change, particularly in the areas of transportation, land-use planning (including biodiversity conservation and maintenance of ecosystem services) and energy.

Region: Quebec

For more information: http://www.mddelcc.gouv.qc.ca/changements/plan_action/pacc2020-en.pdf

Province of Quebec

2013-2020 Government Strategy for Climate Change Adaptation

Report Description: Expresses the Province's vision for addressing climate change by identifying objectives, strategic directions and recommended actions for the conservation of biodiversity and the maintenance of ecosystem services.

Region: Quebec

For more information: http://www.mddelcc.gouv.qc.ca/changements/plan_action/strategie-adaptation2013-2020-en.pdf

Simon Fraser University

ACT (Adaptation to Climate Change Team)

Project Goal: To bring leading experts from around the world together with industry, community, and government decision-makers to explore the risks posed by top-of-mind climate change issues and to identify opportunities for sustainable adaptation

Biome or Habitat Type: All habitats

Region: Canada

Scenarios Network for Alaska and Arctic Planning Arctic

Alaska Canada Climate-Biome Shift Project (AK Cliomes) and the Yukon and Northwest Territories (NWT) Climate-Biome Shift Project

Final project results and data are intended to serve as a framework for research and planning by land managers and other stakeholders with an interest in ecological and socioeconomic sustainability. Project partners include:

- Alaska project funding: US Fish and Wildlife Service
- Canadian project funding: The Nature Conservancy's Canada Project, Ducks Unlimited, and the Governments of YT and NWT
- Data and analysis: Ecological Wildlife Habitat Data Analysis for the Land and Seascape Laboratory
- Further input was provided by stakeholders from other interested organizations.

For more information: <https://www.snap.uaf.edu/projects/biome-shift>

Turn Back the Tide

This tool serves to inform users how climate change will impact Newfoundland and Labrador, as well as the risks and opportunities that are associated with each of these impacts. In understanding how climate change will affect the province, we can better prepare to minimize risk and seize opportunities under a changing climate.

Species: Shorebirds

Region: Newfoundland and Labrador

For more information: <http://www.turnbackthetide.ca/about-climate-change-and-energy-efficiency/impacts-of-climate-change.shtml>

University of Toronto

Climate Change Vulnerability Assessment for Aquatic Ecosystems in the Mississippi and Rideau Conservation Authority Watersheds

Region: Mississippi and Rideau Conservation Authority Watersheds

For more information: <http://mvc.on.ca/wp-content/uploads/2014/10/RVCA-MVCA-Aquatic-habitat-CC-Vulnerability-Sept-15-2014-final2.pdf>

World Wildlife Fund Canada

Planning for a Healthy Arctic Future

To ensure that this region - including wildlife and the people who depend on healthy wildlife populations - can adapt to a changing climate.

Region: Canadian Arctic

For more information: <http://www.wwf.ca/conservation/arctic/>

Appendix C: References

- 1 Convention on Biological Diversity. <https://www.cbd.int/>
- 2 IPCC 2007 Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, 2007. M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson (eds)
- 3 Convention on Biological Diversity. <https://www.cbd.int/>
- 4 Canada's Climate Change Adaptation Platform. <https://www.nrcan.gc.ca/environment/impacts-adaptation/adaptation-platform/10027>
- 5 Convention on Biological Diversity. <https://www.cbd.int/>
- 6 Canadian Biodiversity Strategy. <http://www.biodivcanada.ca/default.asp?lang=En&n=560ED58E-1>
- 7 Canada's Biodiversity Outcomes Framework. <http://www.biodivcanada.ca/default.asp?lang=En&n=F14D37B9-1>
- 8 2020 Biodiversity Goals for Canada. <http://biodivcanada.ca/default.asp?lang=En&n=9B5793F6-1>
- 9 Strategic Plan for Biodiversity 2011-2020. <https://www.cbd.int/sp/>
- 10 Canada's 4th National Report to the Convention on Biodiversity (2009). <https://www.cbd.int/doc/world/ca/ca-nr-04-en.pdf>
- 11 Canada's 5th National Report to the Convention on Biodiversity (2014). <https://www.cbd.int/doc/world/ca/ca-nr-05-en.pdf>
- 12 Natural Areas Conservation Program. <http://www.natureconservancy.ca/en/what-we-do/conservation-program/>
- 13 North American Waterfowl Management Plan. <http://nawmp.wetlandnetwork.ca/>
- 14 Canada's Habitat Stewardship Program. <https://www.canada.ca/en/environment-climate-change/services/environmental-funding/programs/habitat-stewardship-species-at-risk.html>
- 15 Ontario's Species at Risk Stewardship Fund. <https://www.ontario.ca/page/grants-protecting-species-risk>
- 16 Breeding Bird Atlases. <http://www.birdscanada.org/volunteer/atlas/>
- 17 Bumble Bee Watch. <https://www.bumblebeewatch.org/>
- 18 Working Group on Adaptation and Climate Resilience Final Report. 53 pages. https://www.canada.ca/content/dam/ecccc/migration/cc/content/6/4/7/64778dd5-e2d9-4930-be59-d6db7db5cbc0/wg_report_acr_e_v5.pdf
- 19 Marine Protected Areas. <http://www.dfo-mpo.gc.ca/oceans/publications/mpapolicy-politiquezpm/index-eng.html>
- 20 Lake Simcoe Protection Plan. <https://www.ontario.ca/page/lake-simcoe-protection-plan>
- 21 Ducks Unlimited Canada. <http://www.ducks.ca/our-work/wetlands/>
- 22 Canada's 5th National Report to the Convention on Biodiversity (2014). <https://www.cbd.int/doc/world/ca/ca-nr-05-en.pdf>
- 23 Canadian Endangered Species Conservation Council. 2016. Wild Species 2015: The General Status of Species in Canada. National General Status Working Group: 128 pp. <https://www.wildspecies.ca/reports>

- 24 World Wildlife Fund Living Planet Report Canada: A national look at wildlife loss. 2017. 56pp.
- 25 World Wildlife Fund Living Planet Report Canada: A national look at wildlife loss. 2017. 56pp.
- 26 World Wildlife Fund Living Planet Report Canada: A national look at wildlife loss. 2017. 56pp.
- 27 Canada's 5th National Report to the Convention on Biodiversity (2014). <https://www.cbd.int/doc/world/ca/ca-nr-05-en.pdf>
- 28 Canada's 5th National Report to the Convention on Biodiversity (2014). <https://www.cbd.int/doc/world/ca/ca-nr-05-en.pdf>
- 29 *Canada's Species at Risk Act*. <http://laws-lois.justice.gc.ca/eng/acts/s-15.3/>
- 30 *Migratory Birds Convention Act*, 1994. <http://laws-lois.justice.gc.ca/eng/acts/m-7.01/>
- 31 *Wild Animal and Plant Protection and Regulation of International and Interprovincial Trade Act*. <http://lois-laws.justice.gc.ca/eng/acts/W-8.5/index.html>
- 32 Convention on International Trade in Endangered Species. <https://www.cites.org/eng/disc/what.php>
- 33 *Canada Wildlife Act*. <http://laws-lois.justice.gc.ca/eng/acts/W-9/>
- 34 *Ontario Wetland Conservation Strategy*. <https://www.ontario.ca/page/wetland-conservation-strategy>
- 35 *North American Wetlands Conservation Act*, 1989. <http://nawcc.wetlandnetwork.ca/nawca.html>
- 36 *Quebec's Bill 132*. <http://www2.publicationsduquebec.gouv.qc.ca/dynamicSearch/telecharge.php?type=5&file=2017C14A.PDF>
- 37 *Quebec's Environmental Quality Act*. <http://legisquebec.gouv.qc.ca/en/ShowDoc/cs/Q-2>
- 38 Canadian Council of Forest Ministers. <https://www.ccfm.org/english/coreproducts-cc.asp>
- 39 Federal Sustainable Development Strategy for Canada 2016-2019³⁹ details <http://www.fds-sfdd.ca/index.html#/en/goals/>
- 40 Vancouver Declaration on Clean Growth and Climate Change. <https://pm.gc.ca/eng/news/2016/03/03/communiqu%C3%A9-canadas-premier-ministres>
- 41 Pan-Canadian Framework on Clean Growth and Climate Change. <https://www.canada.ca/content/dam/themes/environment/documents/weather1/20170125-en.pdf>
- 42 Adaptation and Climate Resilience Working Group Report. https://www.canada.ca/content/dam/eccc/migration/cc/content/6/4/7/64778dd5-e2d9-4930-be59-d6db7db5cbc0/wg_report_acr_e_v5.pdf
- 43 *Canadian Environmental Assessment Act*. <http://laws-lois.justice.gc.ca/eng/acts/C-15.2/>
- 44 Millennium Ecosystem Assessment. <https://www.iucn.org/commissions/commission-ecosystem-management/our-work/cems-thematic-groups/ecosystem-services>
- 45 The Economics of Environment and Biodiversity. <http://www.teebweb.org/>
- 46 IPCC, 2012: Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation. A Special Report of Working Groups I and II of the Intergovernmental Panel on Climate Change [Field, C.B., V. Barros, T.F. Stocker, D. Qin, D.J. Dokken, K.L. Ebi, M.D. Mastrandrea, K.J. Mach, G.-K. Plattner, S.K. Allen, M. Tignor, and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 582 pp.
- 47 Secretariat of the Convention on Biological Diversity (2010), *Global Biodiversity Outlook 3*, May, 2010, p.56

- 48 Climate data and scenarios: synthesis of recent observation and modeling results, chapter 2. <https://www.canada.ca/en/environment-climate-change/services/climate-change/publications/data-scenarios-synthesis-recent-observation/chapter-2.html>
- 49 Invasive Alien Species. Environment and Climate Change Canada. <http://biodivcanada.ca/default.asp?lang=En&n=81BC7F85-1>
- 50 *Submission from FPT ADMS responsible for conservation, wildlife and biodiversity.*
- 51 *Submission from FPT ADMS responsible for conservation, wildlife and biodiversity.*
- 52 International Union for Conservation of Nature. Commission on Ecosystem Management. <https://www.iucn.org/commissions/commission-ecosystem-management/our-work/cems-thematic-groups/ecosystem-services>
- 53 Canadian Honey Council. http://honeycouncil.ca/archive/honey_industry_overview.php
- 54 Ontario Pollinator Health Action Plan. Ontario Ministry of Agriculture, Food and Rural Affairs. 48pp.
- 55 Eight Things You Should Know about Natural Solutions to Climate Change. Environment and Climate Change Canada. <https://www.pc.gc.ca/en/nature/science/climat-climate/huit-eight>
- 56 We Rise Together: Achieving Pathway to Canada Target 1 through the creation of Indigenous Protected and Conserved Areas in the spirit and practice of reconciliation. 2018. The Indigenous Circle of Experts' Report and Recommendations. Her Majesty the Queen in Right of Canada. 106 pp.
- 57 Working Group Report on Adaptation and Climate Resilience (to inform the Pan-Canadian Framework on Clean Growth and Climate Change). 2016. Environment and Climate Change Canada. Gatineau, Quebec. 78 pp.
- 58 Working Group Report on Adaptation and Climate Resilience (to inform the Pan-Canadian Framework on Clean Growth and Climate Change). 2016. Environment and Climate Change Canada. Gatineau, Quebec. 78 pp.
- 59 We Rise Together: Achieving Pathway to Canada Target 1 through the creation of Indigenous Protected and Conserved Areas in the spirit and practice of reconciliation. 2018. The Indigenous Circle of Experts' Report and Recommendations. Her Majesty the Queen in Right of Canada. 106 pp.
- 60 Indigenous Leadership Initiative – <http://www.ilinationhood.ca/wp-content/uploads/2016/10/Backgrounder-Indigenous-Guardians.pdf>.
- 61 Working Group Report on Adaptation and Climate Resilience (to inform the Pan-Canadian Framework on Clean Growth and Climate Change). 2016. Environment and Climate Change Canada. Gatineau, Quebec. 78 pp.
- 62 We Rise Together: Achieving Pathway to Canada Target 1 through the creation of Indigenous Protected and Conserved Areas in the spirit and practice of reconciliation. 2018. The Indigenous Circle of Experts' Report and Recommendations. Her Majesty the Queen in Right of Canada. 106 pp.
- 63 Pan-Canadian Framework on Clean Growth and Climate Change: Canada's plan to address climate change and grow the economy. 2016. Environment and Climate Change Canada. Gatineau, Quebec. 53 pp.
- 64 Pan-Canadian Framework on Clean Growth and Climate Change: Canada's plan to address climate change and grow the economy. 2016. Environment and Climate Change Canada. Gatineau, Quebec. 53 pp.
- 65 We Rise Together: Achieving Pathway to Canada Target 1 through the creation of Indigenous Protected and Conserved Areas in the spirit and practice of reconciliation. 2018. The Indigenous Circle of Experts' Report and Recommendations. Her Majesty the Queen in Right of Canada. 106 pp.

- 66 We Rise Together: Achieving Pathway to Canada Target 1 through the creation of Indigenous Protected and Conserved Areas in the spirit and practice of reconciliation. 2018. The Indigenous Circle of Experts' Report and Recommendations. Her Majesty the Queen in Right of Canada. 106 pp.
- 67 We Rise Together: Achieving Pathway to Canada Target 1 through the creation of Indigenous Protected and Conserved Areas in the spirit and practice of reconciliation. 2018. The Indigenous Circle of Experts' Report and Recommendations. Her Majesty the Queen in Right of Canada. 106 pp.
- 68 Indigenous Climate Action – <https://www.indigenousclimateaction.com/>
- 69 We Rise Together: Achieving Pathway to Canada Target 1 through the creation of Indigenous Protected and Conserved Areas in the spirit and practice of reconciliation. 2018. The Indigenous Circle of Experts' Report and Recommendations. Her Majesty the Queen in Right of Canada. 106 pp.
- 70 Elders' Statement of the Advisory Committee on Climate Action and the Environment (ACCAE) – http://www.afn.ca/uploads/files/climate_change_fmm/16-12-09_accae_elders_statement_fe.pdf