



FINDING THE NEXUS

Exploring Climate Change Adaptation and Biodiversity

INTRODUCTION

Climate change creates challenges for biodiversity conservation efforts; however, adapting to climate change is the new reality. This reality means species diversity, habitat ranges and ecosystem services have to adapt to climatic shifts. Canadian communities are becoming increasingly vulnerable to a range of impacts including, sea level rise, spread of invasive species, more frequent and intense storms and rising temperatures. At the global scale, climate change is expected to become the leading driver of global biodiversity loss, however, the message is not entirely grim. Governments around the world are already responding to these issues through the development and implementation of strategies that address the need for ecosystem protection and conservation. More and more, strategies are directly targeting the drivers of biodiversity loss by focusing on building community resilience and bridging climate change adaptation with biodiversity conservation efforts.

At the local level, municipalities are positioning themselves as leaders in biodiversity conservation and protection by taking an

integrated approach to their climate change response planning. The integrated approach to environmental conservation is proving to yield many benefits and win-win scenarios, such as improving infrastructure, human health and municipal services. This issue of ICLEI's Nexus series will explore how biodiversity management is contributing to climate change adaptation at the municipal level. By presenting the nexus between these global issues, this edition will highlight biodiversity conservation, and its vital role in building resilient communities.

DEFINING ADAPTATION:

Adapting to climate change means undertaking any initiative or action as a response to actual or projected climatic changes and which reduce the affects of climate change on built, natural, and social systems. By reducing the projected damages from climate change that cannot be avoided, adaptation measures are being created to minimize the negative impacts of climate change.

ABOUT NEXUS SERIES

The Nexus series is an ICLEI Canada publication that 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. The nexuses will provide examples of actions that have been taken at the local level to address multiple challenges facing local governments.

The focus of these publications is to showcase the importance of integrated action on climate change, and help municipal staff understand how climate change adaptation is not exclusive from other key climate change impacts. The series will highlight win-win scenarios by providing a detailed account of how to avoid mal-adaption based on examples from various local initiatives from within Canada and around the world

DEFINING BIODIVERSITY:

Biodiversity is the variability among living organisms, including the diversity of ecosystems, within and between species. Biodiversity provides *ecosystem services*, which is the benefits people obtain from ecosystems. These include provisioning services such as food and water; regulating services such as flood and disease control; cultural services such as spiritual, recreational, and cultural benefits; and supporting services such as nutrient cycling that maintain the conditions for life on Earth.

CLIMATIC IMPACTS ON BIODIVERSITY

Climate regulation is a key service that healthy ecosystems provide. Despite the importance of ecosystems and their services, biodiversity is globally being degraded and lost with species and genetic diversity declining at alarming rates. Various international organizations – such as the Secretariat to the Convention on Biological Diversity – are describing climate change as the leading challenge to conserving biodiversity. Within Canada, our climate is already changing with warmer temperatures, more frequent storms, increase in precipitation and drought; and these conflicting climatic changes are posing multiple threats for ecosystems and the species within them. Knowing this, where lies the solution? The mediator between biodiversity degradation and climate change is the development of adaptation and resilience building measures.

A wealth of research is currently focused on the response of biodiversity (species, communities, ecosystems) to various climate change scenarios. In order to understand how biodiversity will be impacted by climate change, scientists analyze how changing temperatures and precipitation will interact with species' "bioclimatic envelopes": the temperature, humidity, and precipitation needs of a given species and groups of species. The scale and sensitivity of these "envelopes" as well as dispersal ability varies from species to species, as some will be able to shift and expand their ranges, while others will struggle to adapt.

Other climatic impacts to take note of include:

- Wetlands do not migrate and are locked to their ecosystem making them highly vulnerable to changes in water and nutrient levels, and stress from the influx of development;
- Spread of invasive species such as Dutch Elm disease and Emerald Ash Borer is a real concern to municipalities since many trees are situated on public property. Even with preventative programs, the City of Winnipeg lost over 6,000 Elm trees in 2012;
- Human health is impacted with the spread of West Nile Virus, as mosquitoes pick up the virus more readily in higher temperatures, and studies have shown a direct correlation between virus outbreaks and above-average summer temperatures; and
- Decrease in clean and reliable water supply in the Prairie rivers, as summer flows are expected to decrease because of reduced snowmelt and glacier runoff, causing shallow groundwater resources that further compound water shortages.

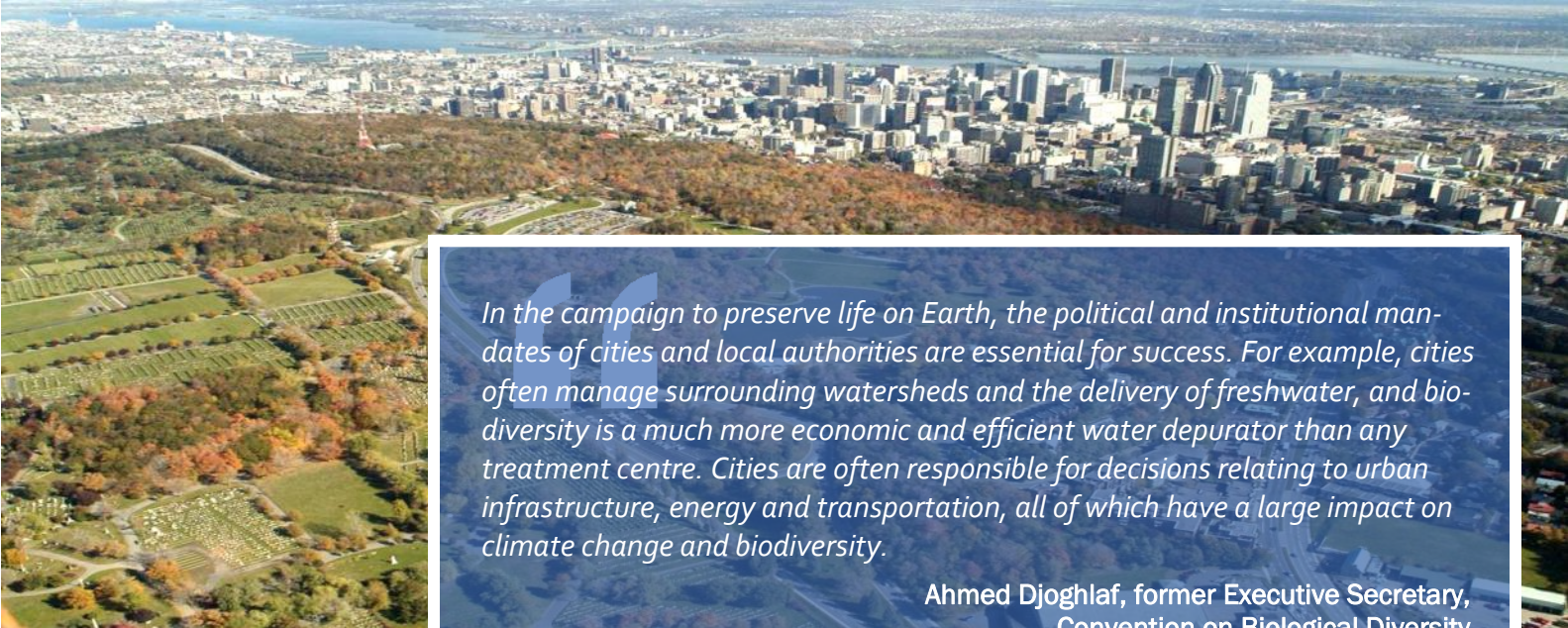
RESPONDING TO CLIMATE CHANGE

Governmental response to climate change is already occurring at global, national, and local scales. Though there are efforts to reduce greenhouse gas emissions, at present, environmental awareness at the local level on biodiversity is not in the mainstream in the same way as other sustainability issues – such as climate change or air quality. Many do not recognize urban spaces as a place for nature. Biodiversity is decreasing even though cities depend on healthy and thriving ecosystems as they have the potential to regulate climate, reduce ecological footprints, provide habitats, protect against hazards, support local agriculture, and offer recreational/cultural spaces. While many communities are making a real push for biodiversity conservation, the vast majority are taking an integrated approach to addressing climate change.

DEVELOPMENT OF A IPCC-LIKE MECHANISM FOR BIODIVERSITY

In response to the increasing global concern over biodiversity loss and the degradation of ecosystems, the United Nations Environment Programme (UNEP) has established an Intergovernmental Platform on Biodiversity and Ecosystem Services (IPBES). The IPBES will bring together science and research that can be used to guide policy development, management strategies and other forms of decision-making. This platform is described as an IPCC-like mechanism for biodiversity, and the goal is to address the lack of global response to biodiversity degradation by facilitating communication between environmental scientists and policy makers. Building on the success of the Intergovernmental Platform on Climate Change (IPCC), the platform will serve as an authority on the state of biodiversity and ecosystem health. IPBES publications will enhance our understanding of the relative impact of global change on biodiversity and ecosystem function, and will provide the sound scientific grounding necessary to develop biodiversity conservation strategies. [Find out more at www.ipbes.net](http://www.ipbes.net)





In the campaign to preserve life on Earth, the political and institutional mandates of cities and local authorities are essential for success. For example, cities often manage surrounding watersheds and the delivery of freshwater, and biodiversity is a much more economic and efficient water depurator than any treatment centre. Cities are often responsible for decisions relating to urban infrastructure, energy and transportation, all of which have a large impact on climate change and biodiversity.

Ahmed Djoghlaif, former Executive Secretary,
Convention on Biological Diversity

Integrated climate change responses restore resilience to a community by addressing the ecological, social, infrastructure and economic impacts of climate change; since hard infrastructure alone cannot bear the impact of a flooding event or drought.

WHY IS THERE A NEED FOR AN INTEGRATED APPROACH TO CLIMATE CHANGE RESPONSES?

Natural areas are needed to deliver essential services that protect human, plant and animal populations from climate hazards such as erosion, flooding, food security and availability, and the list goes on.

Most local actions that bridge climate change mitigation, adaptation and biodiversity conservation directly relate to the protection of ecosystems that provide a range of services and benefits for cities. These “benefits” include the absorption of excess water and reduction of runoff by protecting and conserving wetlands; reduction of greenhouse gas emissions and urban heat-island effect through the development of forest management strategies. Forests also provide essential habitat for species, shade for cooling during extreme heat days, and recreational usage; which is why urban forest strategies is the most common nexus initiative.

To protect ecosystems and landscapes that provide these services, many municipalities are acquiring land for protection, establishing partnerships with conservation organizations, private landowners, community members and upper levels of government.

As cities account for over 50% of the world’s population, local governments are presented with the challenge of mitigating encroachment on natural spaces while addressing rising development pressures. This stress to local biodiversity requires the efforts and attention of municipal governments to effectively manage and protect their region’s green infrastructure and municipal services.

For example, the low-lying and densely populated coastal city of New Orleans will be faced with sea level rise, more violent hurricanes, and increased flooding as a result of climate change, and the city’s adaptive strategy recognizes the value of their regional wetlands in mitigating the effects of these hazards. The city’s Master Plan now includes measures for wetland conservation and restoration as a natural defense to the variable impacts of climate change. These restored ecosystems will also mitigate excessive nutrient outputs to marine ecosystems and serve as habitat for a multitude of species.

ROLE OF LOCAL GOVERNMENTS

Climate change is one of many pressures facing biodiversity, and it is important that conservation initiatives anticipate climate change impacts and integrate the appropriate measures to avoid greater risks and identify opportunities. The impacts, and degree to which the impacts are felt at the local level, can change from year to year, and from community to community. One of the most common criticisms against sustainability and conservation strategies is their lack of accurate projections for future climate scenarios and ecosystem resilience, as well as, consistency in incorporating impacts into planning and development practices. However, scientific climate and biodiversity projections are not designed to provide accurate data down to the community level, leaving decision makers with considerable uncertainty. In this case, the actions of local governments have the potential to become contentious as municipal funds are directed towards adaptation measures and actions. To manage this uncertainty municipal authorities need to generate buy-in from their communities, as it is up to municipalities to effectively communicate its current value and the costs associated with its loss. Similarly, with climate change, communicating the cost of *inaction* should be central to public engagement efforts.

FINDING THE NEXUS

Municipalities often have to adapt their approaches as climate change impacts the day-to-day operations of municipal sectors including transportation, waste management, water services, energy usage, health services, and land-use zoning. With jurisdiction over parks, urban forests, and conservation areas, municipalities are positioned to integrate biodiversity-based solutions into adaptation planning. The following are recommendations for municipalities to consider when taking an integrated, nexus approach to their adaptation and overall community resilience-building strategies.



BIODIVERSITY CONSERVATION MEASURES

- Enhances aesthetic value of urbanized areas
- Promotes feelings of connectivity to the natural world
- Promotes the delivery of natural ecosystem services
- Enhances natural capital
- Enhances the educational value of biodiversity

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- Green infrastructure combats urban heat island effect, water stress, and pollution
- Protection of local wetlands enhances ecosystem resilience and storm surge protection
- Biodiversity conservation will buffer expected shifts in the provision of ecosystem services
- Enhanced biodiversity will maximize resilience against new pests and disease

CLIMATE CHANGE ADAPTATION MEASURES

- City infrastructure accommodates changes in precipitation and temperature
- Health programs are reintroducing natural places as areas for stress relief, and addressing new diseases being brought into communities
- Adaptive emergency response planning prepares communities for more extreme weather events
- Adaptive water management policies lessen the impact of extreme precipitation events

CASE STUDY

CITY OF SEATTLE CLIMATE CHANGE RESPONSE

After an examination of the potential regional impacts of climate change, the city of Seattle, the US geological survey, and the State of Washington combined their efforts to assess Seattle's regional vulnerabilities. Climate projections for the Seattle area point to the increasing occurrence of extreme precipitation over the next 50 years, and Seattle has developed a strategy to manage the associated increase in landslides by restoring vegetation to landscape-prone areas. To further demonstrate the importance of their natural areas, they calculated the economic value of their urban forest, and it was estimated that the storm water retention capacity of an enhanced urban forest would be valued at \$41,300,000 per year.

AREAS OF INFLUENCE

There are many ways local governments can influence the way their cities are planned and managed. The following areas showcase where biodiversity and adaptation can be cohesively addressed and integrated into municipal operations:

INFRASTRUCTURE

For urban areas with high population and building density, relying on biodiversity as “green infrastructure” for ecosystem-based adaptation may not provide the scale necessary to cope with climate change. In cases like this, cities need to evaluate the vulnerability of existing structures and use complimentary adaptive and biodiversity management to ensure that hard and natural infrastructure can reduce large-scale impacts. Around watersheds across Canada, development is reaching 100%, causing considerable strain on ecosystems to provide the necessary water retention capacity needed to cope with growing density levels. To resolve this, careful, ecological-based planning of communities is applied to reduce flooding and infrastructure degradation.

HEALTHY COMMUNITIES

Local governments have a commitment to preserve the health, safety and well-being of residents; however, it is important that ecosystem health is incorporated into this mandate. Ecosystem-based adaptation is one way cities are bridging climate change response. With biodiversity, for example, to mitigate urban heat island, cities are increasing permeable surfaces through greenspace, and also adopting shade guidelines through natural and built infrastructure. Biodiversity in urban environments has been shown to positively impact human health and well-being by reducing stress and can serve as an integral component of health-based adaptation measures.

VALUATION SERVICES

Determining the value of resources and ecosystems is a new field within the environment sector. More and more, the business case is being made to protect valuable species and ecosystems, and the argument being made in their defence is their functional and intrinsic value. Adaptation often relies on these messages: insurance, reducing risk and vulnerability, and the cost for lack of action, to communicate the importance of strong adaptation measures. Within biodiversity discourses, the same can be applied to the value of ecosystems and their services, such as forests as a carbon sink, or a wetlands ability to absorb excess nutrients. Without the value approach, it becomes easy to ignore how much our cities and communities rely on sound and resilient structures, both natural and man-made.

LAND USE PLANNING

Planning is an important tool cities utilize in order to coordinate and manage the overall vision for their community. To protect sites of ecological significance – such as areas with high biodiversity, rare ecosystems, wetlands, or mature forests – cities have to use planning to assist in achieving their goals. The ways cities do this is by land acquisitions, off-sets, zoning, and tradable development rights. Incentive-based program, with a framework similar to the carbon trading market, tend to be highly contentious. Offering developers the ability to remediate damage to one site by protecting another has critics questioning how the value of an ecosystem is decided and whether remediation efforts are adequate.

There needs to be synergy between the natural and built environment as our cities learn to adapt to climate change.



ECOSYSTEM SERVICES	BIODIVERSITY BENEFITS	ADAPTATION BENEFITS	NEXUS ACTION RECOMMENDATION
Urban forests absorb carbon from the air, reduce pollution and contribute to a healthy and diverse city	Trees provide habitat and allow for species dispersal, which is important to maintaining urban biodiversity	Trees provide shade and cool buildings, taking away pressure from the municipality to run cooling centres on extreme heat days	Increase connectivity and range of tree canopy by designing corridors, removing barriers for dispersal, and reforestation
Wetlands provide storage and filtration of water and also buffer storm surges	In some cities, wetland serves as regional biodiversity hotspots, providing habitat for migrating species and refuge for extirpated species	For coastal cities wetlands will buffer increased storm activity, reduce damage to local infrastructure and minimize impacts on human health	Establish wetland protected areas, monitor their capacity to absorb excess water and identify species that depend on wetland habitat
Insect and bird populations pollinate local food crops and vegetation	Pollinating species maintain genetic diversity among vegetation and maintain species resilience to climatic changes	Conservation of pollinating species will buffer uncertainties of species range shifts	Increase public awareness of the value of pollinators by promoting pollinator-friendly gardening and reduce unnecessary pesticide usage
Rich biodiversity has aesthetic, recreational and educational value	Appreciation of biodiversity allows for public support of protected areas and conservation of greenspace	Ecosystems with high levels of biodiversity are more resilient to potential species invasion	Develop public engagement initiatives to increase awareness of the value of biodiversity as a component of climate change response strategies
Greenspace as a natural water purifier and mitigates run-off into waterways and lakes	Greenspaces decrease nutrients and pollution that would otherwise have harmful effects on aquatic ecosystems	Where many cities cannot cope with high stormwater runoff, green spaces control overflow and contamination in water supplies	Develop zoning and/or incentive based programs to protect the land adjacent to waterways

To find the **nexus**, focus on the delivery of an ecosystem service to ensure a win-win scenario.

CASE STUDY

CITY OF CALGARY BIODIVERSITY STRATEGY

Calgary, the largest city in Alberta, is situated 1048 metres above sea level, and has a climate that is highly influenced by the geographic elevation and proximity to the Rocky Mountains. Much of the city's natural open space is located along creeks and waterfronts in the river valley system, resulting in strong conservation and water management policies that have been internationally acclaimed.

In recent years, biodiversity conservation has become an important area for the city. To move biodiversity considerations forward, in 2010, Calgary joined ICLEI's Local Action for Biodiversity (LAB) program. They are the third municipality to join this international program (members also include Edmonton and Montréal) and are working towards the development of their Biodiversity Strategic Plan. This plan will serve as an umbrella policy that will encapsulate all relevant planning and protection policies The City is currently administering, as well as new and specific actions on biodiversity protection. This 10-year plan will be released late 2013, and incorporates biodiversity into how the city grows and develops; allowing the city to use their past experiences and successes in a meaningful way.

The City is also working on a 30-year strategic plan for Parks, *ImagineParks*, which will lay out a foundation of how staff, partners, and community members want to plan and manage their open space system, and ensure that the future of this system responds to the needs of citizens. To find out more about Calgary's biodiversity initiatives, visit: <http://www.calgary.ca/Biodiversity>



GETTING STARTED

FIRST STEP

Understanding the relationship between resilience building and biodiversity management.

SECOND STEP

Recognizing that there are many municipalities around the globe are already engaging with local biodiversity conservation and climate change adaptation strategies, yet the nexus between the two is only now being fully realized.

THIRD STEP

Getting to know the resources already available to municipalities that want to take an active role in integrating adaptation and resilience building into their operations. The key ICLEI programs bridging the nexus include:

ADAPTATION INITIATIVE

ICLEI Canada's Adaptation Initiative offers municipalities the opportunity to implement *Changing Climate, Changing Communities: Guide and Workbook for Municipal Climate Adaptation* in a collaborative way, as participants work towards developing and implementing their adaptation plan in real-time with facilitation and technical support from staff. The tools and support provided through the Initiative also helps to facilitate informed decision making

with regards to climate change and highlights opportunities to integrate adaptation planning with other key planning processes.

The program follows a five-milestone framework that will assist local governments with the creation of an adaptation plan, and participants will finish the program having been involved in all stages of the planning process—from development through to implementation and review.

LOCAL ACTION FOR BIODIVERSITY (LAB) PROGRAM

LAB is ICLEI's global flagship biodiversity program. LAB's approach is action oriented and customized for local and regional authorities and their partners to develop a biodiversity action plan and implement key initiatives. The program offers municipalities with a platform with expand their knowledge of biodiversity management through webinars, workshops, and staff support; and LAB cities are considered leaders in the field of biodiversity. Since the program's inception in 2006, it has expanded to include many more cities and has branched into thematic streams, including LAB Pioneers, Climate Change and Biodiversity and Biodiversity and CEPA (Communication, Education and Public Awareness).

We are in a time where climate mitigation is no longer enough, and impacts on our communities are becoming much more intense.



CONCLUSION

Adaptation is a natural phenomenon. Yet, the current scale and speed of global change demands that human responses transcend that evolutionary pace. It is clear that biodiversity underpins the ecosystem services that we depend on and climate change will alter the delivery of these services at local, regional and global scales.

It is important to consider that in more cases than not, adaptation and biodiversity activities are mutually beneficial. Both are globally significant issues that are finding a voice on the international stage. As more and more groups advocate for widespread challenges like global biodiversity loss, warming temperatures and crumbling infrastructure, it is up to municipalities to make communities resilient and demonstrate that local action does move the world.

With 20 years of work on climate change, we can say that awareness of the impacts of climate change exists at all levels of government. The overwhelming response by Canadian cities to the challenge of climate *mitigation* is a testament to the successes of capacity building activities targeted at local communities. For example, Partners for Climate Protection (PCP) members have implemented over 700 mitigation projects, representing more than \$1 billion in investments and 1.7 million tonnes reduction of GHG emissions. However, adaptation planning and biodiversity management is a newer field, that is steadily gaining traction with municipal governments in Canada.

As local governments often hold authority over biodiversity conservation actions, they are well-positioned to capitalize on the mutually beneficial relationship between biodiversity and climate change adaptation through partnerships, land acquisition, policy development, zoning, bylaws and setting the overall vision for the community.

This edition of the nexus has demonstrated the win-win opportunities from adaptation and biodiversity. The real benefit to cities both from a natural and hard infrastructure standpoint lies in the ability to make stronger and resilient communities. When both objectives are realized, you've found the nexus.

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UPCOMING ISSUES:

- Adaptation and Water Management
- Adaptation and Land Use

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