



## **WILD, CONNECTED AND DIVERSE: A BIODIVERSITY STRATEGY FOR TORONTO**

Prepared by Toronto City Planning and Parks, Forestry and Recreation  
with the Toronto and Region Conservation Authority

**September 2019**



*“We acknowledge that this Strategy was developed on the traditional territory of many nations including the Mississaugas of the Credit, the Anishinabeg, the Chippewa, the Haudenosaunee and the Wendat peoples and is now home to many diverse First Nations, Inuit and Métis peoples. We also acknowledge that Toronto is covered by Treaty 13 with the Mississaugas of the Credit and the Williams Treaties signed with multiple Mississaugas and Chippewa bands.”*

This Biodiversity Strategy aims to support Indigenous values about biodiversity and land stewardship.

---

## FOREWORD

“This place, named after *Tkaronto*, the Mohawk word meaning ‘where there are trees in the water,’ describes a deep rooted and meaningful relationship in natural stewardship between the people and the place. It is home to the five relations, the crawlers, swimmers, four-legged, winged, and the two-legged. The Haudenosaunee, Anishinabeg, Wendat, and Mississaugas of the Credit have been in a long relationship with the beings on this land. The biodiversity of this place once flourished. All Indigenous people from across Turtle Island have been a part of this relationship. We don’t see any hierarchy between us, the land, the waters and all beings.

We are interconnected and rely upon one another for food, shelter, medicine, clothing, and meaning. It has always been important for us to be in good relationship with one another. We have tracked the changes upon the land to guide our own movements when harvesting, hunting, or fishing. We make our decisions thinking seven generations ahead. We knew that if people fell out of relationship then an imbalance would occur. An imbalance is evident today due to the impacts of urbanization.

It is time that we all come together to become protectors and stewards of the lands and waters. Every being plays an important role in the intricate web of life. The sugar maples, *ininaatig*, the Ojibwe word meaning ‘male tree’ provide cleansing and nourishment with high mineral sap for drinking and sweets once processed into sugar. When the trees are tapped in the early spring they provide nourishment for the birds and other beings seen drinking the dripping sap. The sugar maple provides habitat for many songbirds and woodpeckers, while deer and hares nibble on the buds which provide them with an early spring feast. Specific birds feed on the insects that feed upon the leaves. Those fallen leaves in the autumn provide nourishment for the soil and other microorganisms living in the Earth. The sugar maple and other native trees and shrubs provide plenty for others; but our native species are under pressure due to urbanization, climate change and the overly competitive nature of non-native species.

Biodiversity is essential for the health and well-being of all beings. These relationships are interdependent and reciprocal. Let’s protect and support the biodiversity of this place by building or by deepening one’s own relationship with the land.”

### - Carolynne Crawley

*Carolynne Crawley is a Mi’kmaw woman with mixed ancestry from Nova Scotia who is dedicated to social and environmental justice. She is a trainer, mentor, public speaker and participated in the Toronto Biodiversity Strategy Advisory Group.*

# TABLE OF CONTENTS

00

01

02

**FOREWORD**  
3

**EXECUTIVE SUMMARY**  
6

**INTRODUCTION**  
8

A BIODIVERSITY  
FOR TORONTO  
8

WHAT IS  
BIODIVERSITY?  
10

WHAT IS  
ECOLOGICAL INTEGRITY?  
14

**BIODIVERSITY  
IN TORONTO**  
16

HISTORY AND  
PHYSICAL SETTING  
16

HABITATS  
18

SPECIES  
22

BIODIVERSITY HEALTH  
26



03

04

05

**THREATS TO TORONTO'S  
BIODIVERSITY**  
28

HABITAT LOSS  
28

INVASIVE SPECIES  
30

CLIMATE CHANGE  
31

HUMAN ACTIVITIES  
31

**WHAT TORONTO  
IS DOING**  
32

POLICIES, REGULATIONS,  
STRATEGIES AND PLANS  
32

MONITORING  
35

HABITAT RESTORATION  
36

MANAGING INVASIVE  
PLANTS  
38

THE BUILT ENVIRONMENT  
40

COMMUNITY ENGAGEMENT  
42

**VISION, PRINCIPLES AND  
ACTIONS**  
44

VISION  
44

PRINCIPLES  
45

ACTIONS  
46

SUMMARY OF ACTIONS  
54

ENDNOTES  
60

IMAGE CREDITS  
61

## EXECUTIVE SUMMARY

**A**t a global scale, the loss of biodiversity has reached crisis levels, with recent reports from the United Nations highlighting the unprecedented rates of nature's decline. Biodiversity and a healthy natural environment are fundamental to supporting life on Earth. Biodiversity is also essential to the health and livability of cities and cities have an important role to play in protecting and enhancing biodiversity. The Toronto Biodiversity Strategy describes biodiversity in the city, what Toronto is already doing to support biodiversity and additional actions that can be taken to protect and restore biodiversity.

Prior to European settlement, the Toronto region was home to a rich diversity of plants and animals. The combination of habitat types, a temperate climate, and the stewardship of Indigenous communities helped to support a wide range of species with large populations. In a few hundred years, much of the original biodiversity was lost as settlement and urbanization displaced most of the original forest, filled in ravines, and dammed waterways.

In recent decades, Toronto has made gains in protecting, restoring and enhancing the natural environment. Restoration projects within the ravine system and along the waterfront are improving habitat, the urban tree canopy is being expanded, and biodiversity considerations are being integrated into planning decisions in the built environment. Municipal land use policies identify and protect a Natural Heritage System, including significant natural areas. These policies recognize the importance of ecosystem services provided by biodiversity in supporting resilience and sustainability. Provincial and federal initiatives such as the Greenbelt Plan and the Rouge National Urban Park protect important natural areas in and around Toronto. These regional plans recognize the link between urbanization and biodiversity conditions, and the important role urban areas will have in supporting biodiversity in this area moving forward.

Despite recent progress, urban growth continues to put pressure on local biodiversity. The number of people using the city's natural system is increasing; invasive species are displacing native plants and animals; and a changing climate is affecting the life cycles of many species and negatively impacting the ability of our natural areas to provide ecosystem services.

The Toronto Biodiversity Strategy builds upon work that the City of Toronto and its partners are already doing to enhance biodiversity. It aims to promote a livable city that supports biodiversity through the articulation of a vision, ten principles and 23 actions under the themes of protect, restore, design and engage. The Strategy's actions are complementary to provincial and national initiatives that contribute to global biodiversity recovery. The actions also align with the Toronto Ravine Strategy and other City strategies by addressing shared issues including ecological integrity, management of invasive species and the importance of local native plant material.





*“Where you have native species, you have biodiversity,  
where you have biodiversity you have health.”*

Diana Beresford-Kroeger, ‘Call of the Forest’



# 01 INTRODUCTION

## A BIODIVERSITY FOR TORONTO

Toronto is North America's fourth largest city with a population of 2.9 million expected to increase to 3.4 million by 2041<sup>1</sup>. Like most urban areas, Toronto experienced severe biodiversity loss as the city grew and most natural areas were replaced first with farmland and later with urban development. Nevertheless, Toronto still has a rich variety of biodiversity concentrated along a freshwater shoreline, in a connected ravine system, within an extensive tree canopy and in many parks and backyards. This rich legacy of biodiversity contributes to the City's well-being and provides valuable ecological services, including opportunities for recreation and relaxation. The challenge will be to:

- protect habitat that supports biodiversity from further loss;
- restore and enhance degraded natural areas, including water and soils that are the foundation for healthy ecosystems; and
- raise awareness about biodiversity and why it is important.

This is Toronto's first Biodiversity Strategy (the Strategy). It recognizes the intrinsic value of biodiversity and the important ecosystem services that biodiversity provides which are essential for a sustainable and resilient city. It aims to protect and enhance the quality and quantity of terrestrial and aquatic habitat within the City in order to support healthy, robust biodiversity and increase awareness of nature.

The Strategy is intended to recognize and advance the work of the City of Toronto, the Toronto and Region Conservation Authority (TRCA) and many residents and volunteers whose activities are contributing to help conserve urban biodiversity. This Strategy builds directly off the *Toronto Biodiversity Series* and the *Chief Planner Roundtable on Biodiversity* (2017). This Strategy is coming forward at a time of worldwide concern for biodiversity loss.

This Strategy provides an overview of the state of biodiversity; outlines the local context in Toronto; identifies key threats; summarizes ongoing initiatives; and outlines a vision, principles and set of 23 actions to address biodiversity decline in Toronto. Local examples and additional context is illustrated in text boxes throughout the Strategy.

### The State of Global Biodiversity

In May 2019, the United Nations (UN) Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services found that nature is declining at unprecedented rates never seen before in human history<sup>2</sup>. The report analyzed the state of biodiversity on Earth and identified a number of key findings, including:



- the rate of species extinctions is accelerating and negatively impacting people around the world;
- around 1 million animal and plant species are now threatened with extinction, projected to occur within just a few decades;
- the average abundance of native species in most major land-based habitats has fallen by at least 20%, mostly since 1900; and
- more than 40% of amphibian species, almost 33% of reef-forming corals and more than a third of all marine mammals are threatened.

The UN Report identifies the five direct drivers of change in nature with the largest relative global impacts: (1) changes in land and sea use (i.e. habitat transformation and fragmentation); (2) direct exploitation of organisms (e.g. over harvesting); (3) climate change (i.e. rising temperatures and habitat range shifts); (4) pollution (i.e. contamination of habitat) and (5) invasive alien species (i.e. widespread proliferation of non-native species). The Report importantly indicates that it is not too late to reverse this trend of biodiversity decline, but action is needed at every level from local to global.

The United Nations forecasts that by 2050, two thirds of the world's population will be living in cities<sup>3</sup>. Currently more than 80% of Canadians live in cities and that number is expected to reach 90% by 2050. As global and local migration shifts so heavily to cities, it is imperative to recognize the role of biodiversity and ecosystem services in fostering sustainable and resilient urban areas. Municipalities are uniquely positioned to play a significant role by developing locally tailored biodiversity solutions.

## Aligning Biodiversity Actions

Biodiversity loss is a global concern that requires action from all levels of government. In 1992, the United Nation's Convention on Biological Diversity identified the need for governments to take action to sustain living organisms, genetic diversity and the integrity of ecosystems. The UN Convention was updated in 2010 in the Strategic Plan for Biodiversity 2011 – 2020 and the Aichi Targets. In this Plan, biodiversity conservation in cities was identified as a priority, highlighting the links between urbanization, biodiversity loss and the importance of ecosystem services in supporting sustainability and resilience.

The UN Convention set the foundation for the development of Canada's Biodiversity Strategy (1995) and Ontario's Biodiversity Strategy (2011). The actions identified in Toronto's Biodiversity Strategy address the implementation of many of the international, federal and provincial targets that are relevant in the Toronto context.

# WHAT IS BIODIVERSITY?

Biodiversity or “biological diversity” is the variability among living organisms from all sources, including, among other things, terrestrial, marine and other aquatic ecosystems, and the ecological complexes of which they are a part. This includes diversity within species, between species and of ecosystems<sup>4</sup>.

Simply put, biodiversity is the variety of life on Earth. It includes all living things and the ways in which they interact with one another and their environment. There are three levels of biodiversity: ecosystem, species and genetic. Each level is important in its own way.

Ecosystem diversity is the variety of habitats and communities of plants and animals found in a certain area. Each ecosystem supports different species of plants and animals at different stages in their life cycle.

Species diversity refers to all the different types of species within a region, a habitat, or ecosystem. This means both the number of different species and the abundance of a particular species.

Genetic diversity refers to the variety within the same species. Maintaining genetic diversity within a species may improve that populations’ ability to adapt to local conditions and cope with environmental stresses such as climate change.

## Biodiversity in Toronto Ravines

*The ravines are the foundation of biodiversity in our city. They contain the greatest variety of ecosystem, species and genetic diversity in Toronto.*

At the ecosystem level, the ravines include a variety of habitat mosaic such as forests, wetlands, rivers, and streams and the ecological processes within them. A diversity of connected functional habitats support biodiversity, such as birds, frogs, turtles, and fishes that require these ecosystems for their lifecycle needs.

At the species level, the ravines contain a diversity of native species. Each species has important ecological traits and functions that support various ecological processes such as providing food sources thereby supporting overall biodiversity.

At the genetic level, most native species such as native oaks in Toronto ravines have the genetic diversity that allows them to be more adaptable and resilient to disturbances such as extreme climate events and pest infestations.



*“After all, our own health and ultimately our very survival is linked to the species and natural spaces that share the planet with us. Without plants, there would be no oxygen; without the life of the soil, there would be no plants; without unpolluted water, we would die.”*

Margaret Atwood and Graeme Gibson, Biodiversity Series, 2011

Our health, well-being, and economic prosperity depend on nature<sup>5</sup>. We all rely on healthy functioning natural processes (such as the water cycle and the nutrient cycle) to provide the necessities of life including clean air and water, food and energy. The diagram on the following page illustrates some of these key benefits (also called ecosystem services) that biodiversity provides to urban residents including relief from hot summer temperatures, prevention of soil erosion and opportunities for relaxation and recreation. Toronto’s ravine system, which contains most of the city’s habitat for biodiversity, is estimated to provide more than \$822 million in ecosystem services annually<sup>6</sup>.

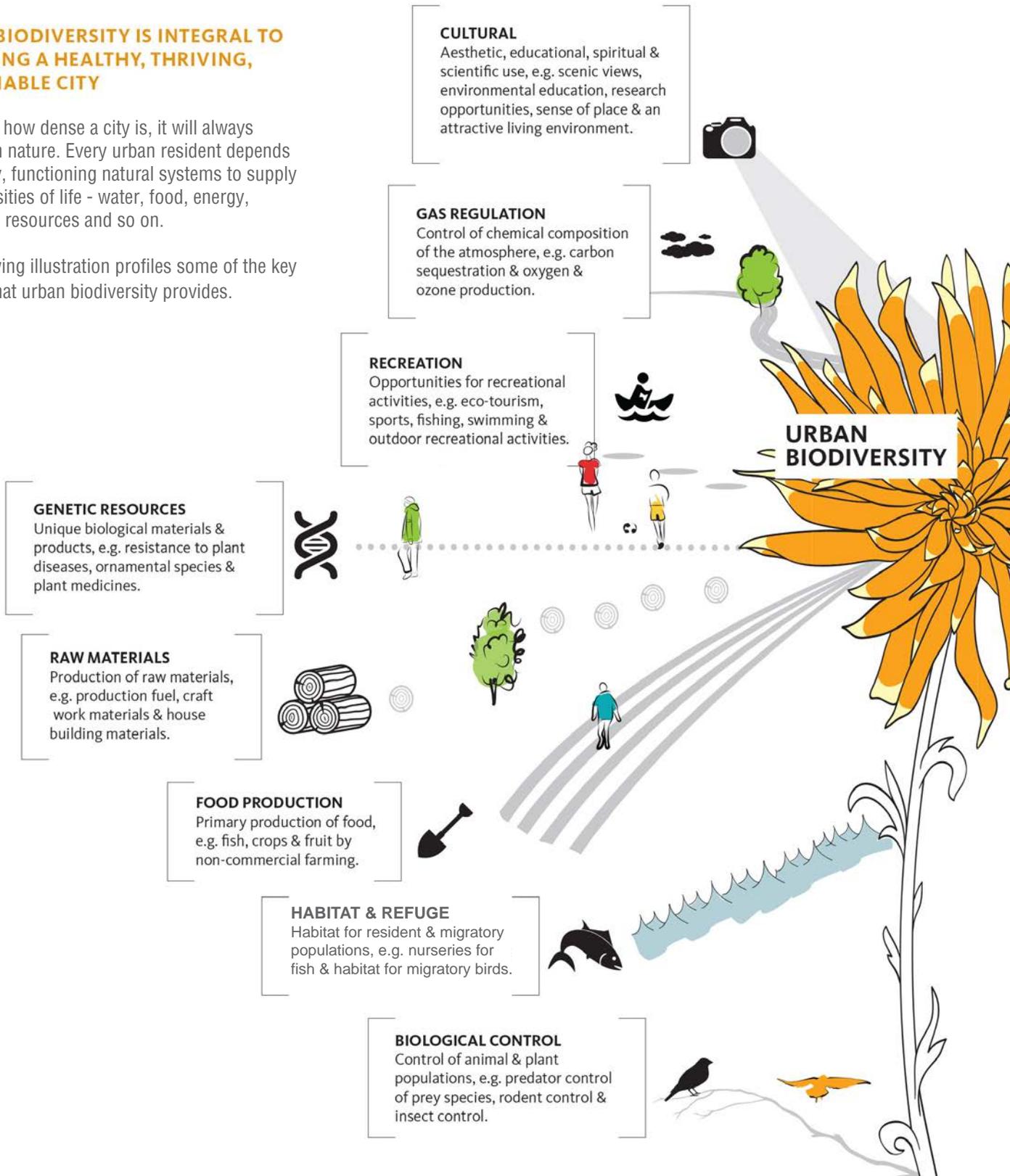
Aside from these quantifiable benefits, biodiversity should be valued in its own right. The sound of songbirds in the spring, watching a salmon navigate upstream or observing a monarch butterfly as it flutters along the shoreline on its fall migration south are experiences that enrich our lives.

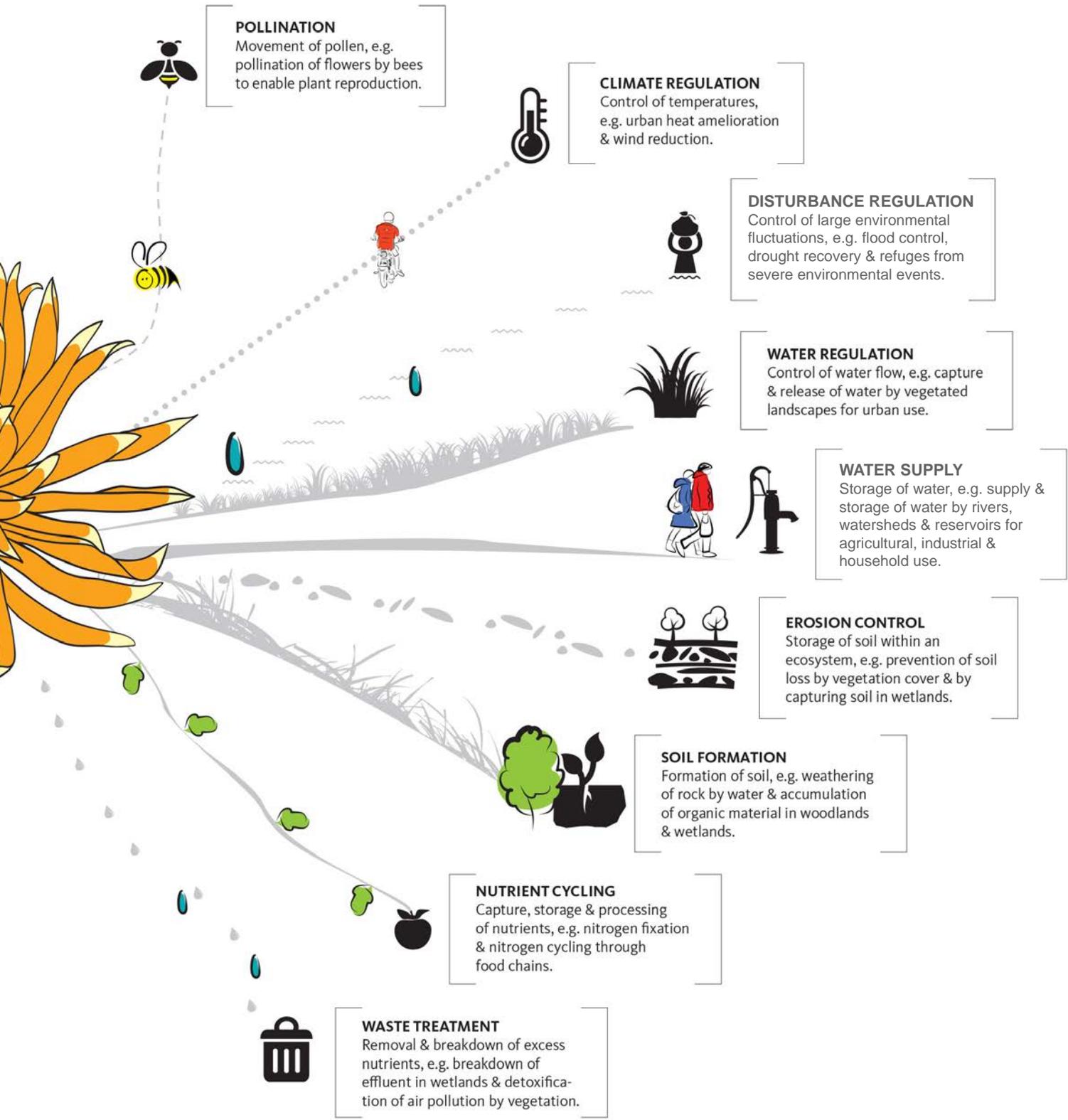
# KEY BENEFITS THAT URBAN BIODIVERSITY PROVIDES

## URBAN BIODIVERSITY IS INTEGRAL TO ACHIEVING A HEALTHY, THRIVING, SUSTAINABLE CITY

No matter how dense a city is, it will always depend on nature. Every urban resident depends on healthy, functioning natural systems to supply the necessities of life - water, food, energy, renewable resources and so on.

The following illustration profiles some of the key benefits that urban biodiversity provides.





# WHAT IS ECOLOGICAL INTEGRITY?

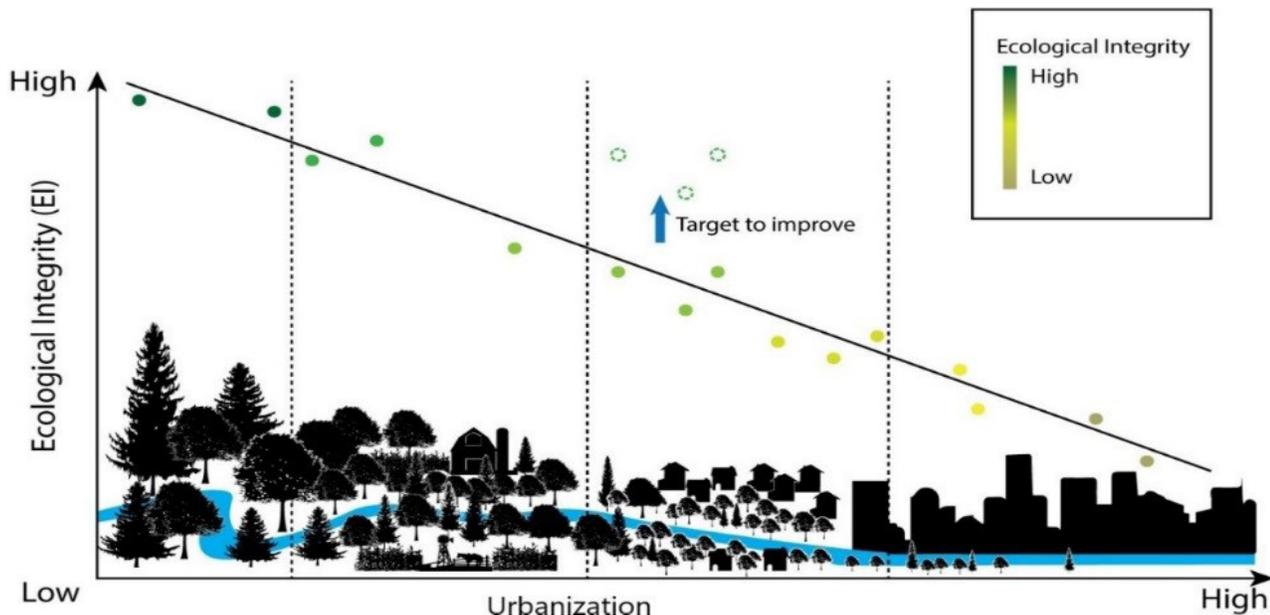
Biodiversity in urban areas is interwoven in complex systems that are made up of natural and built components, with human activity as the most dominant factor. Recognizing the integration of social and ecological systems can help to frame effective management and measurement approaches. ‘Ecological integrity’ is a framework used to describe an ecosystem that is “whole, intact or unimpaired”<sup>7</sup>. At the heart of ecological integrity is the naturalness of an area. Ecological integrity can be defined as:

*A condition in which biotic and abiotic components of ecosystems and the composition and abundance of native species and biological communities are characteristic of their natural regions and rates of change and ecosystem processes are unimpeded<sup>8</sup>.*

Ecological integrity is a well-established approach to managing large protected landscapes used by Parks Canada and Ontario Parks. This approach prioritizes decisions that seek to enhance natural processes, landscape structure and biodiversity<sup>9</sup>.

Toronto’s Biodiversity Strategy and Toronto’s Ravine Strategy both focus on managing natural systems within an urban environment. The vision for Toronto’s Ravine Strategy is “a natural connected sanctuary essential for the health of the city, where use and enjoyment support protection, education and stewardship”<sup>10</sup>. This vision guides the Ravine Strategy’s framework towards policy, investment, activities and stewardship action that will prioritize ecological integrity, where possible.

Ecosystems have the highest integrity when their mixture of living and non-living parts and the interactions between these parts are not disturbed by human activity. Ecological integrity provides a lens to examine the overall health of a landscape by monitoring the composition (species and communities present), structure (patterns of water, rocks, soil, etc.), and function (natural processes).



Relationship between Ecological Integrity and Urbanization



## Ecological Integrity in an Urban Context

*As urbanization expands and displaces natural areas, the ability of ecosystems to function at the same level as historic conditions becomes compromised. Managing for ecological integrity in this context requires assessing existing environmental conditions against both historic and contemporary baseline conditions. In this manner, ecological integrity can be interpreted as a continuum towards improved ecosystem functioning and not necessarily an end point.*

*The altered landscape and the actions of people living within these areas significantly influence the function of local land and water based ecosystems. Within an urban setting, management decisions must consider multiple objectives (co-benefits) that include the intrinsic values of nature, ecosystem services, as well as community well-being. While there are challenges to applying ecological integrity in urban landscapes where humans are an integral part of the ecosystem, using an ecological integrity approach can provide a framework for monitoring and help guide management decisions<sup>11</sup>.*

# 02

## BIODIVERSITY IN TORONTO

*“A city with... a connected system of natural features and ecological functions that support biodiversity and contribute to civic life”*

Toronto Official Plan’s Vision

### HISTORY AND PHYSICAL SETTING

Toronto is located in a place of particularly rich biodiversity, situated on the north shore of Lake Ontario and straddling two forests zones (the Carolinian Zone to the south and the Great Lakes- St. Lawrence Zone to the north-east. Toronto’s rich diversity of plants and animals was supported by a history of land stewardship by Indigenous peoples, and natural elements including a temperate climate, productive soils and availability of freshwater.



#### Toronto on North American Bird Migration Route

*Toronto is at the convergence of two major paths for migratory birds: the Atlantic and the Mississippi flyways. Each spring millions of birds pass through Toronto on their way to breeding grounds in the Boreal forest and then again in the fall on their way to wintering grounds in southern latitudes. Most of these birds are travelling through Toronto but some also stay and breed in the City.*



Prior to European settlement, the natural landscape of Toronto was defined by a mix of hardwood forests, dominated by maple, beech and hemlock trees. In low-lying wet areas, forest and shrub swamps were typical, with extensive marshes at the mouths of the Don, Humber and Rouge rivers. Drier sites on well drained sandy soils featured rich prairies and oak savannahs. This landscape supported a wide range of species with large populations. For example, animals like the passenger pigeon existed in numbers so high that their presence exerted a deep influence on the landscape promoting the growth and distribution of oak trees as well as important Indigenous food crops.

Over the last three centuries, forests were cleared, rivers damned and most natural areas were converted to agriculture and then later to asphalt, brick, turf grass, concrete and glass as the city spread outwards and upwards from the shoreline. Low marshy areas such as Ashbridges Bay, some ravines and parts of the shoreline were filled in and the lower Don River was channelized to make way for urban development. Atlantic salmon, eel and lake trout were amongst the largest fisheries in the late 1600's<sup>12</sup>. By the 1800s over-fishing, the expansion of local sawmills, pollution in rivers and dredging of the shoreline for gravel led to dramatic declines in major fisheries and local extirpations of species like the Atlantic salmon. As the landscape changed, native wildlife that relied on large tracts of forest such as black bears, cougars, wolf and others were unable to sustain viable populations in this new environment. Forest and wetland birds, reptiles and amphibians declined as habitat quantity and quality deteriorated. At least 10 fish species, 11 mammal species, and 6 herpetile species historically found in Toronto are no longer present. As ecologist John Riley described, after three centuries of conversion, the natural landscape of Toronto is a “shadow of its former self”<sup>13</sup>.

## The Passenger Pigeon

*The passenger pigeon was once found in large numbers in the Toronto area. In massive flocks, pigeons would redistribute vast quantities of germinated nuts and seeds from their droppings, encouraging migration of plant species<sup>14</sup>. Many of the food plants that Indigenous nations collected and grew were distributed by moving pigeon flocks, including grapes, cherries, strawberries, wild rice and corn<sup>15</sup>. Now extinct due to widespread hunting and landscape change, the passenger pigeon still lends its name to Mimico, which comes from the Algonkian word Omimeca, which means “resting place of wild pigeons”, as the mouth of Mimico Creek was once an important migratory stopover site<sup>16</sup>.*

# HABITATS

Habitat is where organisms find food, shelter, refuge and where they reproduce. Healthy habitat is key to healthy biodiversity. Most of the remaining natural habitat in Toronto is found within the Natural Heritage System – mostly located in the ravines and along the shoreline. Habitat is also found in urban green spaces such as manicured parks and other open spaces (such as golf courses and cemeteries), utility corridors and in some back yards.

## Natural Heritage System

There are approximately 8,595 ha of terrestrial natural habitat remaining in Toronto, equivalent to 13.5% of the area of the city<sup>17</sup>. This habitat is found within the Natural Heritage System – a network of ravines, valleys and shoreline that contain protected forests, wetlands, valleys, beaches, bluffs, tall grass prairie and watercourses. Collectively these areas provide shelter, food sources, breeding, overwintering and stopover areas for hundreds of species of plants and animals. Large areas of natural habitat are particularly important because they contain, or have the potential to contain higher quality habitats, such as interior forest, and a greater diversity of habitats in larger patches which helps to maintain genetic biodiversity. Toronto’s largest forest habitat is found in the Rouge Valley, Morningside Park and the area around Sunnybrook Park.

Aquatic habitats are also an important part of the Natural Heritage System. There are over 320 km of streams draining six watersheds and approximately 150 km of Lake Ontario shoreline (including the Toronto Island). Aquatic habitat categories include riverine (both warm water and cold water) and coastal wetland habitat.

## Environmentally Significant Areas

Environmentally Significant Areas (ESAs) are hot spots of biodiversity in Toronto. They contain habitats for species at risk or species of special concern; habitats of unusually large size or high diversity; rare and unusual land forms; or they provide ecological functions that help to maintain a healthy ecosystem within and beyond the city such as providing stopover locations for migratory wildlife. There are 86 ESAs identified in Toronto.

## Parks and Other Open Spaces

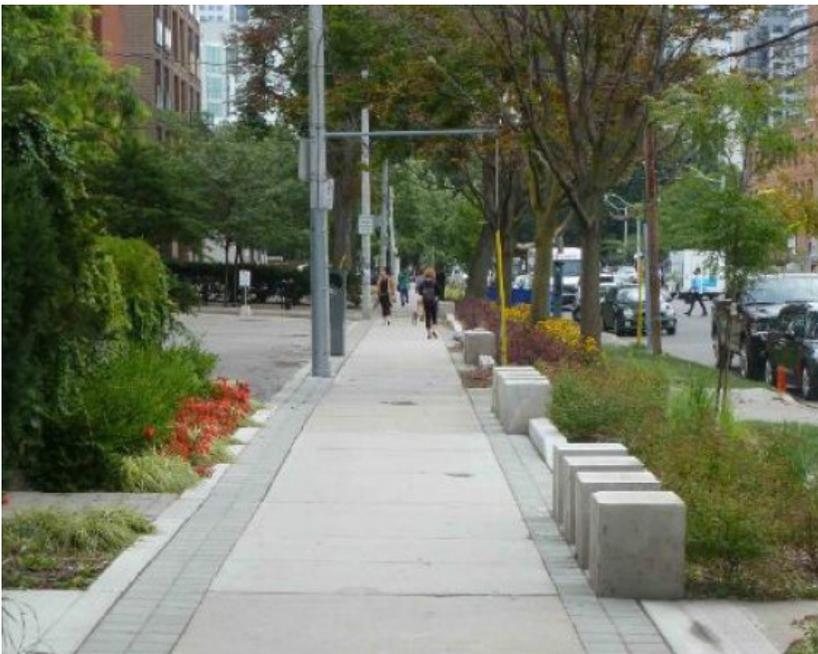
Public parks that support active recreational facilities and amenities such as sports fields and splash pads, as well as cemeteries and even golf courses can contain habitat that contributes to biodiversity. Because they are smaller, more manicured and isolated from the Natural Heritage System, they provide lower habitat value and ecosystem function than areas within the Natural Heritage System. Nevertheless, they still provide opportunities for biodiversity with shrubs, trees, and sometimes small ponds. Examples include Trinity Bellwoods Park, Downsview Park, Allan Gardens, and Mount Pleasant Cemetery.

## Green Corridors

Green corridors are linear systems that help link ecological core areas and support genetic biodiversity by enabling dispersal and movement of plants and animals, while also performing important ecosystem functions. Green corridors in Toronto include hydro corridors such as the Meadoway and multi-use trails such as the Beltline Trail. Green streets which incorporate a variety of trees and vegetation and storm water management can also help link natural areas and provide some ecosystem benefits.

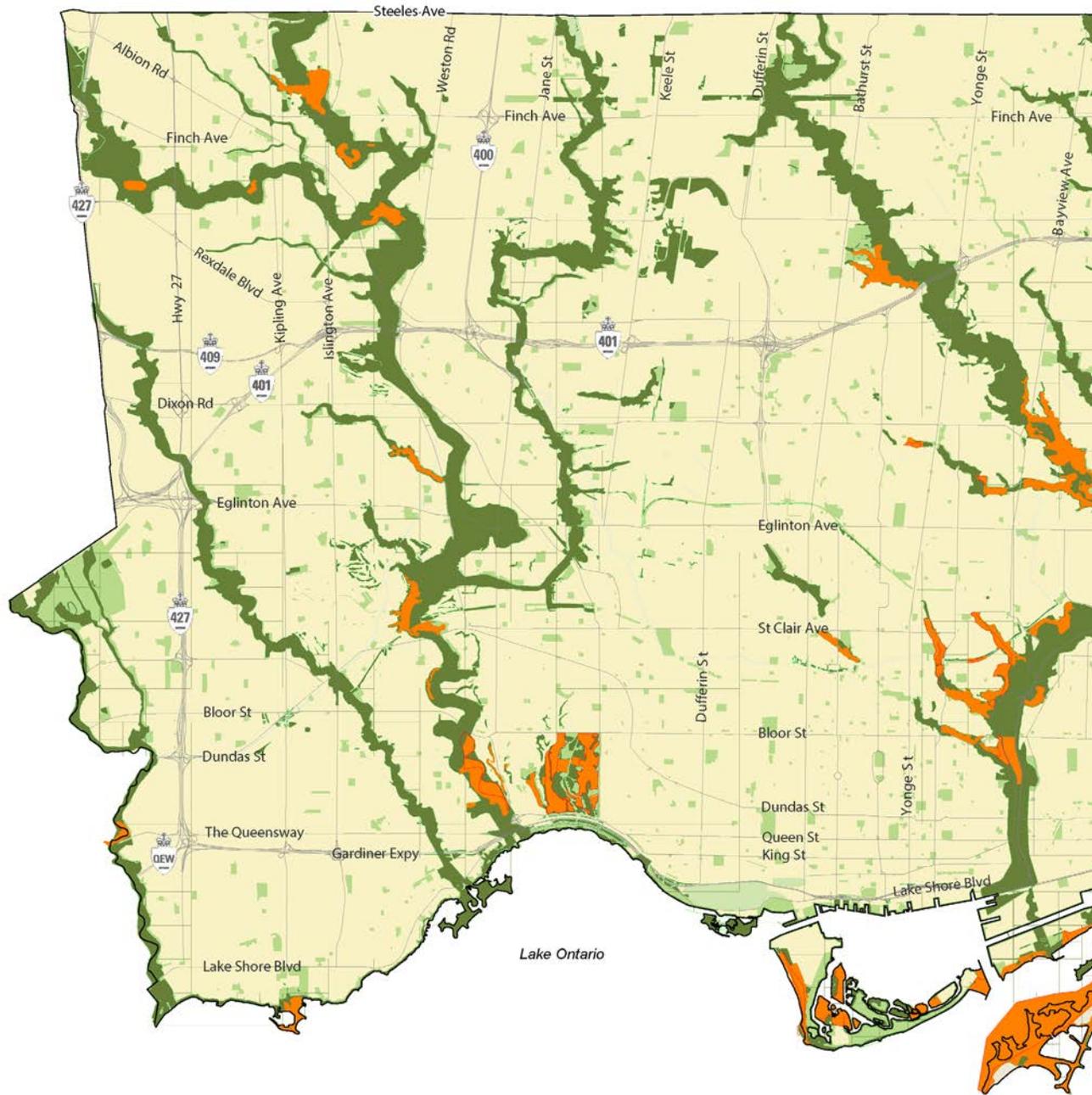
## Nodes and Patches

At a smaller scale, privately-owned backyards and green infrastructure (such as trees, storm water management systems and green roofs) can form habitat fragments or 'islands of green'. Most of these node and patch areas are largely isolated from other natural areas and surrounded by urban development. Despite being quite degraded they can support smaller or less diverse populations of animals and plants as well as mobile birds and insects. If maintained and improved, these patches can play an important role in increasing the overall connectivity of the network by providing a matrix of stepping stones between larger natural areas.



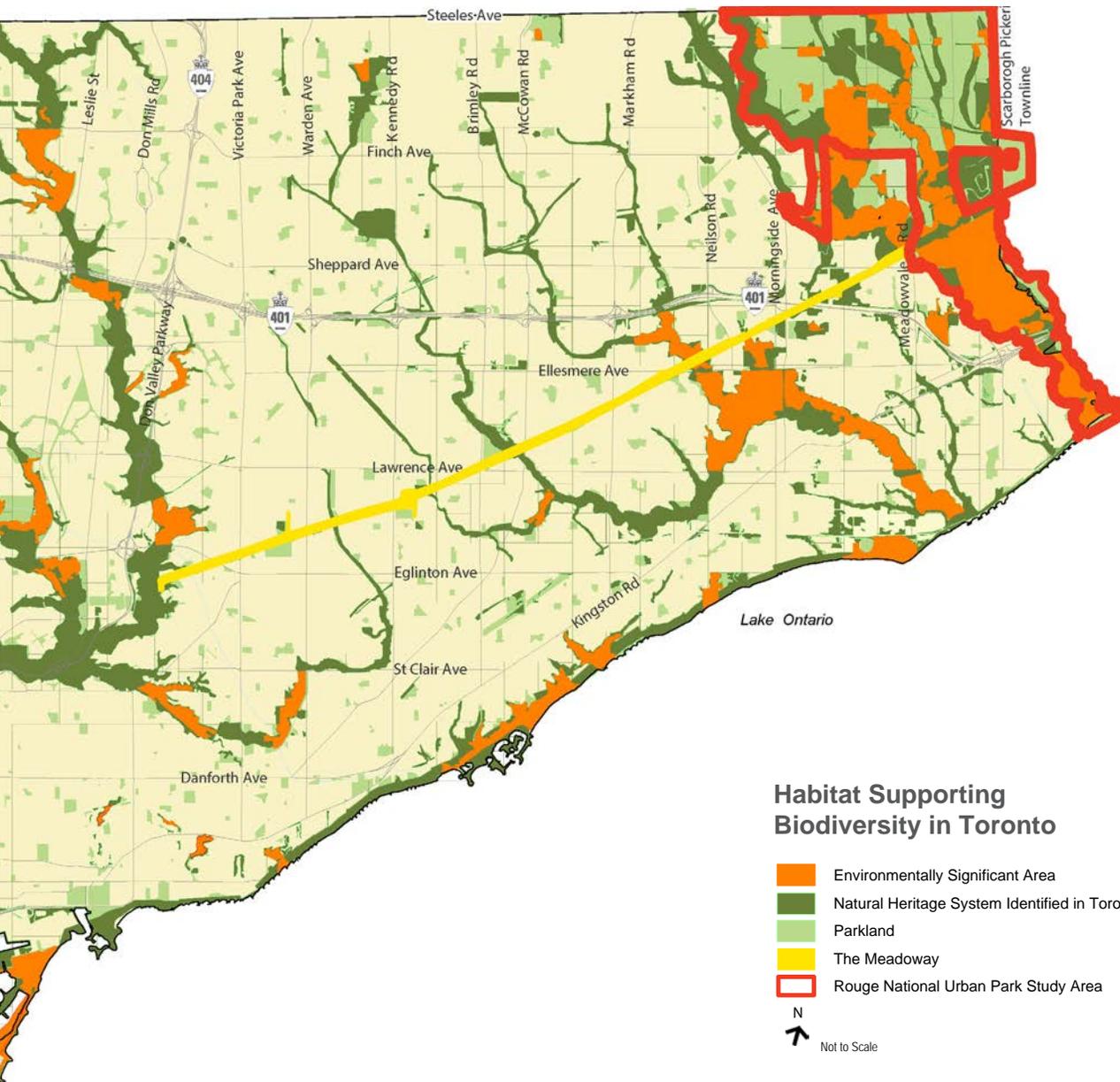
### Greening Streets

*When undertaking capital improvements along city streets, Transportation Services plants native trees, shrubs and plants whenever possible, increasing potential habitat and adding to biodiversity.*



## The Meadowway

*The Meadowway is an initiative to revitalize a hydro corridor in Scarborough from mown grass into a meadow that provides high functioning biodiverse pollinator habitat. This 16-kilometre stretch of urban greenspace and meadowlands will become one of Canada's largest linear urban parks. This east-west corridor will eventually create a functional ecological and active transportation connection between the east Don River Valley and the Rouge National Urban Park. Over the next seven years, this site will become a place filled with butterflies, birds and wildflowers – a rich meadow landscape realized on a scale never before seen in Toronto.*



### Habitat Supporting Biodiversity in Toronto

- Environmentally Significant Area
- Natural Heritage System Identified in Toronto Official Plan
- Parkland
- The Meadowway
- Rouge National Urban Park Study Area

N  
↑  
Not to Scale

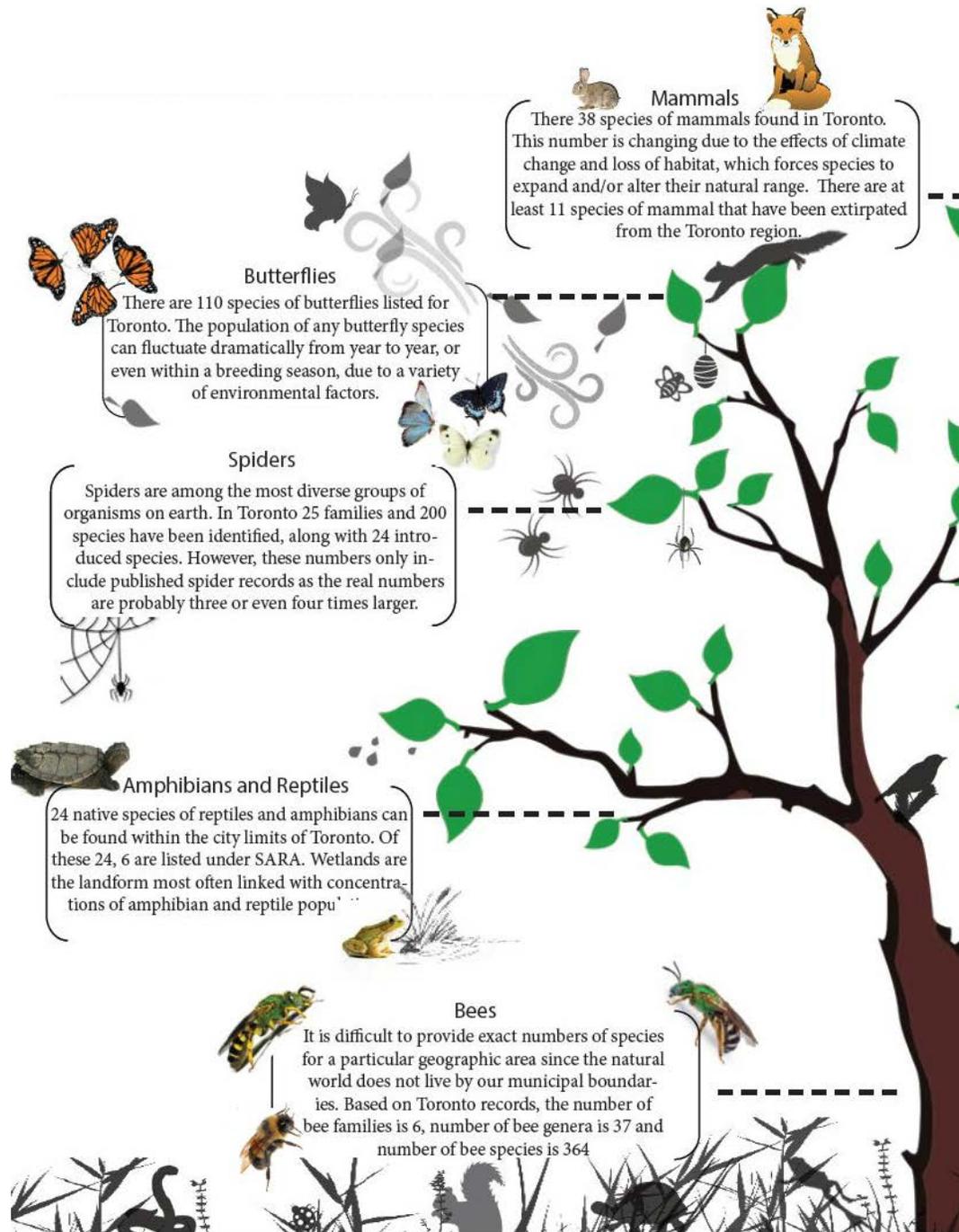
## Rouge National Urban Park

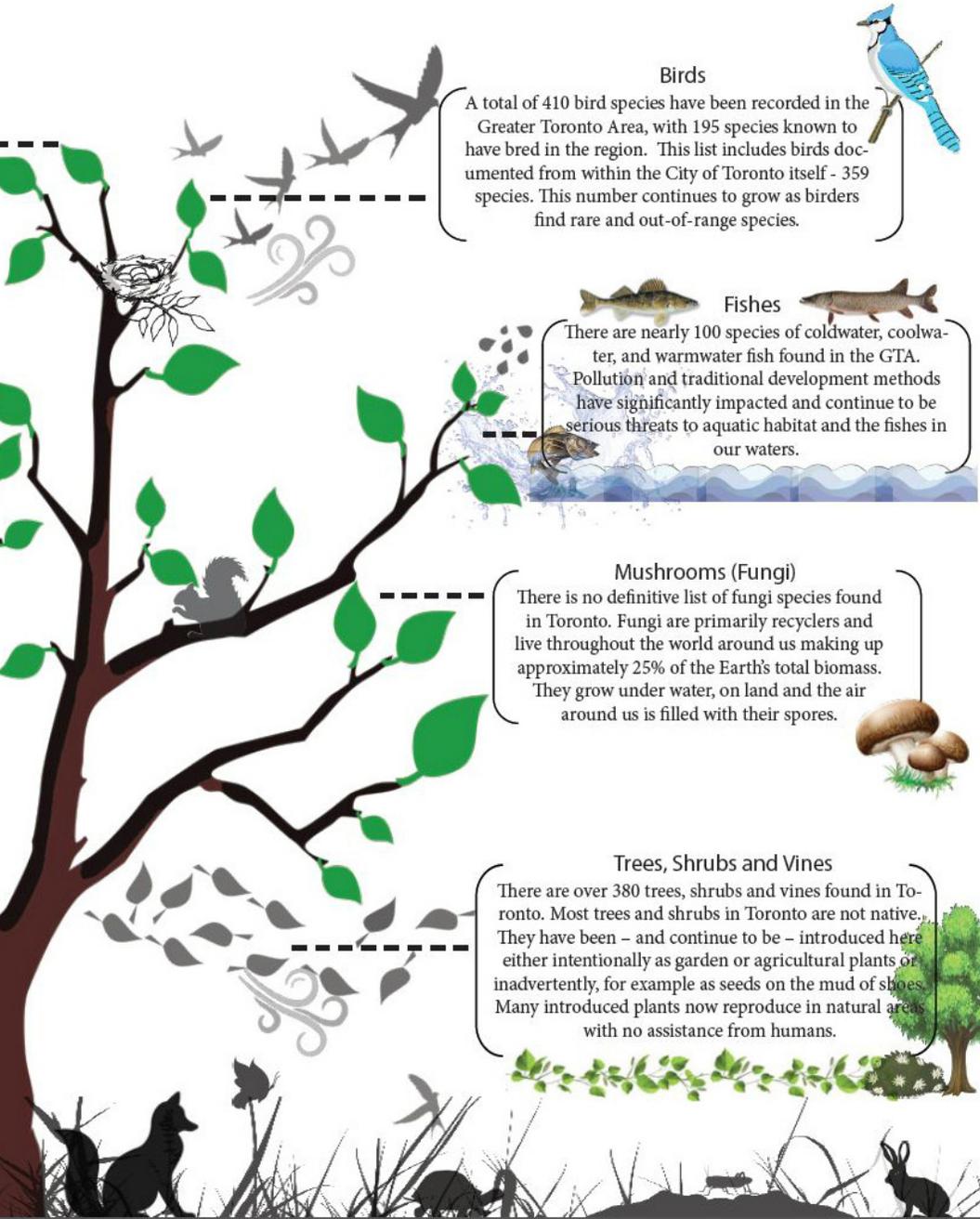
*In 2011, the federal government established Canada's first national urban park in the Rouge Valley area of east Toronto. Rouge National Urban Park includes remarkable biodiversity despite its location in Canada's densest urban region. More than 1,700 species, including 1,000 plant species, 247 bird species, 73 fish species, 44 mammal species, and 27 reptile and amphibian species can be found within the park. The Rouge's relatively high biodiversity is a result of the park's location and its many variations in topography, micro-climates, soil type and land use. Many types of habitat are found within the park, including forests, thickets, meadows, wetlands, rivers and agricultural fields. The park lies at the northern edge of the Carolinian Life Zone, a type of forest ecosystem that supports a rich diversity of life, including many rare and endangered species.*

# SPECIES

## Species Diversity

Historically, Toronto has experienced severe biodiversity loss due to urbanization and associated habitat loss, pollution and introduced species. Nevertheless, Toronto still has a surprising variety of plant, animal, and other species. The Toronto Biodiversity Series identified a number of species that have been found in the Toronto area.





### Birds

A total of 410 bird species have been recorded in the Greater Toronto Area, with 195 species known to have bred in the region. This list includes birds documented from within the City of Toronto itself - 359 species. This number continues to grow as birders find rare and out-of-range species.



### Fishes

There are nearly 100 species of coldwater, coolwater, and warmwater fish found in the GTA. Pollution and traditional development methods have significantly impacted and continue to be serious threats to aquatic habitat and the fishes in our waters.



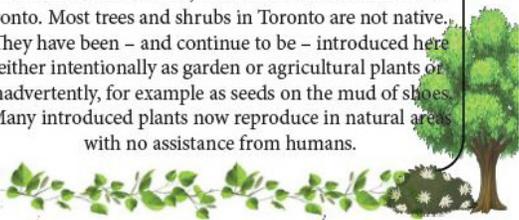
### Mushrooms (Fungi)

There is no definitive list of fungi species found in Toronto. Fungi are primarily recyclers and live throughout the world around us making up approximately 25% of the Earth's total biomass. They grow under water, on land and the air around us is filled with their spores.



### Trees, Shrubs and Vines

There are over 380 trees, shrubs and vines found in Toronto. Most trees and shrubs in Toronto are not native. They have been - and continue to be - introduced here either intentionally as garden or agricultural plants or inadvertently, for example as seeds on the mud of shoes. Many introduced plants now reproduce in natural areas with no assistance from humans.



Most of the species found in Toronto make their home within the Natural Heritage System; however, a large number can also be found in habitat patches, in parks, hydro corridors and backyards. Both common and rare species can be found in Toronto and all are important to supporting the city's biodiversity. Common native species are the foundation of our local biodiversity and need to be supported following the notion of 'keeping common species common'.

A number of non-native terrestrial and aquatic invasive species have been introduced to our region. These species negatively impact our native biodiversity by out-competing it. The proliferation of invasive species is discussed in more detail in the



## Toronto Biodiversity Series

*The Biodiversity Series is a collection of booklets that chronicle some of the amazing organisms that live in Toronto, including birds, butterflies, bees, spiders, mammals, trees and shrubs, mushrooms, reptiles and amphibians and fishes. The goal of the Series is to help re-connect people with the natural world, raise awareness about the seriousness of biodiversity loss and how it affects them, and help cultivate a sense of stewardship in residents. The booklets describe how current City policies, procedures and operations can be enhanced, altered or revised in order to help mitigate local biodiversity loss and engages residents on what they can do to enjoy and protect our local flora and fauna.*



## Keeping Common Species Common

*We often overlook the species we see every day. We may not even notice the American robin pulling a worm out of the ground at our local park, but the protection of these common species should not be ignored. In fact, due to their abundance, common species probably contribute more to our natural areas, ecosystem function and nature appreciation opportunities than uncommon or rare species. Ecological restoration projects that consider the landscape 'as a whole' including all the species that occupy that landscape, can result in better projects that provide benefits to a suite of species. Plus, since we are more likely to encounter common species, they afford us an excellent opportunity to better appreciate the natural world.*

## Species at Risk and Species of Regional Concern

Species at risk in Ontario are identified through the Endangered Species Act (ESA), 2007, as either extirpated, endangered, threatened or of special interest. The province, through the implementation of the ESA, and the federal government through the Species at Risk Act (SARA), 2002 provide assessments of at risk species, and government responses and strategies to protect these vulnerable species. Across Toronto, species at risk protection applies to plant species such as the butternut tree, and animal species like the piping plover, redbelt dace, monarch butterfly and rusty-patch bumble bee.

The TRCA has compiled a list of 'Terrestrial Species of Regional Conservation Concern' for species of concern within the Toronto region that are not covered by the provincial ESA or federal SARA. These species may not be currently rare, but are vulnerable due to their sensitivity to habitat loss and disturbances associated with changes in the surrounding habitat. This list is regularly updated as conditions evolve due to fluctuating environmental factors such as climate change. Some examples include amphibians such as the eastern red-backed salamander; reptiles such as Blanding's turtle; birds such as canvasback duck, wood thrush and sharp-shinned hawk; and mammals such as ermine and hoary bat.



### Species At Risk: Chimney Swift

*Every spring during migration, chimney swifts dart about the sky above Toronto neighbourhoods, catching insects on the wing. At dusk, the swifts begin to revolve around large chimneys. In just minutes, in a spectacular show, hundreds of swifts suddenly funnel down into their communal roost. Some chimneys are home to thousands of individuals for several weeks after they arrive in Toronto. When it comes time to start nesting, the swifts break up into pairs and find other, smaller chimneys throughout the city. Once they have successfully raised young, the families congregate, again using the large communal roosts while they prepare to fly south. We don't often think of cities as habitat for wildlife, but this species relies exclusively on chimneys for its survival.*

*Unfortunately, the number of suitable roosting and nesting sites and availability of food has declined so much over the decades that the population of chimney swifts has declined by 95% from 1968 to 2005<sup>18</sup>. In Ontario the chimney swift is listed as "threatened" under the ESA, 2007.*

# BIODIVERSITY HEALTH

## Ravines

A recent review by the TRCA compared fauna and flora data over several decades to evaluate the health of Toronto's ravines. While there is a significant range in the ecological conditions across the City, the review indicated that ravines and natural areas continue to provide habitat for many species including a number of locally, regionally and provincially sensitive species and species at risk. All 18 area-sensitive breeding bird species expected to be present in urban landscapes in this area were present and 24 mammal species were incidentally reported. Breeding bird species richness has remained relatively stable over the past forty years, with indications of losses in sensitive species such as red-headed woodpecker and wood thrush. Overall mammal species richness has remained constant over this time frame, with some positive indicators related to observations of river otters in the last decade.

A decline has been observed in the quality of vegetation composition along with an increase in invasive plant species presence. About 75% of the area surveyed by the TRCA since 2009 (1,615 ha or about 20% of Toronto ravines) was found to contain at least one of the 15 identified high-risk terrestrial invasive plant species; about one-third of the surveyed area was severely impacted. Several locations indicated that invasive species were already present four decades ago.

## Aquatic Systems

Fish biodiversity within the City of Toronto has changed from historical records to present day. Total fish species richness has remained fairly consistent, but there has been a decline in sensitive species and an increase in the number of invasive fish species. This includes the loss or reduced numbers of sensitive species like darters and several minnow species including one species at risk (reidside dace) and a trend towards more tolerant/generalist species, such as the creek chub, white sucker, blacknose dace, and longnose dace. The reidside dace (endangered) is now limited to a small reach within a single watercourse in Toronto and its remaining habitat is currently at risk.

Fisheries data from almost 500 locations on the Toronto area waterfront over the past few years indicate that the abundance of fish remains steady. Certain species, like the northern pike, a popular game species and top-order predator, has remained stable over the past few years; while pollution-tolerant fish species, like the white sucker and common carp are less abundant overall. These findings indicate that the many waterfront habitat creation and restoration projects undertaken by many partners over the last two decades are helping fish communities. Data collected from a high tech fish tagging study lead by Carleton University, with support from TRCA, provides further evidence that predatory fish higher up in the food chain, like walleye and northern pike, are actively using new and restored habitats in and around the Toronto Harbour. One walleye even travelled to Hamilton Harbour!

Overall, the benthic macroinvertebrate community - the aquatic insects inhabiting the streams and watercourses in Toronto - is dominated by pollution tolerant species which indicates that the streams are receiving a moderate to high level of organic pollution. Although this is an indication of a disturbed ecosystem, there are still some sensitive species present in some locations that reflect better water quality and habitat conditions. Benthic macroinvertebrate communities, including insects, worms, molluscs, and crustaceans have been widely used as indicators. They are good indicators of changes within the local aquatic ecosystems as they are stress-sensitive and less mobile compared to fish. Insects such as mayflies, caddisflies and stoneflies spend most of their lives as larvae in streams, eventually emerging as terrestrial adults. They play an important role in streams as they keep algal biomass balanced and help break down leaves fallen into streams. They are a

major source of food for fish and amphibians, and when the mature insects emerge as adults, they're a key food source for bats and birds inhabiting the ravines in the city.

## Tree Canopy

Toronto's first city-wide canopy study in 2008 identified approximately 10.2 million trees across the city, equating to approximately 26.6% canopy cover<sup>19</sup>. More than half of Toronto's trees are located on private land with the rest located in parks and along city streets. Toronto's urban forest is estimated to provide over \$28 million annually in ecosystem services including energy savings, carbon sequestration, pollution removal and avoided runoff<sup>20</sup>. This valuable resource contributes to Toronto's livability with additional economic and social benefits including improved physical and mental well-being.

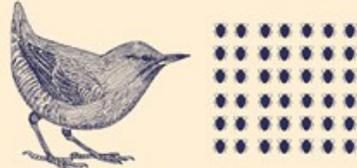
**Native plants are essential to biodiversity.**  
They have evolved to adapt to the local climate and soils of our region and they are well suited to meet the needs of native wildlife.



**They contribute to the functions of a healthy ecosystem by providing wildlife with valuable sources of food and shelter.**



**96% of birds feed their young spiders and insects such as caterpillars, flies, bees and midges.**



**Without enough insects, birds will have a difficult time successfully raising offspring.**

<p>native oaks</p> <p>supports</p> <p><b>500</b></p> <p>caterpillar species</p>	<p>asian ginkgos</p> <p>supports</p> <p><b>5</b></p> <p>caterpillar species</p>
---	---

**Non-native plants support very few insect species compared to native ones.**

## Importance of Native Plant Species

*Native plants are those that occur naturally in a region in which they evolved.*

*Unfortunately, most of the landscaping plants available in nurseries are not grown from locally sourced seed. These plants do not offer the same benefits to wildlife. Some landscaping plants are also invasive and can spread into natural areas where they outcompete native species, degrading the remaining habitat. The City encourages property owners to select locally-adapted native plants for landscaping wherever possible especially near natural areas. Every yard can make a difference, and many yards together can make a significant contribution.*



# 03

# THREATS TO TORONTO'S BIODIVERSITY

## HABITAT LOSS

**D**irect loss of habitat is the most significant factor in global, regional and local biodiversity decline. As a result of habitat loss, first due to agriculture and then to urbanization, many species of wildlife that were once native to Toronto have disappeared or are at risk of disappearing. Moose and elk disappeared during the initial European settlement of Toronto in the 1700s. By the beginning of the 20th century, northern river otter<sup>21</sup>, fisher, American marten, black bear, wolf, cougar, lynx and bobcat had all disappeared from the landscape. The groundhog (or woodchuck) used to be very common in Toronto but now is rarely seen. Habitat loss has also resulted in a significant decline in breeding and migratory bird populations. Migratory birds, like the piping plover struggle to find appropriate habitat on busy and groomed beaches.

While many butterfly species still thrive in Toronto's meadows, wetlands, shrub lands and forests, some, especially those with naturally small populations, could not adapt to the loss and fragmentation of habitat and can no longer be found in Toronto. Species like the Karner Blue have disappeared due to the loss of oak savannah. Habitat loss has also resulted in some bee species becoming endangered and even extirpated from the Toronto area. The rusty-patch bumblebee was once common and now has not been observed for nearly a decade in Ontario. Many reptiles and amphibians lack sufficient habitat to secure the existence of their populations in Toronto in the future. For the wood turtle, habitats lack sufficient connectivity through the city to enable their movement between habitat types in order to complete their life cycle. Locally common species could also be at risk if their habitats are further lost, fragmented or degraded.

Recent efforts to manage and reduce the impacts of historic habitat losses are well underway. Habitat loss in Toronto has essentially halted due to protection provided by land use designations and zoning. Activities are underway to restore and enhance formerly degraded natural areas within the ravines and along the waterfront, while new habitats are being created within built up urban areas.

### Habitat Loss Leads to Major Impacts at All Levels of Biodiversity:

**At the ecosystem level** - loss and fragmentation of habitat leads to isolation and degradation of the remaining natural patches;

**At the species level** - native species populations become smaller and more vulnerable to competition from invasive species; and

**At the genetic level** - species lose natural connectivity and opportunities for gene flow.



## INVASIVE SPECIES

The proliferation of non-native invasive species in terrestrial and aquatic systems is a significant threat to biodiversity. Non-native species can disrupt ecosystems in two ways. First, they have invasive characteristics including aggressive growth and adaptation to degraded conditions. Second, the removal of native species from an ecosystem can have cascading negative effects on other co-evolved species, which rely on the native species for shelter, food, pollination or other resources. As native flora and fauna habitat and life processes are disrupted, the ability of native biodiversity to persist long term is compromised.

Ontario has more invasive species than any other province in Canada and it remains vulnerable to new invasions due to geography, climate, degraded habitats and highly urbanized nature<sup>22</sup>. Urban landscapes often provide ideal conditions for invasive species, mainly due to: continuous disturbance allowing for easily dispersed, fast growing and more resistant species to establish themselves; and presence of multiple points of entry for non-native species including release or escape from surrounding landscapes.

Invasive species management is a challenge in large urban centres across North America. Other urban municipalities in Ontario are experiencing similar rates of invasive species as Toronto. Non-native, invasive organisms pose a significant threat to Toronto's natural systems and urban forests. As an international trading centre, Toronto is considered a high risk area for accidental import of pests, such as Asian long horned beetle found in an industrial park in 2003. Some of the most invasive species found in Toronto include dog-strangling vine, garlic mustard, European buckthorn (also known as common buckthorn), Norway maple, rusty crayfish, emerald ash borer and gypsy moth.



### The Norway Maple Story

*Norway maple was first introduced to North America from Europe in the 1700s and became popular as a street tree. By the early 1990's, Norway maple made up about 60% of the street tree population of Toronto (pre-amalgamation). It is now found in many of Toronto's ravines and natural areas where it out-competes native vegetation. Its success comes from many factors including its rapid growth as a result of a long growing season (early leaf out/late leaf fall).*

*Norway maple has a large crown that casts a dense shade, blocking sunlight from reaching understory plants. It depletes the soil of moisture that is required to support other vegetation. The fallen leaves contain phytotoxic chemicals that inhibit the growth and development of other vegetation; and its seed is highly successful in germinating and colonizing natural forests. The resulting loss of native understory vegetation leads to soil erosion and slope failure, as well as loss of biodiversity and habitat.*

## CLIMATE CHANGE

The future climate of Toronto is predicted to include more frequent extreme weather events such as heat waves and more extreme drought/rainfall. Changes in water and air temperature may make conditions more favorable for diseases and invasive species, which puts pressure on native species. For example, some species such as the gypsy moth, that used to be kept in check in part by our cold winters, are now more likely to survive the winter and are changing population dynamics in our tree populations. Extreme rainfall will lead to more flooding and erosion which affects the health of downstream water bodies and habitats. Temperature and changing weather patterns will also affect the life cycles of many species. As the climate changes some species will adapt by migrating to new locations, changing their breeding seasons or seeking new food sources. Less adaptable species will disappear from their current habitats.

## HUMAN ACTIVITIES

Walking off the designated path, allowing dogs to run off-leash through natural areas, hunting by outdoor cats, human foraging for food, picking or digging up wildflowers or other plants, dumping garden litter into natural areas, planting invasive plants, the creation of informal trails and structure – all these activities can significantly impact biodiversity by compacting the soil, spreading invasive species, trampling native vegetation and/or disturbing the stability of a natural area. This is especially true in an urban area where people are increasingly using natural areas as outdoor space. Increased understanding of the impacts of humans/pets on the natural environment and the importance of biodiversity may lead to behaviour change and support the need for better control over these impacts.

Serious threats to aquatic systems that result from human activity include overuse of salt and other chemical pollutants and exposure/release of sediment that may then be carried by rain into streams and Lake Ontario.





# 04 WHAT TORONTO IS DOING

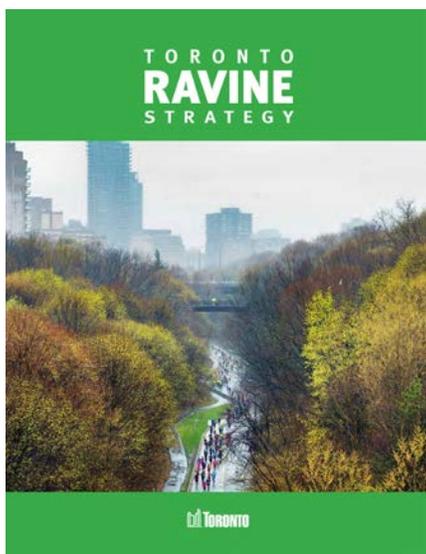
The City of Toronto works with a variety of partners to protect, restore and enhance biodiversity and engage the community. The projects described below illustrate key initiatives that the City and TRCA are undertaking that contribute to improving biodiversity and ecological integrity within the ravines, the urban forest and the built environment. This is not an exhaustive list but is intended to illustrate important ongoing and emerging work that addresses key threats to biodiversity in Toronto.

## POLICIES, REGULATIONS, STRATEGIES AND PLANS

Toronto has been proactive in protecting biodiversity through land use policies and regulations that protect natural areas within a Natural Heritage System. Toronto's Official Plan, Zoning bylaws and *Ravine and Natural Feature Protection bylaw*, along with the TRCA's *Regulation of Development, Interference with Wetlands*, and *Alterations to Shorelines and Watercourses* under the *Conservation Authorities Act* all work together to protect and direct development away from sensitive natural areas. Recently, the City amended the Official Plan to designate an additional 68 ESAs (for a total of 86) providing important ecological habitats with additional protection. Protecting ESAs in Toronto is akin to provincial and national efforts to protect ecologically important areas. Without this range of policy protection, these areas would continue to be lost.

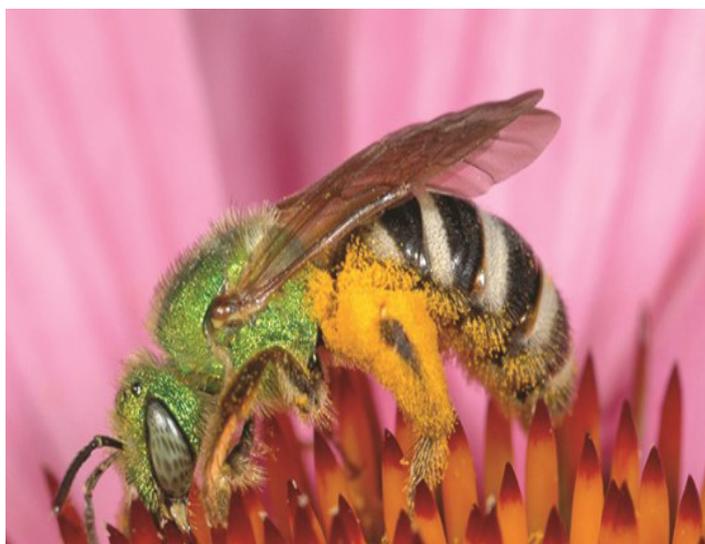
City and TRCA staff also work in partnership to undertake studies and develop strategies to guide the protection, restoration and management of natural systems including the Toronto Ravine Strategy, best management practices for ESAs and watershed plans. Outside the ravines, tree removals are regulated through the *Private Tree Protection bylaw*, *Trees on City Streets bylaw* and the *Parks bylaw*.

Other City-wide resource management plans recognize the importance of ecosystem services provided by natural systems and provide direction on their management to City Divisions. The *Strategic Forest Management Plan* identifies actions to achieve a healthy, sustainable urban forest with the goal of increasing canopy cover from 28% to 30-40%. The *Wet Weather Flow Master Plan* aims to reduce, and ultimately eliminate, the adverse impacts of wet weather runoff (runoff generated by rain or snowmelt) and prevent flooding, improve water quality in water courses and the lake, restore groundwater recharge and discharge and improve aquatic habitats. The *Pollinator Protection Strategy* introduced a series of actions to assist in protecting and encouraging pollinators in the city. Provincial and federal legislation that protects biodiversity also applies within Toronto including the *Endangered Species Act*, the *Invasive Species Act*, the *Migratory Birds Convention Act* and the *Environmental Assessment Act*.



## Toronto Ravine Strategy

*The Toronto Ravine Strategy (2017) is the first comprehensive, intentional and coordinated vision and strategy for Toronto's 11,000 ha ravine system. It aligns efforts and investments across several City divisions for greater coordination and to achieve a bold vision for these extraordinary places so they can be enjoyed for decades to come. The Strategy contains 20 actions to guide future management, use, enhancement and protection of Toronto's extensive network of ravines. The Ravine Strategy received a 2019 Canadian Society of Landscape Architects' Award of Excellence award in the category of land management.*



## Pollinator Protection Strategy

*Toronto is home to a wide range of pollinators, including bees, wasps, flies, butterflies, moths, beetles, and birds. The Pollinator Protection Strategy identifies actions that the City and community can take to protect our diverse native pollinator community. The City also has a complimentary PollinateTO grants program to fund pollinator habitat creation projects that educate and engage the community.*



## MONITORING

The City and TRCA are collecting biological data to help characterize the ecological health of the natural systems and identify trends. This information also informs ecological restoration, erosion mitigation and wildlife habitat enhancement. Some initiatives are designed to document ecological conditions across the city and to understand changes over time. Others collect species, habitat and other biological data to help inform local management decisions. Characterizing, measuring, and assessing biodiversity and ecological integrity can be a challenge, especially in an urban context. It requires the selection of indicators that are measurable and ecologically meaningful, can track progress toward management objectives, and are robust enough to capture variation within the study area, yet are feasible and practical to implement.

The TRCA's Regional Watershed Monitoring Program (RWMP) is a long-term monitoring initiative to monitor biodiversity at the species and ecosystem levels on a regional scale. It helps to assess ecological integrity by characterizing the structure and composition of the ecosystems monitored and identifying trends over time. The data informs watershed plans and report cards and can be applied at the local or site level to inform management decisions. Terrestrial ecosystem monitoring for the RWMP collects data on tree type and health, vegetation pests and diseases, composition and per cent cover of understory and ground layer species, and per cent cover of non-native species at permanent long-term monitoring plots throughout the city's natural areas (7 forest vegetation plots, 4 wetland vegetation plots, and 21 meadow vegetation plots). Composition and abundance of different breeding birds and frogs are also measured. Aquatic habitat sampling looks at fish and benthic macroinvertebrates<sup>24</sup> at 40 aquatic monitoring locations within Toronto's ravines. Fish are weighed, measured, and identified to species before being released and benthic macroinvertebrates are identified.

The City has undertaken a Tree Canopy Study that tracks trends in urban forest canopy cover. Detailed plot-based assessments were conducted in 2008 and 2018 to characterize the structure and function of the urban forest. A wide range of factors were measured at 407 permanent plots across the city, including species composition, canopy cover, shrub area under the canopy, age class and more. While it is very labour intensive, undertaking this study every 10 years will identify changes over time. These assessments help to inform urban forest strategies and management plans.

The City entered into a partnership with the University of Toronto's Faculty of Forestry in 2019 to establish an ecological monitoring program for Toronto's ravines and natural areas. Two hundred permanent monitoring plots have been established in ravines and natural areas throughout the city where data will be collected on plants at all spatial layers (ground, shrub, sub-canopy, canopy). Data on floristic quality, invasive species (type and abundance), woody debris, regeneration of trees and shrubs, and tree health will also be collected. This data will help to define baseline ecological conditions and derive indicators of ecological integrity to track success of management interventions and ecosystem changes over time. The same protocol is also being used by several other municipalities across southern Ontario, which will allow for vegetation quality comparisons across larger landscapes.

### Citizen Science

*Volunteers in the City of Toronto's Community Stewardship Program engage in various citizen science monitoring activities including pollinator monitoring and photo monitoring. Through partnerships with Humber College and Ecospark, the volunteers also monitor changes in size and density of invasive Phragmites patches to assess the effectiveness of control techniques. The City has also partnered with the Toronto Field Naturalists for ecological monitoring of flora and fauna in Cottonwood Flats from 2018 – 2020, which will help inform management decisions.*

## HABITAT RESTORATION

Ecological restoration supports biodiversity and ecological integrity by restoring ecosystem structure, composition and function. By focusing on the reversal or mitigation of landscape impairments, biotic and abiotic processes are restored, creating the foundation for a resilient natural system.

Urban Forestry plants over 100,000 trees and shrubs annually on streets, parks and ravines. The majority (approximately 80%) of the stock is grown from seed for use in naturalization and community plantings. Growing plant material from seed ensures that each individual has genetic diversity that contributes to more resilient landscapes.

In 2004, Forest Ontario and the City of Toronto developed an innovative pilot project for urban forests: using locally adapted seed of native species in tree planting projects to increase the genetic diversity of Toronto's urban forest. The concept of "biological appropriateness" recognizes that plants are genetically programmed to grow in sync with environmental cues in the location from which they originate. Since 2009, the City has planted 12,000 trees grown from local seed gathered in Toronto's ravines. The goals of the tree seed diversity project are to maintain native biodiversity at the site and landscape level, contributing to ecological health; as well as to maintain genetic variations within populations that may contribute to future resilience of Toronto's trees. TRCA also has a strong planting program that includes local seed collection. Seeds from native plants are collected and grown at TRCA's nursery and then used in restoration projects.

The City and TRCA also implement and monitor ecological restoration projects including streams and valley lands, wetlands, shorelines, grasslands, woodlands and forests and essential wildlife habitats. Sites are selected to provide maximum benefit to natural system function. Occasionally restoration projects are also selected based on opportunity (e.g. major capital works planned or new funding opportunity).

Toronto has approximately 300 km of informal natural surface trails. Good trail design and maintenance helps protect the natural environment, keep trail users safe and ensure an enjoyable trail experience. The City's Natural Environment Trail Strategy identifies opportunities and constraints and planning policies and management strategies to ensure the protection of natural areas while offering safe and enjoyable recreational opportunities for all natural environment trail users.

### Collecting and Growing Local Seed in the High Park

*In High Park, a program was initiated in the 90's to collect and propagate local seed in the High Park native plant nursery. This program provides stock for planting in the park as well as for selling to the public for planting in local private gardens. Some of the High Park stock has been planted elsewhere in the city, particularly in savannah restoration sites such as South Humber Park and Lambton Park. Seed has also been collected and propagated from other city parks.*

## Ecosystem Restoration - Blythwood Ravine



After restoration



Before restoration

*This small ravine near Mount Pleasant Road had been disturbed by mountain biking until 2007. The slopes were overgrown with invasive trees and shrubs like Norway maple and buckthorn. The bottom of the small ravine was compacted and there was no vegetation at all. In 2011 the site was closed to bicycles, invasive trees were removed and a mix of native trees, shrubs and herbaceous species was planted. In 2015, four years after planting, the site looks very different and supports the growth of healthy robust vegetation. The goal was to restore a valuable ecosystem by supporting the growth of native species. The work included protecting growing conditions, removing the invasive species that had taken over the site and replanting the native species.*

## MANAGING INVASIVE PLANTS

Many invasive plants are introduced accidentally as a result of escape from nearby gardens and the import of contaminated nursery stock or soil products. Once transported to new territory, they spread naturally or with the aid of human facilitated transport. The ongoing disturbance of our ravine and natural areas by recreational activities, land management practices, and land development provide ideal conditions for invasive plants to establish and thrive. Invasive plant species exhibit characteristics that make them expensive and difficult to control. These include rapid growth and young sexual maturity; prolific seed production; highly successful seed dispersal, germination and colonization; unbridled vegetative spread; and ability to out-compete native species. In extreme situations, invasive species may displace all other plants growing with them, forming single species habitats, which do not offer the same benefits to wildlife as native species.

The decision and actions to manage invasive species are extremely complex, especially in highly altered and continually disturbed ecosystems, such as the urban ecosystems in the City of Toronto. Techniques to manage invasive species tend to be resource intensive, while the distribution and scale of invasive populations are widespread. Decisions to actively manage or control invasive species requires an ongoing commitment to a site and must consider a complex set of factors that include the option for adaptive management as the landscape continually changes due to outside pressures.

The City's Urban Forestry group actively manages natural areas and are recognized as leaders in the management of invasive plants in Ontario. Urban Forestry also provides expertise on several regional working groups sharing information about invasive plants and natural area management with other land managers, including as a board member of the Ontario Invasive Plant Council. Both mechanical and chemical control methods are used to manage invasive plants. Herbicide is only used as a last resort for specific species when mechanical control is not effective. Spray applications are minimized wherever possible in favour of direct application to a freshly cut stump using a paint brush. Control and application methods are regularly updated based on best practices and lessons learned to increase efficiency and minimize herbicide use by combining mechanical and chemical control methods. Management and control of invasive plants are prioritized based on the following considerations:

- protection of high quality habitats and rare species locations (i.e. ESAs);
- low infestation level and/or new introductions;
- level of ecological threat, as per "Invasive Exotic Species Ranking for Southern Ontario, 2002";
- opportunities to coordinate with park construction and infrastructure projects;
- opportunities to increase connectivity of restored sites and expand areas adjacent to restored lands by undertaking restoration planting and removing invasive seed sources;
- need to address safety issues (e.g. erosion and slope stability, reduced sightlines); and
- sites where forest management has created significant forest gaps and there is risk of subsequent invasive plant expansion (e.g. ash removal after emerald ash borer infestation).



## Community Volunteers

*Urban Forestry engages community groups and volunteers to assist with stewardship, restoration and monitoring activities. Volunteers plant native species and manage invasive plants that do not require pesticide treatment and where control methods would not cause excessive site disturbance. Managing invasive species requires an ongoing commitment to a site.*

## THE BUILT ENVIRONMENT

The built environment presents both a challenge and an opportunity for biodiversity. The City, TRCA and other agencies look for opportunities to incorporate biodiversity into the urban fabric of the city in unique and innovative ways. Although these opportunities may not allow for ecosystems to be restored to their historic or pristine conditions they do improve the biodiversity and ecological integrity of the city landscape.

In 2006, the Toronto Green Standard (TGS) was introduced to address key environmental priorities in Toronto including protecting and enhancing ecological functions, integrating landscapes and habitats and reducing building-related bird collisions and mortalities. In 2009, City Council adopted the TGS sustainable design requirements for new private and city-owned development to help protect and encourage biodiversity by requiring new development to treat glass to prevent bird strikes, use night sky certified lighting and plant only native species adjacent to natural areas. Toronto was the first city in North America to adopt a bylaw to require and govern the construction of green roofs. In 2009, The Guidelines for Biodiverse Green Roofs identify how to design green roofs to create habitat opportunities and support biodiversity.

Detailed plans for new neighbourhoods such as the Port Lands, the High Park Apartment Neighbourhood and Don Mills Crossing include specific policies to protect, restore and enhance existing natural features and encourage new development to incorporate biodiversity by creating new habitat, planting a variety of species that are pollinator friendly and designing green roofs that are more biodiverse.



### Bird-Friendly Development Guidelines

*Hundreds of migratory birds die each year by colliding with windows. As of 2017, 162 species of birds have been killed by collisions with buildings in Toronto, 64 were Species at Risk<sup>23</sup>. In 2007, Toronto was the first city in North America to publish Bird-Friendly Development Guidelines – a comprehensive list of building design and operation strategies to make new and existing buildings less dangerous to migratory birds. This initiative has greatly assisted in drawing attention to the need to mitigate the dangers the urban environment poses to migrating birds and demonstrated how cities can play a role in reducing migratory bird deaths. In 2016 the City published “Best Practices for Bird-Friendly Glass” and in 2018 “Best Practices for Effective Lighting”, which updated our bird-friendly strategies. More recently, the Ontario Ministry of Municipal Affairs has engaged the Canadian Standards Association to develop bird friendly guidelines which could eventually be applied nationally.*



## Don Mouth Naturalization

*The revitalization of the Don Mouth is a precedent-setting undertaking aimed at transforming the mouth of the Don River from an industrialized channel with low biodiversity and ecological integrity to a healthier, more naturalized river outlet while simultaneously providing critical flood protection to Toronto's eastern waterfront. Naturalization of the Don Mouth will improve the aquatic and terrestrial habitat conditions at the mouth of the river, improve connectivity between the Don River and Lake Ontario, and create a more natural river landscape which will provide opportunities for recreation and enjoyment.*

## COMMUNITY ENGAGEMENT

Community awareness and engagement is fundamental to communicating the relevance of biodiversity to the public. Both the City and TRCA undertake and support community engagement activities aimed at increasing awareness of biodiversity and encouraging connection with nature and the outdoors.



### Community Stewardship Program

*The City of Toronto's Natural Environment Community Stewardship Program engages over 5,000 volunteers each year. Participants learn about native trees, shrubs, herbaceous plants, invasive species, ecological monitoring and sustainable trail design and help with on-going maintenance and monitoring activities in natural areas. Through this program, volunteers plant trees and shrubs in city parks and natural areas like High Park and the Humber Bay Butterfly Habitat. Restoration of natural environments can be very specialized, requiring professional training and specialized equipment. Sites are selected by considering factors such as: staff resources related to volunteer management; ease of training volunteers with specific plant identification; staff resources to support clean-up of events; safety issues related to poisonous plants or steep slopes; and the presence of rare flora.*



## Natural Environment Interpretive Projects

Many of the City's capital projects in parks and natural areas are designed to both restore habitat and native species and interpret biodiversity. The East Point Bird Sanctuary is part of a city-wide initiative to enhance and protect bird habitat and increase birding activity through public education programming. The material and design of the pavilions are meant to be evocative of flight, with cut-outs resembling flocks of birds above the names of birds that inhabit this significant migratory flyway stopover site. Nearby bird blinds provide safe vantage points for viewing.

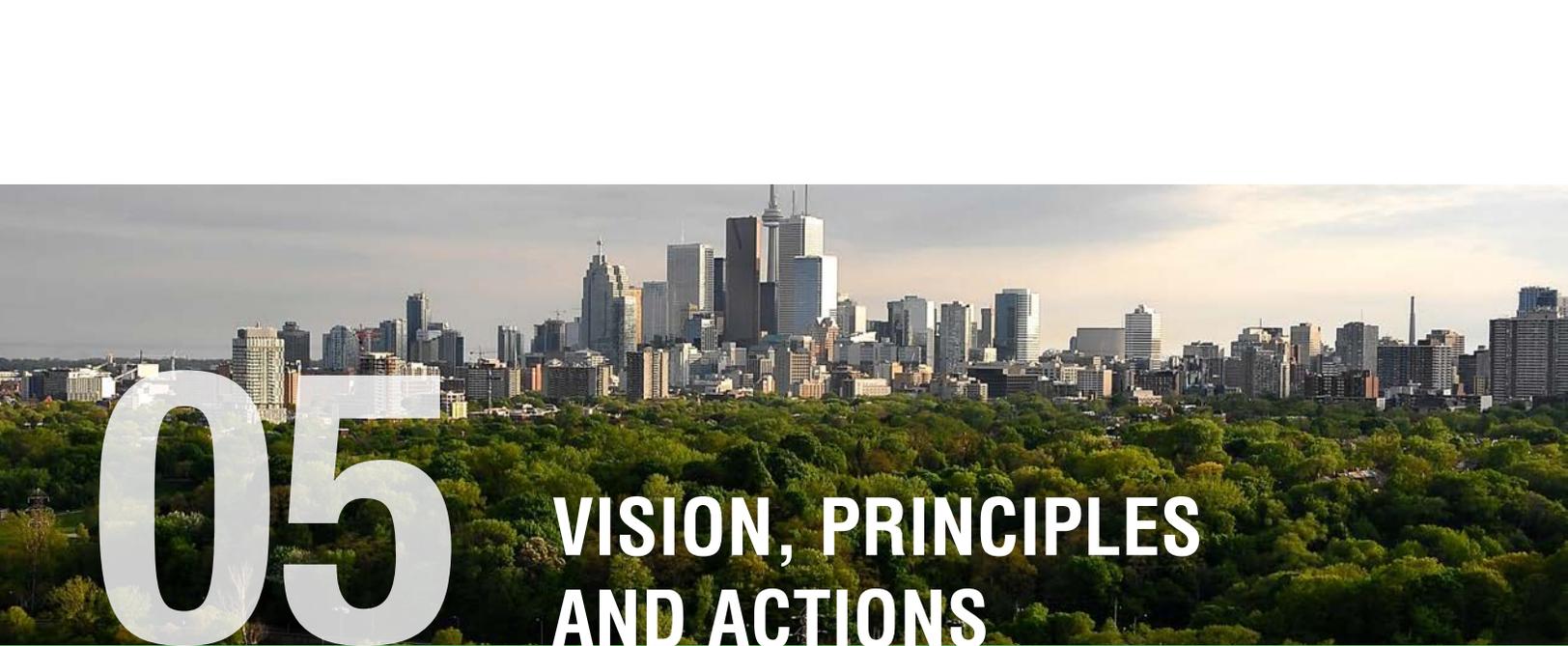
## The Pollinator Laneway

The Pollinator Laneway, a collaborative project between the City and the David Suzuki Foundation, intends to raise awareness about the importance of pollinators through colourful murals painted on laneway garages adjacent to Felstead Park in Toronto's east end. Voluntary "Butterflyway Rangers" find opportunities to plant pollinator patches in yards and parks and raise awareness about the importance of growing milkweeds and other wildflowers as a way to provide food and shelter for pollinators such as monarch butterflies.



## WexPOPS Garden Space

WexPOPS is a partnership with the University of Guelph to create a pop up garden in a private strip-mall parking lot on Lawrence Avenue East. The temporary installation includes street furniture and plantings of 29 species of native wildflowers and grasses (all grown at the University of Guelph and to be transplanted to the Meadowway). Local high school students, mostly newcomers from Nigeria, are employed to take care of the garden.



# 05

## VISION, PRINCIPLES AND ACTIONS

### VISION

---

*Imagine a Toronto with flourishing natural habitat and an urban environment that supports a great diversity of wildlife. Envision a city whose residents treasure their daily encounters with the remarkable and inspiring world of nature, and the variety of plants and animals with whom we share this place. A Toronto that aspires to be a world leader through citizens who take pride and engage in the protection, restoration and enhancement of our flora and fauna.*

---

# PRINCIPLES

The Biodiversity Strategy is based on the following ten principles:



**1. Biodiversity is fundamental to the health of all beings.**

Biodiversity has ecological, economic, social and cultural value necessary for healthy communities and a strong economy.



**2. Biodiversity has intrinsic value.**

Biodiversity is essential to life on earth and must be respected and protected regardless of its value to humans.



**3. Biodiversity is key to resilience.**

Understand the potential effects of urban stressors and climate change and their cumulative impacts.



**4. Use ecological integrity to assess ecosystem health and guide management.**

Strive to achieve the highest possible level of ecological integrity in the context of the urban environment.



**5. Focus on habitat and native species.**

The foundation of healthy biodiversity is abundant, well-connected, functioning habitat that provides native species with places to forage, shelter and reproduce.



**6. Integrate biodiversity into all aspects of city life.**

There are many things that Torontonians can do to support biodiversity through everyday actions, municipal operations, policies and regulations.



**7. Collaborate with a broad range of stakeholders.**

Achieving healthy biodiversity requires engagement of a broad range of stakeholders in order to achieve success.



**8. Develop authentic reciprocal relationships with Indigenous communities.**

Work with Indigenous leaders to integrate Indigenous worldviews with western science to protect, restore and enhance biodiversity.



**9. Support equitable access.**

Increase awareness and appreciation of biodiversity amongst all residents and identify opportunities to enhance biodiversity.



**10. Measure and report on results.**

The state of biodiversity and the success of biodiversity initiatives will be monitored.

# ACTIONS

The actions identified in this section aim to enhance the quality and quantity of biodiversity and increase awareness of nature. These 23 actions are organized under four themes: protect, restore, design and engage. These actions, the lead agency, partners and status are summarized in Summary of Action (page 54).

## PROTECT

*“Preserving biodiversity and tending endangered species are essential.”*

Diana Beresford-Kroeger, ‘Call of the Wild’

### **Action 1. Develop an ecological integrity monitoring and reporting framework.**

Develop a made-in-Toronto ecological integrity framework for monitoring and reporting on the health of the ravine system, in consultation with relevant internal and external experts, through the City’s Ecosystem Services Working Group. Building on existing information, common measurement goals will be identified using local and regional indicators.

---

### **Action 2. Develop action plans for regional species of concern.**

Action plans will provide guidelines for protecting, enhancing and creating habitat, a strategy for monitoring life-cycles and an implementation plan. Key habitat types will be identified using a landscape level approach. The work will engage experts and citizen scientists to provide advice on target species and/or species groups.

---

### **Action 3. Report on progress of actions.**

Post updates on progress of Strategy actions to City’s biodiversity web page. Updates should identify key projects and information.

## ACTIONS

#### **Action 4. Update watershed plans.**

Update to identify and prioritize land use and infrastructure measures to protect, restore and enhance the biodiversity health of terrestrial and aquatic habitats within watersheds.

---

#### **Action 5. Develop a regional biodiversity strategy.**

Support the development of a regional biodiversity strategy to protect and restore biodiversity across jurisdictional boundaries.

---

#### **Action 6. Educate municipal decision makers.**

Provide training for municipal staff and other decision-makers such as Committee of Adjustment members about the importance of biodiversity habitat and the impact of development activities on biodiversity.

---

#### **Action 7. Develop best practice guidelines for buffers adjacent to major new developments.**

Guidelines will address elements such as native planting species, width of buffer and location of trails in order to protect and enhance natural features.

### **ACTIONS**

# RESTORE

*“Ecological Restoration is the process of assisting the recovery of an ecosystem that has been degraded, damaged or destroyed.”*

## **Action 8. Review policies and bylaws for opportunities to support biodiversity.**

Undertake reviews of: Zoning Bylaw soft landscaping requirements for properties adjacent to ravines; and Property Standards and Grass and Weeds Bylaws for additional opportunities to support biodiversity. Continue to develop policies to support biodiversity in area-based planning studies, secondary plans and site and area specific policies. Review opportunities to further protect migratory and breeding birds from hazard related to development adjacent to natural features.

---

## **Action 9. Identify opportunities and priority sites for restoration.**

Identify and prioritize opportunities to increase ecological function and resilience of natural areas throughout the City. This work will be in addition to on-going work on Environmentally Significant Areas (ESAs) and the Ravine priority areas and will complement Pollinator Protection Strategy actions.

Activities may include adding to the diversity of native plant species and, where appropriate, facilitating the spread of established native plant communities and establishing refuge and stopovers for species such as birds and butterflies. This work would include both private and public lands such as hydro corridors, public realm, green roofs, and capital infrastructure projects.

### ACTIONS

### **Action 10. Advance plans and programs for management of terrestrial invasive species.**

Continue management of invasive species, prioritizing areas with high quality habitat and where early infestation can be eradicated or easily set back to allow for recolonization by native plants. Work in partnership with TRCA, and identify opportunities and gaps in existing plans and programs through the Ecosystem Services Working Group.

---

### **Action 11. Expand communication about management of terrestrial invasive vegetation and planting of native species.**

Continue to develop messages and educational materials to promote the use of native plant materials and discourage the planting of invasive species. Provide information on the impact of non-native invasive species, the importance of biodiversity and how to prevent spread of invasive species.

---

### **Action 12. Continue and expand training for City operations and maintenance staff on biodiversity best practices.**

Building on the pilot Biodiversity training course and Pollinator Protection Practices for City staff, increase awareness of biodiversity and identify best practices to protect and enhance habitat and the planting of invasive species.

Training of PFR staff will be coordinated through the City's Horticultural Program of Excellence. The course syllabus would be made available to Transportation Services and other large property owners such as Hydro One.

## **ACTIONS**

# DESIGN

*“Our urban environment can ‘cohabit’ with nature – imagine a city that is supportive of life and growth both for people and other plant and animal species designed in a way that a diversity of species can live together. Recast urban design as a form of a ‘new activist joint urban and environmental stewardship whose project is to create footholds for biodiversity.’”*

Toward an Urban Ecology – Kate Orff SCAPE

## **Action 13. Develop design best practices for biodiversity in the built environment.**

Develop best practices to promote biodiversity sensitive design and the use of native plant material to support habitat and reduce impact of the built environment on biodiversity in the urban context. Provide training for landscape architects, architects, engineers and planners to support best practices.

---

## **Action 14. Identify and construct ‘eco-passages’ and ‘wildlife corridors’.**

TRCA to identify locations to facilitate habitat connectivity and wildlife movement, including aquatic species, using a systems based approach within and around the Natural Heritage System.

---

## **Action 15. Review and update existing City design standards, guidelines and incentive programs to support biodiversity.**

Review the following for potential opportunities to enhance biodiversity, including the use of native plant material: the Biodiverse Green Roofs Guidelines; the Toronto Green Standard; the Green Streets Technical Guidelines and the Eco-roof Incentive Program. For example, the Pollinator Stewardship Incentive Program framework could be revised to incorporate biodiversity into the ‘project assessment criteria’ and revise the name to ‘Pollinator and Biodiversity Stewardship Incentive Program’ when the current pilot ends in 2020.

### ACTIONS

## **Action 16. Promote and expand awards certification programs for property owners.**

Promote existing programs that recognize property owners for creation of biodiverse front/ back yards that use native plant material. Work with partners to expand awards/ certification program to recognition of other biodiverse landscapes. Develop evaluation criteria for inclusion of biodiversity in the evaluation of submissions to the Toronto Urban Design Awards.

# ENGAGE

*“If each of us becomes aware of the rich variety of life forms, their beauty and their critical roles within the varied ecosystems of Toronto, we will surely be inspired to protect this natural heritage.”*

Margaret Atwood and Graeme Gibson, Biodiversity Series, 2011

## **Action 17. Undertake innovative, collaborative, interpretive projects.**

Continue to work with partners to create opportunities to interpret the importance of nature and native flora and fauna in order to cultivate stewardship and increase awareness of biodiversity, through innovative design, art and story telling that engages and informs the public.

---

## **Action 18. Develop a strategic and targeted communications plan.**

Expand existing communications and develop a series of campaigns targeting a variety of audiences to: increase awareness of importance of biodiversity and impact of non-native invasive species; promote the use of native plant materials; discourage the planting of invasive species; prevent bird collisions with windows; and educate people about living with wildlife, including human and urban wildlife conflicts.

---

## **Action 19. Expand the Urban Biodiversity Series.**

Potential booklets could include wildflowers, wasps, dragonflies and damselflies, ants, aquatic invertebrates and invasive species. Identify opportunities to increase other online resources (such as videos) and support other platforms (such as iNaturalist).

### ACTIONS

### **Action 20. Develop a guide on ‘Backyard Biodiversity’ and a ‘Biodiversity Toolkit’ for children.**

Address the importance of biodiversity and best practices for what residents can do to support biodiversity in their backyards. Toolkit to use characters to connect concept of biodiversity to children’s world.

---

### **Action 21. Develop a self-guided ‘biodiversity in the City’ tour.**

Develop a self-guided tour with geo-referenced downloadable podcasts about the habitats and wildlife found in the ravines and/or along a street or subway route in Toronto. This would be based on the Biodiversity booklet series and the Toronto Historical Landscape Project.

---

### **Action 22. Develop an interactive GIS based historical landscape and ecology map.**

The Toronto Historical Landscape Project will engage academic institutions to research remnant ecology around the time of European settlement and any other points in time.

---

### **Action 23. Develop international partnerships.**

Explore partnerships with international organization such as Biophilic Cities and the National Park Cities movement to learn from, share and support innovative work on biodiversity.

# SUMMARY OF ACTIONS

	<b>ACTION</b>	<b>LEAD</b>	<b>PARTNERS</b>	<b>STATUS</b>
	<b>PROTECT</b>			
1.	Develop an ecological integrity monitoring and reporting framework	PFR TRCA	City Planning Toronto Zoo Academic Institutions Parks Canada Citizen scientists	To be initiated
2.	Develop action plans for regional species of concern	TRCA	PFR City Planning ROM Toronto Zoo Parks Canada Academic Institutions Indigenous Knowledge Carriers Environmental groups Citizen scientists	Underway
3.	Report on progress of actions	City Planning	PFR TRCA	To be initiated
4.	Update watershed plans	TRCA	City Planning Toronto Water PFR	Ongoing
5.	Develop a regional biodiversity strategy	TRCA	GTA municipalities	To be initiated
6.	Educate municipal decision makers	City Planning PFR	Toronto Water MLS TRCA	Underway
7.	Develop best practice guidelines for buffers adjacent to major new developments	City Planning	TRCA PFR	Underway

	<b>ACTION</b>	<b>LEAD</b>	<b>PARTNERS</b>	<b>STATUS</b>
	<b>RESTORE</b>			
8.	Review policies and bylaws for opportunities to support biodiversity	City Planning	PFR Toronto Water MLS	Ongoing
9.	Identify opportunities and priority sites for restoration	PFR TRCA	City Planning Transportation Services Toronto Water Hydro One Indigenous Knowledge Carriers Community groups BIAs	Underway
10.	Advance plans and programs for the management of terrestrial invasive species	PFR TRCA	Ecosystem Services Working Group Ontario Invasive Plant Council	Ongoing
11.	Expand communication about management of terrestrial invasive vegetation and planting of native species	PFR TRCA	City Planning Toronto Water Transportation Services Solid Waste Management Toronto Zoo Indigenous Knowledge Carriers Canadian Nursery Landscape Association Ontario Invasive Plant Council North American Native Plant Society	Underway
12.	Continue and expand training for City operations and maintenance staff on biodiversity best practices	PFR	City Planning Transportation Services Hydro One	Underway

	<b>ACTION</b>	<b>LEAD</b>	<b>PARTNERS</b>	<b>STATUS</b>
	<b>DESIGN</b>			
<b>13.</b>	Develop design best practices for biodiversity in the built environment	City Planning	PFR TRCA Indigenous Knowledge Carriers	To be initiated
<b>14.</b>	Identify and construct 'eco-passages' and 'wildlife corridors'	TRCA	City Planning Transportation Services Toronto Water Toronto Zoo PFR Toronto Wildlife Centre	Underway
<b>15.</b>	Review and update existing City design standards, guidelines and incentive programs to support biodiversity	City Planning PFR EED	Toronto Buildings Toronto Water Transportation Services TRCA	Ongoing
<b>16.</b>	Promote and expand awards and certification programs for property owners	City Planning	PFR EED TRCA Canadian Wildlife Federation Monarch Watch World Wildlife Fund Carolinian Canada Coalition	To be initiated

	<b>ACTION</b>	<b>LEAD</b>	<b>PARTNERS</b>	<b>STATUS</b>
	<b>ENGAGE</b>			
17.	Undertake innovative, collaborative, interpretive projects	PFR Transportation Services EED	TRCA Evergreen Toronto Arts Council TFN FLAP Urban Nature Alliance Protect NatureTO Community groups Academic institutions Indigenous Knowledge Carriers Design associations (OALA, OAA, LO) Businesses Artists	Ongoing
18.	Develop a strategic and targeted communications plan	PFR TRCA	City Planning EED Toronto Water Transportation Services Solid Waste Management Indigenous Knowledge Carriers Toronto Wildlife Centre Canadian Nursery Landscape Ontario Invasive Plant Council North American Native Plant Society FLAP	Underway
19.	Expand the Urban Biodiversity series	City Planning	PFR TRCA ROM Indigenous Knowledge Carriers Academic institutions Environmental Groups Citizen scientists	Ongoing
20.	Develop a guide on 'Backyard Biodiversity' and a 'Biodiversity Toolkit' for children	City Planning	PFR EED TRCA	Underway

	<b>ACTION</b>	<b>LEAD</b>	<b>PARTNERS</b>	<b>STATUS</b>
21.	Develop a self-guided 'biodiversity in the City' tour	City Planning PFR	ROM TRCA Metrolinx TTC Toronto Zoo Indigenous Knowledge Carriers Academic Institutions Tourism Toronto	To be initiated
22.	Develop an interactive GIS based historical landscape and ecology map	City Planning	PFR TRCA Academic Institutions Indigenous Knowledge Carriers	Underway
23.	Develop international partnerships	City Planning PFR	TRCA Environmental groups Community groups Academic Institutions	Underway



*“Perhaps it will be the city that reawakens our understanding and appreciation of nature, in all its teeming, unpredictable complexity.”*

The Greening of the City, Jane Jacobs

## ENDNOTES

- 1 Ontario Ministry of Municipal Affairs and Housing (MMAH) (2019). A Place to Grow: Growth Plan for the Greater Golden Horseshoe, 2019. Toronto, Ontario
- 2 IPBES (2019). Summary of policymakers of the global assessment report on biodiversity and ecosystem services of the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. Bonn, Germany.
- 3 United Nations Department of Economic and Social Affairs (2018). News: 68% of the world population to live in urban areas by 2050, says UN. New York, USA. Accessed from: <https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html>
- 4 United Nations Convention on Biological Diversity (UN CBD) (1992). Convention on Biological Diversity. Retrieved from: <https://www.cbd.int/doc/legal/cbd-en.pdf>
- 5 Millennium Ecosystem Assessment (2005). Ecosystems and Human Well-being: Biodiversity Synthesis. World Resources Institute, Washington, DC, USA.
- 6 Green Analytics (2018). Ecosystem Services Values of the City of Toronto Ravine System. Prepared for the City of Toronto and the Toronto and Region Conservation Authority.
- 7 Environmental Commissioner of Ontario (ECO) (2015). Annual Report 2014/2015: Small Things matter. Environmental Commissioner of Ontario: Toronto, Ontario.
- 8 Province of Ontario (2006). Provincial Provincial Parks and Conservation Reserves Act, 2006.
- 9 ECO (2015)
- 10 City of Toronto (2017). Toronto Ravine Strategy. Toronto, Ontario. Accessed from: <https://www.toronto.ca/wp-content/uploads/2017/10/9183-TorontoRavineStrategy.pdf>
- 11 Ordóñez, Camilo and Duinker, Peter (2012). Ecological integrity in urban forests. *Urban Ecosystems*. 15: 863-877.
- 12 Riley, John (2013). *The Once and Future Great Lakes Country: An Ecological History*. McGill-Queen's University Press: Montreal, Quebec.
- 13 Riley (2013)
- 14 Riley (2013)
- 15 Riley (2013)
- 16 Toronto and Region Conservation Authority (TRCA) (n.d.). "Watershed Features – Etobicoke & Mimico". Toronto, Ontario. Accessed from <https://trca.ca/conservation/watershed-management/etobicoke-mimico-creek/watershed-features/>
- 17 City of Toronto (2001). City of Toronto Natural Heritage Study. Toronto, Ontario.
- 18 Committee of the Status of Endangered Wildlife in Canada (COSEWIC) (2007). Chimney Swift (*Chaetura pelagic*) COSEWIC assessment and status report. Ottawa, Ontario. Accessed from <https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/chimney-swift/chapter-9.html>
- 19 City of Toronto (2013). Every Tree Counts: A Portrait of Toronto's Urban Forest. Parks Forestry and Recreation. Toronto, Ontario. Accessed from <https://www.toronto.ca/wp-content/uploads/2017/12/92de-every-tree-counts-portrait-of-torontos-urban-forest.pdf>
- 20 Note: urban forest valuations derived from analysis of field data collected in 2008
- 21 Note: Since the fall of 2012, river otters have been sighted at the edge of the Toronto city limits.
- 22 Ontario Ministry of Natural Resources (2012). Invasive Species Strategic Plan. Toronto, Ontario. Accessed from: <https://www.ontario.ca/page/invasive-species-strategic-plan-2012>
- 23 Fatal Light Awareness Program (n.d.). FLAP Canada. Accessed from: <https://flap.org/>

## IMAGE CREDITS

Amro Zayed: page 33  
City of Toronto: pages 22/23, 27, 33, 37, 42, 43 (top)  
Ian Sturdee: page: 23  
ICLEI Canada: pages 12/13  
Joshua Wise: pages 16, 25, 36  
Jose San Juan: pages 29, 31  
Katherine Fleitas (photo): Page 43 (middle)  
Matt Forsythe: pages 2, 11, 15, 34, 39  
Phil Saunders (artist): page 43 (middle)  
Robert Burley: pages: cover, 54  
Robert Mays: pages 19, 43 (bottom)  
Toronto and Region Conservation Authority: page 14  
Waterfront Toronto: page 41

*For more information on the Toronto Biodiversity Strategy,  
please contact; [sustainablecity@toronto.ca](mailto:sustainablecity@toronto.ca)*

