Biodiversity in Ontario's Greenbelt

Ontario Nature

David Suzuki Foundation

SOLUTIONS ARE IN OUR NATURE

BIODIVERSITY IN ONTARIO'S GREENBELT

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David Suzuki Foundation and Ontario Nature

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This report was made possible through the generous support of the Ontario Greenbelt Foundation.

Introduction

ONTARIO'S GREENBELT STRETCHES north to south from the wild forests of the Bruce Peninsula to the lush Carolinian woodlands in Niagara Region. It spans west to east from the small vernal pools of Halton Region to the butterfly plains of Rice Lake. The richness of habitat in the region is evident in the sight of turtles sunbathing on stream banks, the sound of birdsongs from the trees and the flicker of tiny movements in the grass as small mammals duck in and out. Slick-skinned salamanders and tiny, brightly striped fish rely almost entirely on the land and water of the Greenbelt for their survival. Indeed, the Greenbelt is home to 78 of over 200 provincially listed species at risk in Ontario. Their wavering but continued presence serves as a reminder of the importance in this area of the woodlands, wetlands, meadows, rivers and streams.

The Greenbelt is a bustling place where speeding cars zig and zag on wide highways, and the silhouettes of buildings on the horizon define a hard, concrete skyline. Plants and animals that move at a different pace can often be forgotten or dismissed in urban and suburban areas that hum with human energy and automated movement. The constant push of cities to grow and convert natural areas to shopping centres, residential developments, parking lots and roads threatens these plants and animals and their habitat. Natural areas are paved over, split apart and whittled away to increasingly small fragments.

Almost unbelievably in some instances — witness Jefferson salamanders crawling through the basements of homes built in the way of their migration paths to get to their breeding grounds — plants and animals continue to eke out their existence within this altered environment. Humans chose to settle in this part of Ontario in large part because of the rich diversity and fertility of the land. Millions now make their home in this region, as do a large number of our most enchanting species at risk, including the monarch butterfly, the red-headed woodpecker, the spotted turtle, the lakeside daisy and many more. Ironically, however, the popularity and subsequent development of the region have resulted in many species' decline and loss.

Humans chose to settle in this part of Ontario in large part because of the rich diversity and fertility of the land. Millions now make their home in this region, as do a large number of our most enchanting species at risk.

While loss and fragmentation of habitat is an imminent threat to 97 per cent of species at risk in the Greenbelt, the connection between habitat protection and human health and well-being is often overlooked. Adequately protecting the habitat of the redside dace, a tiny fish with 80 per cent of its Canadian habitat in the Greenbelt, for instance, could have profound benefits for people. The fish is extremely sensitive to environmental changes in the rivers and streams it calls home — even small declines in water quality or quantity can lead to the loss of redside dace populations. As a result, the species can signal problems such as a deterioration of drinking water or the onset of drought. On a more positive note, keeping redside dace populations healthy can help ensure that water sources are clean and plentiful. This little fish reveals a simple truth: humans and other life all require healthy, functioning ecosystems to survive. We're in it together.

The Greenbelt was created by the Ontario Government in 2005 in recognition of the significance of the region's natural and agricultural values — and the risk that these areas might be gobbled up by residential and industrial uses. The Greenbelt acknowledges and accommodates a multitude of land uses within its 728,434 hectares (1.8 million acres), while aiming to maintain agricultural land as well as natural and hydrological systems. The Greenbelt Plan was designed to build on the ecological protection already in effect under two earlier and precedent-setting land use plans, the Niagara Escarpment Plan and the Oak Ridges Moraine Conservation Plan. It works in concert with other policy and legislation such as the Endangered Species Act, 2007; the Provincial Policy Statement; and the Growth Plan for the Greater Golden Horseshoe.

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In coordination with these laws and policies, the Greenbelt Plan articulates a vision of planning that is system based, protecting more than individual natural features to incorporate the areas that surround, connect and support them. System-based planning requires that decision-makers consider the impact that a development or activity has on the landscape as a whole, rather than just on the project area.

In 2008, the David Suzuki Foundation released *Ontario's Wealth, Canada's Future: Appreciating the Value of the Greenbelt's Ecological Services*. Building on that research, this subsequent report, *Biodiversity in Ontario's Greenbelt,* showcases the significance of the Greenbelt for the diversity of life in Ontario and emphasizes the importance of system-based planning. Beginning with an overview of Greenbelt species and ecosystems, the first section of this report highlights their value and diversity, and then outlines trends for species at risk in the region. The second section discusses historical and ongoing threats to species in the Greenbelt, focusing on the threat of habitat loss and degradation for the redside dace, Jefferson salamander, common snapping turtle and hooded warbler. The third section describes a more promising path forward, assessing current policy and ongoing voluntary stewardship initiatives on public and private land. The conclusion includes recommendations for ensuring that species and their habitat are protected in the Greenbelt.

PART 1

Nature at the Edge of the Pavement: Biodiversity in the Greenbelt

THE GREENBELT IS A WORLD of both natural and human-made wonders, heavily populated by a diverse web of life made up of plants, animals and other life forms, each connecting and contributing to the function and health of the area. Diversity defines the Greenbelt — from its wide range of habitats and landscapes to the incredible differences among the life forms within them. While the values of human diversity in language, culture and custom are often touted as beneficial to society, the benefits of biological diversity are less commonly understood and celebrated.

The Greenbelt's grasslands, woodlands, wetlands and waterways underpin many major economic activities, such as forestry, agriculture and tourism. They also benefit human health and well-being — physical, mental, social and spiritual. When these natural systems are lost or degraded, humans and other life suffer both directly and indirectly.[1] Their critical importance can be quickly dismissed in an area undergoing rapid change and population growth.

Southern Ontario is one such area. It is one of the most heavily populated places in Canada: with a population of over 13 million people, it is home to one in three Canadians.[2] Most of the population — over 75 per cent of Ontarians — have settled inside or in close proximity to the Greenbelt.[3] The temperate climate that attracts many people to the area also provides favourable conditions for other species, including over one-third of Ontario's species at risk. For most of these species, habitat loss is the greatest threat.[4]

"Nature holds the key to our aesthetic, intellectual, cognitive and even spiritual satisfaction."
— E. O. Wilson

1 Sara J. Wilson. 2008. *Ontario's Wealth, Canada's Future: Appreciating the Value of the Greenbelt's Eco-Services.* Report to the David Suzuki Foundation. Vancouver, Canada. p.3.

2 www.ontario.ca/en/about_ontario/EC001035.html.

3 Ontario Biodiversity Council. 2010. *State of Ontario's Biodiversity 2010: Highlights Report.* A Report of the Ontario Biodiversity Council. Peterborough, Canada. p.8.

4 Committee on the Status of Endangered Wildlife in Canada (COSEWIC). www.cosewic.gc.ca.

Greenbelt Habitats

Habitat within the Greenbelt is shaped, broadly speaking, by three special environments: the Niagara Escarpment, the Oak Ridges Moraine and the Carolinian life zone. The value of these environments in terms of biodiversity is described here, followed by a discussion of species at risk and what those species can tell us about the overall health of the Greenbelt.

SPECIAL ENVIRONMENTS WITHIN THE GREENBELT

These three significant natural environments constitute the Greenbelt, providing an incredible range of habitat for Ontario's species: the long, curving spine of the Niagara Escarpment which shelters cliff-dwelling creatures and rare wetland types; the thick band of the Oak Ridges Moraine which secures the headwaters of many rivers and aquatic habitats; and the complex quilt of the Carolinian life zone along the edge of Lake Ontario. Here numerous ecosystems — many increasingly rare and fragmented — abound with common, rare and at-risk plants and animals.

Three significant environments constitute the Greenbelt: the long, curving spine of the Niagara Escarpment, the thick band of the Oak Ridges Moraine, and the complex quilt of the Carolinian life zone along the edge of Lake Ontario.

NIAGARA ESCARPMENT

The Niagara Escarpment is perhaps the most dramatically varied landscape within the Greenbelt, with its southern drop into the churning waters of Niagara Falls and its northern arc forming the tall cliff faces of the Bruce Peninsula. It is part of a large and complex geological formation, stretching from New York state up through Manitoulin Island and back down into Michigan and Wisconsin. Made up of substantial peaks of bedrock covered in sediment deposits from glacial movement, the escarpment has been shaped, over time, by natural erosion leading to varied elevations, underwater caves and more than 60 waterfalls. Its varied elevations have resulted in a range of habitat types for many species at risk, from hibernacula for the eastern massassauga to vernal pools for Jefferson salamander. The escarpment also contains the only populations of American hart's-tongue fern in Canada.[5]

The escarpment provides shelter to some of Ontario's oldest and most unique trees — a population of eastern white cedars that cling stolidly to the sheer rock face. These gnarled, ancient trees could be considered natural bonsai trees, trimmed and tended by the rugged conditions in which they grow. Many of the cedars are well over 1,000 years old, with the oldest close to 1,700. The cliff ecosystem of the escarpment is both rare and fascinating and illustrates the breadth of habitat provided by the highest elevation points in southern Ontario.[6]

5 Ian Attridge, Rick Lindgren and Linda Pim. 1998. *Protecting the Niagara Escarpment: A Citizen's Guide.* Report to the Coalition on the Niagara Escarpment. Scarborough, Ontario. pp.8–14.

6 Attridge and others, *Protecting the Niagara Escarpment: A Citizen's Guide,* p.12.

OAK RIDGES MORAINE

The Oak Ridges Moraine is one of the most significant landforms in southern Ontario, created by the ebbs and flows of long-ago glacial movements that loosely packed layers of rock, sand and gravel across its 160 kilometres. The landscape includes rare habitat such as kettle lakes, as well as thick swathes of woodlands, marshes and meadows. The Oak Ridges Moraine also contains the headwaters of more than 65 rivers and streams.[7]

Stretching from east of Peterborough to its westernmost point where it joins the Niagara Escarpment in northern Peel, the Oak Ridges Moraine harbours the most continuous forest cover in the Greater Toronto Area. The moraine is still 30 per cent forested,[8] despite the pressures of development and land conversion that have resulted as Toronto and its suburbs push northward.

The moraine provides critical migratory routes for birds and mammals as well as habitat for several at-risk species such as the king rail, spiny softshell turtle and redside dace. All 13 of the frogs and toads known to the Great Lakes inhabit wetlands on the moraine.[9] One per cent of the moraine also contains rare open meadow habitat, in the form of retired farm fields or of remnant tall grass prairie ecosystems — the most vulnerable ecosystem in southern Ontario.[10]

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CAROLINIAN LIFE ZONE

The Carolinian life zone,[11] which overlaps with the southern section of the Greenbelt, extends from Toronto on Lake Ontario, to Grand Bend on Lake Huron and Windsor on Lake Erie. Early botanists coined the term *Carolinian* after discovering plants and animals thought to exist only in the Carolinas. Indeed, this unique region supports ecosystems found nowhere else in Canada, such as globally rare dune ecosystems, forests where rare tulip trees grow and habitat for opossums.[12] Its weather conditions include warm temperatures, low rates of frost and plentiful rainfall, a combination that has resulted in one of the highest diversity of habitats and species per square inch in Canada.[13] The Carolinian life zone is home to some of the most threatened species in the country, many of which are at the northern limit of their range, including American chestnut, eastern fox snake and eastern prairie fringed-orchid. Living at the northern extent of their range, such plants and animals often have adapted to tougher conditions (longer winters, colder average temperatures) than their southern counterparts.[14] These adaptations can result in northern populations having unique genetic characteristics that help them to resist blight and/or disease, traits that may become increasingly important for species facing the predicted creep of rising temperatures currently modelled in climate change projects.[15]

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7 Moraine for Life: Oak Ridges Moraine Foundation. http://moraineforlife.org/about/.

8 Moraine for Life.

9 Central Lake Ontario Conservation Authority. *Durham Region Coastal Wetlands: Baseline Conditions and Study Findings 2002 and 2003.* 2003. Report for the Central Lake Ontario Conservation Authority. Toronto, Canada. p.1.

10 Ontario Biodiversity Council, *State of Ontario's Biodiversity 2010,* p.21.

11 The term *life zone* was first coined by C. Hart Merriam in the late 19th century to describe areas where plants and animals relied on similar conditions. http://en.wikipedia.org/wiki/Life_zone.

12 Lorraine Johnson. Winter 2010/2011. Endangered ecosystem: Carolinian zone. *ON Nature*.

13 Jane Bowles, Michelle Kanter, Veronique LeHouk and Dave Martin. 2004. *Species at Risk in Carolinian Canada and How to Help.* Report to the Carolinian Canada Coalition. London, Canada. p.5.

14 Michelle Connolly, Keith Ferguson, Susan Pinkus and Faisal Moola. 2010. *On the Edge: British Columbia's Unprotected Transboundary Species.* Report to the David Suzuki Foundation. Vancouver, Canada. p.16.

15 Connolly and others, *On the Edge.*

Before European settlement, Carolinian Canada was a landscape blanketed by lush deciduous forests comprising sycamore, black oak, cucumber magnolia, tulip and other trees. Providing habitat for the Acadian flycatcher, prothonotary warbler and other Carolinian species, the forests sheltered an assortment of now at-risk plants such as the American ginseng and wood poppy. Warm rains and above-average temperatures ensured both the canopy and the understorey of these forests grew quickly and prolifically.

Today, because of the pressures of land conversion and development, the Carolinian forest is one of Canada's most endangered ecosystems.

DIVERSITY OF THE LANDSCAPE WITHIN THE GREENBELT

Within the Niagara Escarpment, the Oak Ridges Moraine and the Carolinian life zone, forests, grasslands, wetlands and rivers support a rich diversity of life forms, right on the doorstep of many urban dwellers.

FORESTS

Once covering up to 90 per cent of the southern Ontario landscape,[16] forests are still the most significant ecosystem in the Greenbelt. They now cover roughly 24 per cent of the Greenbelt, approximately 182,594 hectares.[17] These areas are remnants of the almost continuous canopy that formerly covered this landscape. Most are small in size and often fragmented from neighbouring woodlands by development, roads or infrastructure corridors.[18]

16 Pat Mohr and John Riley. 1994. *The Natural Heritage of Southern Ontario's Settled Landscapes: A Review of Conservation and Restoration Ecology for Land-Use and Landscape Planning.* Report to the Ontario Ministry of Natural Resources. Aurora, Canada.

17 Wilson, *Ontario's Wealth, Canada's Future,* p.2.

18 Ryan Cheng and Peter Lee. 2008. *Urban Sprawl and Other Major Land Use Conversions in Ontario's Greenbelt from 1993-2007: A Change Analysis Project Using Satellite Imagery.* Report to the David Suzuki Foundation and the Greenbelt Foundation. Global Forest Watch Canada. Edmonton, Canada. p.9, fig.2.

A number of species at risk inhabit these forested ecosystems, such as the wood turtle, American ginseng and cucumber tree. The majority of Greenbelt species at risk use woodlands for at least one element of their life cycle.[19] Forests provide multiple benefits to humans as well: by cleaning air and water, by storing carbon and tempering the effects of climate change and by providing shade and wood products. Based on these and other services, the David Suzuki Foundation has valued the economic benefits of forests in the Greenbelt at roughly $5,400 per hectare per year.[20]

WETLANDS

Three-quarters of southern Ontario's original wetlands have been lost since settlement, mostly as a result of drainage for agriculture and development.[21] In some areas, such as metropolitan Toronto, less than 15 per cent of the wetlands remains, and the function of several watersheds, such as Highland Creek, is severely impaired by the impervious surfaces that surround them.[22]

Wetlands make up approximately 12 per cent of the Greenbelt's land base — roughly 96,014 hectares.[23] The value of these wetlands is enormous. The marshes, bogs, fens and swamps of the Greenbelt store carbon, filter water and provide natural stormwater management systems. In economic terms, wetlands can be valued at roughly $14,000 per hectare per year based on the role they play in, among other functions, climate regulation, flood control, waste treatment and habitat provision.[24] In addition, these areas support a wide range of species at risk, such as the Blanding's turtle, swamp rose mallow and least bittern. The Greenbelt also provides protection for some rare Great Lakes coastal wetlands, located at the mouths of streams and rivers that empty into Lake Ontario and Georgian Bay. The position of these wetlands between permanent deep water and upland areas creates unique and critical habitat types.

The Greenbelt Plan protects all wetlands, a boon to municipal decision-makers attempting to conserve these critical ecosystems. Before the introduction of the plan, most municipalities protected only Provincially Significant Wetlands, as required by the Provincial Policy Statement, leaving many locally and regionally significant wetlands open to development.

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RIVER VALLEYS

River valleys cover 7,821 hectares of the Greenbelt and provide diverse habitats and microclimates, often resulting in a high proportion of regionally and locally significant species.[25] Numerous species at risk also rely on these areas, including fish such as the river redhorse, dragonflies such as the rapids clubtail and reptiles such as the wood turtle. Critical to many species, river valleys provide shelter from harsh weather and cover from predators and offer fresh water and food.[26]

Many of the Greenbelt's river valleys run north to south, in some cases, as with the Don and the Humber, providing vital natural corridors across the landscape and connecting the large freshwater

19 Species at Risk Act Public Registry status reports. www.sararegistry.gc.ca/default_e.cfm.
20 Wilson, *Ontario's Wealth, Canada's Future,* p.29.
21 Ducks Unlimited Canada. 2010. *Southern Ontario Wetland Conversion Analysis.* A Report of Ducks Unlimited Canada. Barrie, Canada. p.1.
22 Toronto Region Conservation Authority: www.trca.on.ca/protect/watersheds/highland-creek/.
23 Wilson, *Ontario's Wealth, Canada's Future,* p.2.
24 Wilson, *Ontario's Wealth, Canada's Future,* p.34.
25 Ontario Ministry of Natural Resources. 2005. *Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005* (2nd ed.). Queen's Printer for Ontario. Toronto, Canada. p.75.
26 Ontario Ministry of Natural Resources, *Natural Heritage Reference Manual.*

system of Lake Ontario with the groundwater and surface-water features of the Oak Ridges Moraine.[27] As water moves from the surface through the ground to deep aquifers, it is filtered in a process called groundwater recharge, helping to ensure that the rivers provide safe, clean water into Lake Ontario. The protection provided by these river valleys thus has a direct benefit to humans. The David Suzuki Foundation estimates the value of the ecological services provided by rivers in the Greenbelt at roughly $335 per hectare per year.[28]

GRASSLANDS

Only 441 hectares of the Greenbelt is covered by grasslands — far less than one per cent of the entire plan area. The scarcity of this ecosystem type in the Greenbelt reflects the national trend: grasslands are the most endangered ecosystem in Canada, from the native grasslands in British Columbia's Okanagan and Kootenay regions to the scattered remnants of tall grass prairie and oak savannah in the Oak Ridges Moraine. The moraine is one of the northernmost areas where tall grass prairie ecosystems grow in Ontario, largely because of its unique soil composition.[29] Though tall grass prairies have never been the dominant ecosystem across the moraine, areas such as the County of Northumberland were once large, contiguous regions of tall grass prairie and savannah.[30]

Urban development and agricultural conversion are the two greatest threats to the grasslands of the world — the arid climate and topography that create these ecosystems also make them desirable places for human settlement and the production of food.[31] These conditions are uncommon, resulting in a relatively low number of tall grass prairies: before European settlement, roughly 80,000 hectares of prairie and savannah existed in southern Ontario. There is now less than two per cent of the original grasslands remaining in the entire province.[32] In the Greenbelt, small grassland patches provide potential habitat for species like the barn owl. These areas play a critical economic role in climate regulation, water run-off control and nutrient cycling and are valued at roughly $1,600 per hectare per year.[33]

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27 Greenbelt Plan, 2005. S.O. 2005. Queen's Printer for Ontario. Toronto, Canada. pp.20–21.

28 Wilson, *Ontario's Wealth, Canada's Future,* p.43.

29 Moraine for Life.

30 Barry King. The Northumberland forest. Save the Oak Ridges Moraine (STORM) Coalition. www.stormcoalition.org/newsroom/king121305.htm.

31 Grasslands Conservation Council of British Columbia. www.bcgrasslands.org/grasslands/UnderstandingGrasslands.htm.

32 Lorraine Johnson. Spring 2008. A garden of rarities. *ON Nature,*.

33 Wilson, *Ontario's Wealth, Canada's Future,* p.36.

Why Biodiversity Matters

The protection of natural spaces is often undervalued when compared with activities that may yield more immediate and tangible returns, such as creating single-family dwellings or extracting sand and gravel for new highways. Current economic evaluations often fail to take into account many of the less tangible goods and services provided by natural areas, leading to short-term decisions to develop or alter these places despite potential negative impacts.

Such decisions may not acknowledge that humans rely on biodiversity — the web of life on our planet that provides for everything from basic needs to inspiration for our most beautiful accomplishments and greatest knowledge. This web of life is currently in peril. At least 16,000 species across the world are dangerously close to extinction.[34] Four hundred and seventy of those species have habitat in Canada and are currently listed as at risk nationally. Over 200 of these species are located in Ontario.[35] Seventy-eight rely on the Greenbelt for some or all of their habitat needs.

The loss of species and their habitat has a direct impact on the economy, society and ecology of the country and its citizens.[36] Ecosystems maintain a delicate balance where each life form acts in concert to allow the system to function. Changes to or losses of all or part of these systems, such as eradicating an animal population with pesticide or destroying a woodland through conversion to subdivisions, affect the ability of the system to provide the resources or services necessary for a healthy, functioning environment.

The annual worth of the Greenbelt's natural capital has been estimated at roughly $2.6 billion by the David Suzuki Foundation — an average value of $3,487 per hectare per year.

These resources are *natural capital* — the occasionally valued but often unappreciated wealth of the natural world. The term is used to describe both natural materials that currently have a value in the marketplace (such as timber) and those that do not (such as the genetic diversity of unique or rare populations of plants and animals). Natural capital attempts to capture the economic value of numerous ecosystem services that are also often taken for granted despite their direct and indirect benefits to humans. Ecosystem services include water storage and filtration, carbon sequestration, soil retention, pollination and habitat provision for species at risk.

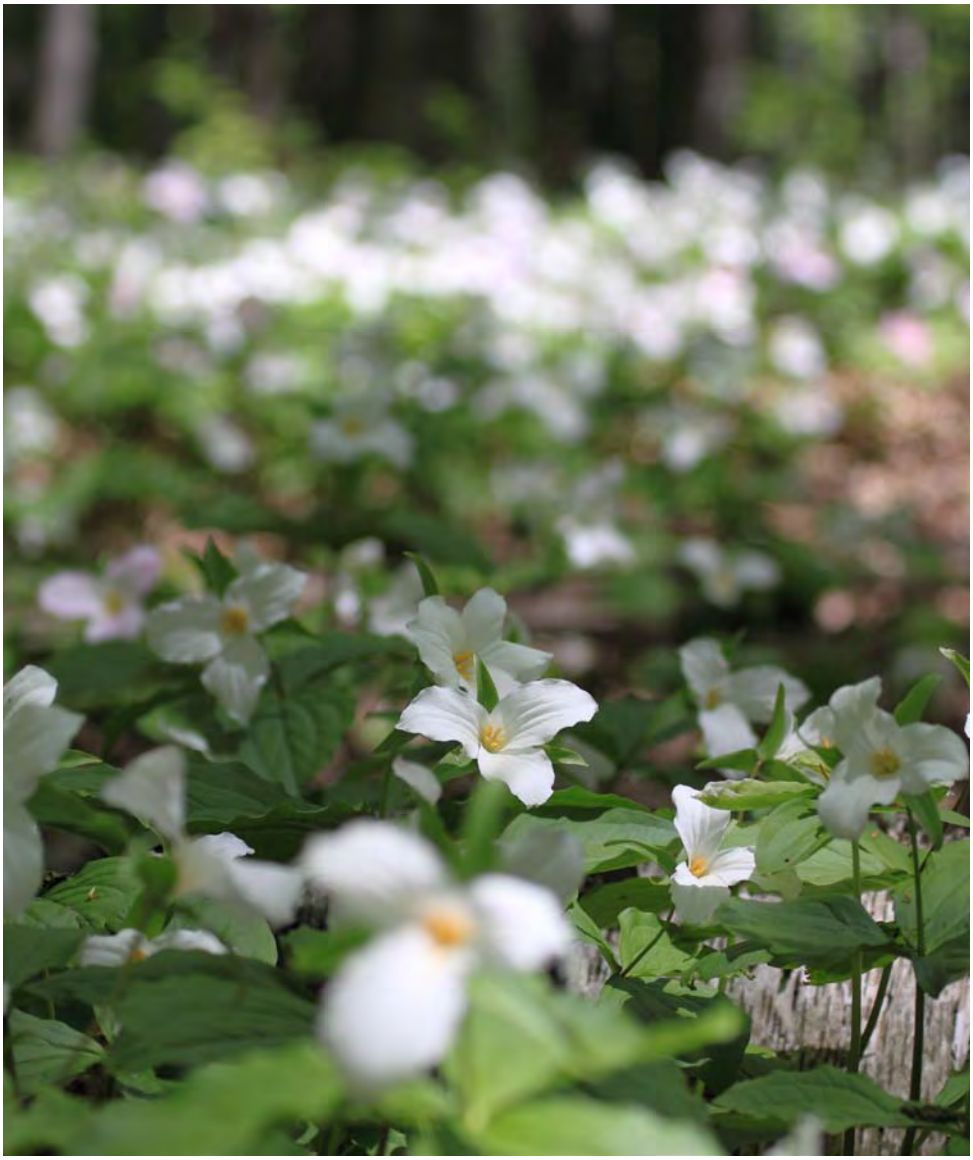
Every species plays a role in the functioning of ecosystems, and thus in the provision of ecosystem services that are frequently not valued in traditional economic models. Natural capital estimations can help to highlight both the tangible and the intangible values of biodiversity. Currently, economists are developing ways to measure the economic values of natural capital and the associated ecosystem services. Ecological economics translates the critical value of biodiversity into hard numbers that can help inform individual and societal decision-making on land use. The annual worth of the Greenbelt's natural capital has been estimated at roughly $2.6 billion by the David Suzuki Foundation — an average value of $3,487 per hectare per year.[37] Plants, animals and

34 Michelle Connolly, Lindsay Coulter, Faisal Moola and Devon Page. 2007. *Rich Wildlife/Poor Protection: The Urgent Need for Strong Legal Protection of British Columbia's Biodiversity.* Report for the David Suzuki Foundation and Sierra Legal. p.2.

35 All but three of Ontario's provincially listed species are listed nationally as well. The Western Virginia white butterfly and the eastern elk have not been listed under the Species at Risk Act (SARA), and data on the eastern cougar have been classified as deficient.

36 Secretariat of the Convention on Biological Diversity. 2010. *Canada's Fourth National Report to the United Nations Convention on Biological Diversity.* Report to the United Nations. Canada. p.2.

37 Wilson, *Ontario's Wealth, Canada's Future,* p.1.



other life forms provide numerous ecosystem services that contribute to this estimated worth, including seed dispersal, pest control, soil retention and pollination services.[38]

All species, including humans, receive direct and indirect benefits from healthy, functioning ecosystems. The loss or weakening of these systems can have both anticipated and unforeseen consequences. For example, *nature deficit disorder* is a term coined to underline the negative health impacts (increased anxiety, depression, obesity) associated with childhoods spent largely indoors, dissociated from the natural world.[39] Indeed, research indicates that many benefits arise from regular exposure to nature, ranging from improved academic achievement and family relationships to lower crime rates and increased longevity.[40]

38 Wilson, *Ontario's Wealth, Canada's Future,* pp.1–5.

39 Richard Louv. 2005. *Last Child in the Woods: Saving Our Children from Nature Deficit Disorder.* Algonquin Books. Chapel Hill, NC.

40 News Bureau, Illinois. http://news.illinois.edu/news/09/0213nature.html.

Species at Risk Within the Greenbelt

In 2004, an analysis of Greenbelt species at risk illustrated the biodiversity at risk in the region.[41] At the time, 72 of the species at risk listed in Ontario had some or all of their known populations in the Greenbelt area. That number has now risen to 78 and includes 25 plants, 25 birds, 12 reptiles, six fish, five mammals, two butterflies, two amphibians and one dragonfly. The majority of these species face habitat loss and fragmentation as their primary threat.[42]

RAPIDS CLUBTAIL: Habitat Loss and Fragmentation Create a Ripple Effect

Habitat loss and fragmentation are a significant threat facing all species at risk in the province.[43] According to the status reports prepared by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), habitat loss and fragmentation threaten close to 90 per cent of species at risk in Ontario — and about 97 per cent of Greenbelt species. In response to this threat, the Environmental Commissioner of Ontario has repeatedly issued directives, most recently in his 2010 annual report, to provincial leaders to help staunch the conversion of natural spaces to developed lands.[44]

For the rapids clubtail, the first dragonfly listed as a species at risk in Ontario, the Greenbelt's provisions for the protection of key hydrological features and the northern portions of river valleys could not come at a better time. More than three-quarters of this dragonfly's known habitat is within water corridors that are protected by and connected to the Greenbelt. The existing populations of the small, dark-coloured dragonfly rely on the Greenbelt's Humber and Mississippi rivers for all aspects of their life cycle. Listed as a species at risk in Ontario in 2009, it is one of the Greenbelt's few listed species that can claim the dubious honour of entering the list at the highest level of threat: endangered.

Rapids clubtail require medium to large streams and rivers with heavily vegetated shorelines. Their disappearance from the Credit and Thames rivers has been cited by experts as an indicator of the overall deterioration of the water quality and flow caused by development along those waterways.[45] Vegetated areas close to rivers filter contaminants from nearby human activities. The loss of these areas can lead to changes in the water quality and quantity, which has significant impacts for dragonflies, because they rely on cool, clear water with quiet pools and riffles for breeding. The rapids clubtail require thoughtful action by humans to both protect and restore these stream buffers and water corridors. In return, they help keep insect populations such as mosquitoes and midges under control.

Rapids clubtail is the first dragonfly listed as a species at risk in Ontario; more than three-quarters of its known habitat is within water corridors protected by and connected to the Greenbelt.

PHOTO DAN IRIZARRY/FLICKR

41 Anne Bell and Jerry DeMarco. 2004. *Waiting for the Ark: Endangered Species in the Golden Horseshoe Greenbelt.* Report to Environmental Defence. Toronto, Canada. pp.13–14.

42 COSEWIC.

43 Ontario Biodiversity Council, *State of Ontario's Biodiversity 2010,* p.5.

44 Environmental Commissioner of Ontario. 2010. *Redefining Conservation: Annual Report 2009/2010.* Report to the Legislative Assembly of Ontario. Toronto, Canada. p.101.

45 Peter Christie. Summer 2011. The tiny hunter. *ON Nature*: 19–23.

BOBOLINK: Coexisting can be a delicate balance

Losses of about 65 per cent of the bobolink population since 1968, with the most significant declines of roughly seven per cent per year over the last decade, prompted its 2010 provincial listing as threatened.

PHOTO BY KELLY COLGAN AZAR VIA FLICKR

Humans and other animals often develop symbiotic relationships, particularly when the loss of natural areas pushes them into increasingly tight quarters. Given the rate of habitat loss and the close quarters shared by humans, plants and animals in southern Ontario, it is interesting to examine a species that relies on and is threatened by human activity: the bobolink.

The bobolink is a small bird with a native habitat of grasslands and open meadow ecosystems. Though small populations were present in Ontario before European settlement, most bobolinks lived in western North America. Increasing conversion of forested land in Ontario to agriculture, combined with development of native grasslands in Western Canada and the United States, spurred a slow eastward movement of many of the western populations of bobolink. Now, the bobolink is present in farmers' fields across Ontario. Though it is still relatively widespread in the area, losses of about 65 per cent of the bobolink population since 1968, with the most significant declines of roughly seven per cent per year over the last decade, prompted its 2010 provincial listing as threatened.

Without the conversion of forests to agriculture, the bobolink could never have established such a large population in Ontario, yet its most significant threats have been caused by changes in market forces and technological advances in that same industry. Key threats to the bobolink in the Greenbelt and the rest of Ontario include a second wave of habitat loss that began in the mid-20th century, when working farms began converting to crops such as soybeans and alfalfa, resulting in the loss of crops that could serve as replacement grasslands.[46] As well, bobolink nests are vulnerable to haying that occurs before their young have fledged — warmer springs with less precipitation and advancing agricultural technology have allowed haying to begin before the bobolink breeding season is completed, possibly resulting in increased mortality of the species.[47]

Tallgrass prairies are recognized in the natural heritage system of the Greenbelt, which is crucial if remnant patches are to persist within the plan area. For species like the bobolink, which use farm fields as habitat, the efforts of farmers and landowners within the Greenbelt will also likely play an important role in the species' survival and recovery. Bobolink populations are particularly strong along the central and northern Niagara Escarpment.[48]

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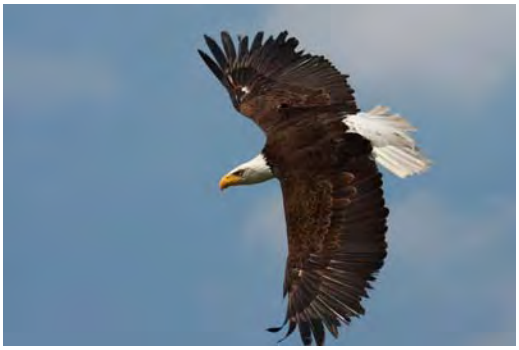
46 E. K. Bollinger and T. A. Gavin. 1992. Eastern Bobolink populations: Ecology and conservation in an agricultural landscape. pp. 497–506 in *Ecology and Conservation of Neotropical Migrant Landbirds*. J. M. Hagan III and D. W. Johnston. (Eds.) Smithsonian. Washington, DC.

47 Bollinger and Gavin. Eastern Bobolink populations.

48 Cadman, M.D., D.A. Sutherland, G.G. Beck, D. Lepage, and A.R. Couturier (eds.). 2007.. *Atlas of the Breeding Birds of Ontario, 2001–2005.* p.587.

BALD EAGLE AND PEREGRINE FALCON: Human actions can help turn the tide

Species showing improvement are doing so for a variety of reasons. Advancements in research findings, the influence of environmental policy (such as chemical bans) and concerted habitat restoration efforts have all played a role.[49] Four Greenbelt species (southern flying squirrel, bigmouth buffalo, greenside darter and red-shouldered hawk) have been removed from the list of species at risk, largely because of greater information becoming available about their populations. Others have experienced significant improvements in their populations because of strong environmental policy and stewardship both inside and outside of the Greenbelt. The bald eagle and peregrine falcon, recently down-listed from endangered to special concern and threatened, respectively, are commonly cited as symbols of the significance policy can have on the recovery of species at risk.



The national ban on DDT in 1985 has been linked with a huge upsurge in these species' populations within a few generations. DDT was a pesticide in wide use throughout most of the 20th century, before its effects on birds of prey, songbirds and waterfowl were identified in Rachel Carson's *Silent Spring*. Carson argued that DDT was causing widespread eggshell thinning and disruptions to breeding habits for many birds, resulting in high mortality rates.[50] DDT has since been classified as moderately toxic to humans by the World Health Organization. The effect of DDT illustrates the importance of policy and planning that take into account the health of species and humans.

Greenbelt to the Rescue

The creation of the Greenbelt in 2005 aimed to "provide a continuous and permanent land base necessary to support human and ecological health in the Greenbelt and beyond."[51] That same year, the Millennium Ecosystem Assessment reported that humans had changed ecosystems more rapidly and extensively in the last 50 years than in any other period in history.[52] Certainly such changes had been ongoing in southern Ontario, especially around the Greater Golden Horseshoe. The Greenbelt offers an opportunity to choose a different path forward and to ensure, for example, that no more species join the ranks of those that have already been extirpated from the area: spring salamander, lake sturgeon, timber rattlesnake, eastern wolf and eastern cougar.

The creation of the Greenbelt has also increased public recognition of the importance of protecting biodiversity. The coupling of stronger policy and heightened awareness of species at risk and their habitat is a hopeful sign for the plants and animals. It is critical that the Greenbelt's principles of connecting and protecting natural areas be used to drive system-based planning and to help inform decision-making, so that biodiversity is protected on public and private lands alike.

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49 Bowles and others, *Species at Risk in Carolinian Canada,* p.10.

50 Rachel Carson. 1962. *Silent Spring.* Houghton Mifflin. Boston.

51 Greenbelt Plan, p.15.

52 Millennium Ecosystem Assessment. 2005. *Ecosystems and Human Well-Being: Synthesis.* Island Press. Washington, DC. Foreword.

PART 2

LOSING OUR CONNECTIONS: Key Threats to Greenbelt Species at Risk

A Fragmented World

"Destroying a rain forest for economic gain is like burning a Renaissance painting to cook a meal."
— E. O. Wilson

The high concentration of species at risk in the Greenbelt — more than one-third of the total in Ontario — is inextricably linked to the intense development pressure in this area. The conversion of natural and agricultural land to low-density housing developments, paved roadways and aggregate pits and quarries has had a significant impact on the overall health of the ecosystems in the area. The siting of developments is a key factor in their overall impact. When poorly sited, developments can fracture ecosystems or rupture connecting corridors among natural areas. Many creatures are imperilled by the loss of connectivity between the variety of habitats they rely on for different parts of their life cycle. Loss and fragmentation of habitat have significantly affected the majority of populations of species at risk in the Greenbelt.

Habitat fragmentation can be defined as breaking up large sections of habitat into smaller pieces, often resulting from clearing land for cities, roads and agriculture.[53] It affects the ability of many species to persist in an area, rendering them vulnerable to loss of food and shelter, increased disturbance from human activity, collisions with vehicles on roads and increased exposure to predators and parasitic or invasive species (for example, raccoons, feral cats, cowbirds and garlic mustard) that thrive along the edges of remaining, increasingly isolated patches of habitat. The Intergovernmental

53 Committee on the Status of Species at Risk in Ontario (COSSARO). Glossary: Habitat fragmentation. www.mnr.gov.on.ca/en/Business/FW/2ColumnSubPage/STEL02_168425.html.

Panel on Climate Change (IPCC) has also shown that the damage done to species by fragmentation may be compounded by the expected increase in global temperature.[54]

For certain species, the risks associated with habitat fragmentation may lead to their disappearance from an area.[55] Most animals, for example, move naturally across the landscape to differing habitat required for their breeding, feeding and wintering behaviours. Without the freedom to move from place to place, species become increasingly vulnerable to threats from humans and the natural world, leaving them susceptible to devastating effects from both natural and human-caused disasters (for example, forest fires or chemical spills). Populations can become inbred and susceptible to disease or blight. Limited food availability can weaken overall health. Regular seasonal patterns (such as migration to breeding areas) can become disrupted, altering behaviours and birth rates. Juveniles may not be able to disperse to less populated regions, and larger populations may have difficulty recolonizing areas where habitat has been restored or improved.[56]

The predicaments of many Greenbelt species highlight the fundamental link between habitat connectivity and healthy populations, as well as the losses that can be suffered as a result of habitat fragmentation. For species that face habitat loss and fragmentation as a primary threat, addressing detrimental impacts that land use decisions can have on the ecosystem as a whole is vital. The Greenbelt Plan helps to ensure that development decisions and changes to natural features are considered from a landscape-level perspective.

The challenge is nevertheless significant. From 1971 to 2001, urban areas in Canada more than doubled from 14,676 to 30,693 square kilometres. Ontario experienced one of the highest jumps in land conversion in the country, from under 6,000 to nearly 10,000 square kilometres.[57] Though the size of these developed regions is relatively small compared to the land base in the country, urban centres are often located in areas of high biodiversity[58] — such as the Greenbelt — and their footprint is enormous. Urban areas threaten biodiversity by causing the loss and degradation of habitat, through the encroachment of paved surfaces and human activities that cause pollution, greenhouse gas emissions and exploitation of species.[59] The construction of development sites in areas of high biodiversity can often result in high impacts to particular ecosystems such as wetlands.[60]

A report prepared for the Environmental Commissioner in 2008[61] detailed the disastrous effects of settlement patterns on wildlife habitat in southern Ontario after the Second World War. For more than 50 years, communities have been expanding their footprints through the development of low-density, single-family homes and their associated infrastructure (such as shopping malls, sewage treatment plants and roads). The pervasive creep of these suburban communities has likely caused "irreversible losses of forests, green space, wetlands, wildlife habitat, and natural environments."[62]

Most animals move naturally across the landscape to differing habitat required for their breeding, feeding and wintering behaviours. Without the freedom to move from place to place, species become increasingly vulnerable to threats from humans and the natural world.

PHOTO SCOTT GILLINGWATER

54 A. Fischlin, G. F. Midgley, J. T. Price, R. Leemans, B. Gopal, C. Turley, M. D. A. Rounsevell, O. P. Dube, J. Tarazona and A. A. Velichko. 2007. Ecosystems, their properties, goods, and services. *Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. M. L. Parry, O. F. Canziani, J. P. Palutikof, P. J. vander Linden and C. E. Hanson. (Eds.) Cambridge University Press. Cambridge, London.

55 *Natural Heritage Reference Manual,* pp.195–198.

56 *Natural Heritage Reference Manual*, pp.195–198.

57 Secretariat of the Convention on Biological Diversity, *Canada's Fourth National Report,* p.29.

58 Secretariat of the Convention on Biological Diversity, *Canada's Fourth National Report,* p.29.

59 Secretariat of the Convention on Biological Diversity, *Canada's Fourth National Report,* p.98.

60 Secretariat of the Convention on Biological Diversity, *Canada's Fourth National Report,* p.29.

61 Jack Donnan. 2008. *Economic Implications and Consequences of Population Growth, Land Use Trends, and Urban Sprawl in Southern Ontario.* Report to the Environmental Commissioner of Ontario. www.eco.on.ca.

62 Ibid, p.2.

In 2010, the conversion of agricultural lands to urban, built-up areas was also found to be a significant threat to species at risk that may rely on agricultural fields for surrogate habitat, such as grassland species.[63] Agricultural lands provide food and other commodities to southern Ontario residents — but they can also act as habitat for many species at risk, such as the American badger and barn owl. From 1993 to 2007, 68 per cent of the roughly five per cent of land that had been converted in the Greenbelt was agricultural.[64] York Region underwent the most significant land conversion of all the regional municipalities in the Greenbelt, accounting for 32 per cent of the land converted in the Greenbelt between 1993 and 2007.[65]

EDGE EFFECT

Agricultural lands provide food and other commodities to southern Ontario residents — but they can also act as habitat for many species at risk, such as the American badger and barn owl.

Many species at risk in the Greenbelt require relatively undisturbed natural areas of a significant size for all or some of their life cycles. As areas decrease in size because of habitat loss or fragmentation, the "interior" habitat they offer grows smaller and the amount of exposed "edge" habitat grows larger, augmenting threats to species that require the safety of interior habitat conditions for breeding and/or nesting.

In woodlands, edge habitat is usually warmer, drier and more susceptible to disturbance by predators and parasitic or invasive species than the sheltered, wetter interior forest. The *Natural Heritage Reference Manual* defines interior habitat for woodlands as more than 100 metres from the edge of the forested area, meaning that woodlands must be of a significant size to ensure this habitat exists.[66] The smaller the forest patches become, the fewer species remain within them.[67] In woodlands less than 100 hectares in size, for example, interior habitats are smaller than what is required by species like the hooded warbler and Acadian flycatcher.[68] The Greenbelt currently has an average of 30 per cent natural cover (forests and associated wetlands), with areas in the Niagara Escarpment containing well over 40 per cent.[69] These areas stand in marked contrast to some sections of southwestern Ontario, where natural cover can be as low as five per cent of the land base.[70] Environment Canada recommends that watersheds retain a minimum of 30 per cent natural cover to retain critical interior forest habitat.[71]

63 Ryan Cheng and Peter Lee. 2008. *Urban Sprawl and Other Major Land Use Conversions in Ontario's Greenbelt from 1993-2007: A Change Analysis Project Using Satellite Imagery.* Report to the David Suzuki Foundation. Global Forest Watch Canada. Edmonton, Canada. pp.4–5.

64 Cheng and Lee, *Urban Sprawl,* p.6.

65 Cheng and Lee, *Urban Sprawl.*

66 *Natural Heritage Reference Manual,* p.198.

67 Environment Canada. 2004. *How Much Habitat Is Enough? A Framework for Guiding Habitat Rehabilitation in Great Lakes Areas of Concern*. (2nd ed.). Report for the Ministry of the Environment. p.7.

68 Landowner Resource Centre. *Conserving the Forest Interior: A Threatened Wildlife Habitat.* www.lrconline.com/Extension_Notes_English/pdf/forInterior.pdf.

69 Wilson, *Ontario's Health, Canada's Future,* p. 24.

70 Ontario Nature. 2004. *Suggested Conservation Guidelines for the Identification of Significant Woodlands in Southern Ontario.* Report for Ontario Nature. Toronto, Canada. p.74.

71 Ontario Nature, *Suggested Conservation Guidelines*, p.8

CLIMATE CHANGE

The anticipated effects of climate change will be magnified in fragmented areas. Invasive species are more likely to gain a toehold whereas native species may be unable to make the necessary northern migration.[72] Current climate change models predict that plant and animal populations will have a better chance at long-term survival as global temperatures increase if they are able to move northward to areas with a more suitable climate.[73]

A recent report by the Environmental Commissioner predicted that the climatic conditions of most of southern Ontario will shift more than 500 kilometres northward, resulting in an average summer temperature increase of 2.6 C within the next 100 years. The temperature increase will likely be accompanied by more extreme weather events, including water shortages, severe storms and increased and prolonged heat waves.[74] As a result, according to the report, "Ontario's ecosystems will change radically with climatic shifts in the coming years."[75] Indeed, northern species have already begun to move northward from the United States, species that may disrupt existing ecological systems, such as the Virginia opossum and the black-legged tick.[76] These species can introduce new bacteria into ecosystems, crowd out native species in breeding and feeding grounds and disrupt the established food web.[77] Increasing temperatures may also alter species habitat, displacing prey species or changing moisture levels in soil. The ability of species to adapt to these and other climate-related threats will be heavily affected by habitat fragmentation. The presence of human-made barriers such as roads or cities would likely hinder the ability of many species to move across the landscape to locate alternative food sources and breeding grounds, potentially leading to disastrous effects on local populations as temperatures rise.

Current climate change models predict that plant and animal populations will have a better chance at long-term survival as global temperatures increase if they are able to move northward to areas with a more suitable climate.

A resilient landscape is a critical buffer against the predicted effects of climate change. Without landscape connectivity, species may be unable to move to more hospitable environments if necessary to escape established populations of invasive species or protect themselves against extreme weather events. In addition, temperature changes may alter plant cycles, requiring species to move to find new food sources. Maintaining landscape connectivity may be the single greatest protective tool for biodiversity in a changing climate. The IPCC has stated that without it, 20 to 30 per cent of the earth's plants and animals may go extinct — the largest mass extinction since the disappearance of the dinosaurs more than 65 million years ago.[78]

72 Environmental Commissioner, *Report 2009/2010*, p.33.
73 Environmental Commissioner, *Report 2009/2010*, p.33.
74 Environmental Commissioner, *Report 2009/2010*, p.33.
75 Environmental Commissioner, *Report 2009/2010*, p.33.
76 Environmental Commissioner, *Report 2009/2010*, p.34.
77 Environmental Commissioner, *Report 2009/2010*, p.34.
78 A. Fischlin and others, Ecosystems, their properties, goods, and services, p.213.

What are Species At Risk Telling Us?

The loss or decline of species is often used to illustrate loss of function in ecosystems. Like the canary in the coal mine once used to determine whether the levels of poisonous gas were too high for humans, these species signal the impact of human activities in the environment on which humans also ultimately depend. Four species at risk are highlighted here to illustrate the range of threats faced by species occupying diverse habitats across the Greenbelt and to demonstrate the pervasive challenge posed by ongoing habitat loss and degradation.

In the five years following the creation of the Greenbelt in 2005, 22 new species were listed as being at risk in Ontario. Eight of these species, roughly one-third, have habitat in the Greenbelt: rapids clubtail, common snapping turtle, bobolink, Canada warbler, chimney swift, common nighthawk, olive-sided flycatcher and eastern flowering dogwood. Threats to these species are diverse, and in some cases, such as the aerial insectivores, poorly understood.[79] Invasive species, pesticide use, road mortality, hunting, agricultural operations and less prey are among the causes of decline for one or more of these species. Habitat loss and degradation are a common threat to all.[80]

Four Greenbelt species have been placed in higher-risk categories. Three of these species — American columbo, redside dace and spotted turtle — face habitat loss as a primary threat. One species, American chestnut, is threatened by the non-native chestnut blight fungus.[81]

For the redside dace, of which 80 per cent of the remaining population occurs in the Greenbelt, habitat loss and degradation resulting from urbanization are the greatest threats.

REDSIDE DACE: THE HEALTH OF THE WATERSHED

For the redside dace, of which 80 per cent of the remaining population occurs in the Greenbelt, habitat loss and degradation resulting from urbanization are the greatest threats.[82]

The redside dace has been steadily declining over time. Five of 24 confirmed historic populations have already been lost.[83] Although its greatest stronghold in Ontario lies within the Greenbelt, it continues to decline even here — a sign of the deterioration of hydrological systems within the plan area caused by development pressures. Alarmingly, some of its most stable populations are in Greenbelt municipalities expected to face significant jumps in human population in the next 10 to 15 years: Durham, York and Simcoe.[84]

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79 J. McCracken. 2008. Are aerial insectivores being "bugged out"? *BirdWatch Canada* 42: 4–7.

80 COSEWIC.

81 See American chestnut at www.cosewic.gc.ca.

82 Redside Dace Recovery Team. 2010. *Recovery Strategy for the Redside Dace* (Clinostamus elongatus) *in Ontario.* Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources. Peterborough, Ontario. pp.6–10.

83 Redside Dace Recovery Team, *Recovery Strategy*, pp.6–10.

84 COSEWIC. 2007. *COSEWIC Assessment and Update Status Report on the Redside* Dace (Clinostomus elongatus) *in Canada.* Committee on the Status of Endangered Wildlife in Canada. Ottawa, Canada. p.28.

The redside dace is a strong indicator of the overall health of watersheds, given its sensitivity to changes in water temperature, quality and flow.[85] It could serve as the Greenbelt's poster child for the impacts of habitat loss and degradation. Both federal and provincial recovery strategies for the species emphasize the immediate threat of urban development, and they note the importance of addressing the "underlying mechanisms" that drive the destruction of natural areas.[86] These mechanisms include an increase in paved surfaces in urban areas that cause stream temperature fluctuations, unsatisfactory storm management that leads to increased pollutants in watercourses and changes to water flow that can alter breeding and feeding areas.[87] Understanding and addressing these mechanisms to maintain or restore hydrological systems would benefit both redside dace and humans inhabiting the same watersheds.

The impacts of habitat loss and degradation are well illustrated by comparing two redside dace populations in Lynde Creek, one of the few watercourses in southern Ontario with both viable and historical populations of this species. With headwaters originating on the Oak Ridges Moraine, Lynde Creek and its tributaries drain an area of approximately 130 kilometres into Lake Ontario. This watershed is highly rural in its northern sections and increasingly urban in the southern section near Whitby. In the northern section of the creek, a population of redside dace remains viable, though not strong. In the southern section of the creek, the redside dace population is likely gone. Though opportunities exist for restoration efforts, increasing urbanization has led to lower natural cover, playing a significant role in reducing the range and abundance of redside dace in the watercourse.[88]

The redside dace is a strong indicator of the overall health of watersheds, given its sensitivity to changes in water temperature, quality and flow. It could serve as the Greenbelt's poster child for the impacts of habitat loss and degradation.

Some portions of the southern end of Lynde Creek and many of its associated coastal wetlands fall outside the purview of the Greenbelt Plan, as they are located in existing or previously approved urban areas. A watershed-based approach to protecting and restoring redside dace is thus a challenge, requiring the cooperation of municipalities and conservation authorities to address development pressures the length of the river corridor.

Recent efforts by the Town of Whitby to purchase and protect upland properties to reduce the effects of impervious surfaces (for example, roads, parking lots and buildings) on the stream, combined with the Greenbelt's stronger protections of the Lynde Creek headwaters on the Oak Ridges Moraine, may benefit the small red-striped fish. Ontario Streams, a not-for-profit environmental organization, has also undertaken a large private-landowner project to help restore vegetated buffers on the watercourse (see Section 3 of this report).

JEFFERSON SALAMANDER: A TALE OF TWO REGIONS

The long-toed, long-snouted Jefferson salamander is an elusive species inhabiting the vernal pools and forests of the Niagara Escarpment. The salamander is secretive by nature, spending winter buried underground in dry deciduous forests, and spring and summer in small, ephemeral ponds close to its forested hibernation grounds. Despite, or perhaps because of, its mysterious nature, the Jefferson salamander is a much-beloved symbol of the escarpment's natural wonders. Though its range in Ontario was once continuous on and adjacent to the escarpment, with some populations on the north shore of Lake Erie, the salamander is now known to be present in only 328 breeding ponds often isolated from each other by roads and other developments.

85 Redside Dace Recovery Team, *Recovery Strategy,* p.7.
86 COSEWIC, *Report on the Redside Dace*, p.28
87 Redside Dace Recovery Team, *Recovery Strategy,* p.7.
88 Redside Dace Recovery Team, *Recovery Strategy,* p.3.

Habitat loss and degradation resulting from development and other human activities are the number one threat to the Jefferson salamander.[89] This species must cover relatively large distances every year as it migrates between underground areas for wintering and wetlands for breeding. Disruption of natural corridors between these areas can severely impair the salamander's ability to breed.

Indeed, Jefferson salamander populations appear to be doing better in areas where habitat fragmentation is low. For instance, in York Region, where urban growth has accelerated dramatically over the last 30 years — since 1971, the developed area in the region has more than doubled — a population of salamanders was verified to be extant, but not likely to persist, by Ontario's Natural Heritage Information Centre (NHIC).[90] Though a number of wetlands remain in the area, only small forest patches are present, and the area has been highly fragmented by urban development that occurred before and immediately after the passing of the Greenbelt Plan.[91] In some cases, these developments were "grandfathered," that is, permitted to go forward because approval had been granted before the new plan came into effect.[92] In others, these developments are activities permitted under the Greenbelt Plan, often to the detriment of species habitat, such as infrastructure development or aggregate extraction of rock or gravel.[93]

Habitat loss and degradation resulting from development and other human activities are the number one threat to the Jefferson salamander.

PHOTO COURTSEY TODD W PIERSON VIA FLICKR

In comparison, numerous healthy populations of Jefferson salamander still exist in the more rural areas at the western edge of the Greenbelt's Protected Countryside in Halton Region.[94] The lush, deciduous forests and wetlands, which have long harboured these populations, have not been heavily fragmented.

In fact, Halton Region currently has the highest number of viable populations of Jefferson salamander in the Greenbelt.[95] One of the healthiest populations identified by the NHIC [96] occurs in an area near Speyside, where the percentage of natural cover is high (approximately 37 per cent forest and 17 per cent wetland) and connections among natural areas are relatively intact. It is important to note that before the passing of the Greenbelt Plan, this area fell outside the protections of the Niagara Escarpment Plan. Its inclusion in the Greenbelt's Protected Countryside will help ensure the persistence of the Jefferson salamander and other native species in the region.

The creation of the Greenbelt has also helped Halton Region strengthen its own natural heritage system policies. Its most recent official plan extended many Greenbelt natural heritage policies across the region as a whole. The extension of the natural heritage system outside the Greenbelt is a promising and laudable initiative which should benefit both known and undiscovered populations of Jefferson salamander.

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89 Jefferson Salamander Recovery Team. 2010. *Recovery Strategy for the Jefferson Salamander* (Ambystoma jeffersonianum) *in Ontario.* Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources. Peterborough, Canada. p.10.

90 Natural Heritage Information Centre, Ontario Ministry of Natural Resources. http://nhic.mnr.gov.on.ca.

91 Cheng and Lee, *Urban Sprawl*, pp.4–5.

92 Environmental Registry (accessed Feb. 1, 2011). www.ebr.gov.on.ca/ERS-WEB-External/displaynoticecontent.do?noticeId=MjM0NjE=&statusId=MjM0NjE=&language=en.

93 Greenbelt Plan, p.54 (site alteration).

94 Note, however, that portions of the Halton Region have experienced heavy development as well over the last few decades, leading to natural cover in some areas as low as 12 per cent.

95 Natural Heritage Information Centre.

96 Natural Heritage Information Centre.

COMMON SNAPPING TURTLE: Licence to kill

The common snapping turtle is a rather prehistoric-looking creature. Its impressive size and even more impressive hooked upper jaw have perhaps awarded it with an undeserved reputation as being dangerously aggressive — rumoured to nip at the toes of unsuspecting swimmers in freshwater lakes, in search of a tasty morsel. Even its nomenclature reflects the dread evoked by its fierce beak, long neck and long tail: in English, it is the *snapping* turtle; in French, *tortue serpentine*, loosely translated as the serpent turtle. Its reputation is not well deserved. Though its posture may be aggressive if cornered on land, there are no confirmed attacks from a snapping turtle in the water in Ontario. It will usually choose flight over fight if an escape route is available.[97] The common snapping turtle is often to be seen sunning its large shell beside the freshwater habitat it relies upon.

Road mortality is a highly significant threat for Canada's largest freshwater turtle because of its slow, lumbering gait and habitat fidelity.

The 2009 listing of the common snapping turtle as a species of special concern illustrates the impact of a specific type of lost connectivity that results from road development. The common snapping turtle — as its name suggests — was once abundant in wetlands, slow-moving streams and ponds throughout southern Ontario, including the Greenbelt. Over the last several decades, however, its numbers have been steadily dropping and its range contracting.[98] Road mortality is a highly significant threat for Canada's largest freshwater turtle because of its slow, lumbering gait and habitat fidelity.

Given that southern Ontario has more roads than anywhere else in Canada and has suffered extensive aquatic habitat loss and degradation — for example, 85 per cent of wetlands have been lost since settlement in the Niagara Region[99] — road mortality poses a particular threat to reptiles and amphibians as they move back and forth between aquatic and terrestrial habitats, often to mate or lay eggs. Combined with low reproductive rates, the effects of roadkill on populations of the common snapping turtle can be devastating. Quite simply, the loss of mature adults in populations can slow reproduction levels below what is needed to maintain viable population numbers, and even relatively secure populations can be severely affected.[100]

As the listing for snapping turtle is quite recent, few data have been gathered on the health of its populations, but reports from groups like the Ontario Road Ecology Group show that snapping turtles are often hit by passing vehicles.[101] The impact of road mortality on the common snapping turtle illustrates a weakness of the Greenbelt Plan, which allows infrastructure development, including roads, in natural heritage areas, following an environmental assessment. As a result of this policy, the common snapping turtle, as well as many other species at risk, faces the twinned threat of road mortality and habitat loss.

The news is not all bad, however, for common snapping turtle habitat in the Greenbelt. While infrastructure and road development have caused and will likely continue to cause some wetlands to be damaged or lost, positive trends have emerged for protecting both locally and regionally significant wetlands within the Greenbelt.[102] The Greenbelt Plan has resulted in regional municipalities in the area protecting or working toward protection for all wetlands and adjacent lands within their region, not only those designated as provincially significant, from development and site alteration.

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97 www.tortoisetrust.org/articles/snappers.htm.

98 COSSARO Classification March 24–25 and May 27–29, 2009, assessments reported to the Minister of Natural Resources on June 11, 2009. p.4.

99 Ontario Biodiversity Council, *State of Ontario's Biodiversity 2010.*

100 COSSARO, p.4.

101 Ontario Road Ecology Group, Toronto Zoo. www.torontozoo.com/conservation/RoadEcologyGroup.asp.

102 Unpublished data. 2010. *Monitoring the Greenbelt's Wetlands Project*. Ducks Unlimited, Ecojustice, Earthroots and Ontario Nature. Report to Friends of the Greenbelt Foundation.

HOODED WARBLER AND OTHER FOREST BIRDS: Living on the edge

Several Greenbelt species at risk are birds that rely on large forest patches for at least one part of their life cycle (breeding, nesting, feeding and/or migration).[103] These include the recently listed olive-sided flycatcher, Canada warbler and whip-poor-will as well as the hooded warbler, Acadian flycatcher and cerulean warbler. Habitat loss and degradation are known or suspected threats to all of these species.

The hooded warbler, so named for the dramatic black hood next to the bright yellow face of the male of the species, requires large forested areas for survival and clearly illustrates the threats posed by habitat fragmentation and the edge effect. The hooded warbler builds its nest close to the ground and requires areas of 100 to 400 hectares to protect itself from predators lurking on the edge of its habitat. The loss of large, intact forests in southern Ontario, including the Greenbelt, has had a significant impact on this species' ability to guard its nest from the parasitic brown-headed cowbird. The cowbird, a grassland species that thrives along forest edges, lays its eggs in the nests of other birds such as the yellow warbler, song sparrow, red-eyed vireo and chipping sparrow. Its young often outcompete the young of the host species. Under favourable conditions, the cowbird can lay up to 40 eggs in other birds' nests in a single season.[104] Without the ability to go deeper into forests where cowbirds do not penetrate, hooded warblers are ill-equipped to defend themselves.[105] The lack of interior forest also exposes them to edge habitat predators such as raccoons, common crows, grey squirrels and domestic cats.

Concerted efforts by landowners outside the Greenbelt to create the conditions necessary for the hooded warbler to thrive have helped, in part, to improve its overall ranking over the last five years from threatened to special concern.

Few large forest patches remain in the Carolinian life zone of the Greenbelt, and hooded warbler populations have been extirpated from the more heavily developed sections of Halton, Niagara and York. Currently, there are only four known populations of hooded warbler in the Greenbelt.[106] None of these populations is considered likely to persist, in part because of the small size of the forest patches in which they live and the extremely high site fidelity of the species that makes it difficult for hooded warblers to adapt and move to areas with more woodland cover.[107]

One of the healthiest populations ranked by the NHIC is located in the Niagara Region near the small town of Brookville.[108] Unfortunately, the warblers' survival remains questionable. Though the area still has relatively high forest cover, and the patch in which the warblers are located is one of the largest forested areas in the region, natural cover mapping shows some potential fragmentation of the area, which may have resulted in the relatively low health of the population.

Concerted efforts by landowners outside the Greenbelt to create the conditions necessary for the hooded warbler to thrive have helped, in part, to improve its overall ranking over the last five years from threatened to special concern.[109] Education, outreach and action by local conservation organizations, such as the Carolinian Canada Coalition and Bird Studies Canada, have helped landowners to practise group tree selection, where trees are cut in a manner that more closely resembles old-growth stands with natural gaps in the canopy. These initiatives demonstrate that a concerted approach to education and habitat restoration across a landscape can have proven

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103 Landowner Resource Centre, *Conserving the Forest Interior*.

104 Bird Studies Canada. *Brown-headed Cowbird Fact Sheet*. www.bsc-eoc.org/national/nw_cowbirdsheet.html.

105 Bowles and others, *Species at Risk in Carolinian Canada,* p.14.

106 Natural Heritage Information Centre.

107 COSEWIC. 2000. *COSEWIC Assessment and Update Status Report on the Hooded Warbler* (Wilsonia citrina) *in Canada.* Committee on the Status of Endangered Wildlife in Canada. Ottawa, Canada.

108 Natural Heritage Information Centre.

109 Bird Studies Canada.

benefits for forest birds. Similar, targeted stewardship efforts should be undertaken with identified populations in the Greenbelt.

Meanwhile, it is fortunate for the hooded warbler and other forest-dwelling species at risk that the Greenbelt Plan defines woodlands to capture even small stands of trees.[110] Within the plan, woodlands can be designated as significant because of the function they provide in the landscape. For example, small forest patches can be deemed significant if they occur in areas with little overall forest cover. Since the Greenbelt Act was only passed in 2005, it is too early to determine whether these stronger protections have been successful in both creating and protecting hooded warbler habitat, but the broader definitions of woodlands have, in part, enabled planners to take a landscape approach to natural heritage system planning in areas where hooded warbler are found, such as Halton Region.[111]

110 Greenbelt Plan.

111 Region of Halton: *Regional Official Plan.* www.halton.ca/cms/one.aspx?portalId=8310&pageId=8483.

The Benefits of Functioning Ecosystems

Functioning ecosystems provide an immense number of ecosystem services, which are relied on by all components within the web of life, including humans. Sometimes referred to as the planet's "life-support systems,"[112] these ecosystem services comprise tangible goods and services such as clean water, timber, wild foods, pollination, flood control and carbon sequestration as well as cultural, spiritual, recreational and health benefits.[113]

By protecting ecosystems such as the habitat of species like redside dace and Jefferson salamander, Ontarians are protecting their own drinking water. Similarly, by protecting wetlands and small freshwater areas for the common snapping turtle, we can better manage stormwater, leading to lower rates of flooding and soil erosion. Without these healthy ecosystems, infrastructure that performs the same services would have to be built at great cost to society, with no guarantee that the function would compare favourably to that which is provided for free by the original natural areas. In areas of high environmental degradation, human health tends to be lower.[114] Without the full complement of Greenbelt species, critical ecosystem services will be lost, which will have immense ramifications for humans living in and near the Greenbelt.

Humans rely on natural areas for both their physical and their mental well-being. Keeping watercourses clean and flowing ensures humans have healthy drinking water. Retaining wetlands helps prevent floods and soil erosion. Maintaining forest cover aids with cleaning the air and regulating temperature. Keeping natural spaces intact has also been shown to benefit mental health. A study conducted in the 1980s among hospital patients showed that patients with a view of green spaces enjoyed quicker recoveries and experienced less pain while recuperating.[115] Children exhibit higher levels of concentration when encouraged to get regular exercise outdoors.[116] Office workers reported lower levels of stress and higher job satisfaction when windows faced natural areas.[117]

Collectively, we must protect the natural ecosystems in the Greenbelt, for humans and wildlife alike. The next section explores what is needed to protect species at risk and their habitat, and some of the tools at our disposal to do so, examining the strengths and weaknesses of supporting policies.

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112 Millennium Ecosystem Assessment, *Ecosystems and Human Well-Being*, p.1.

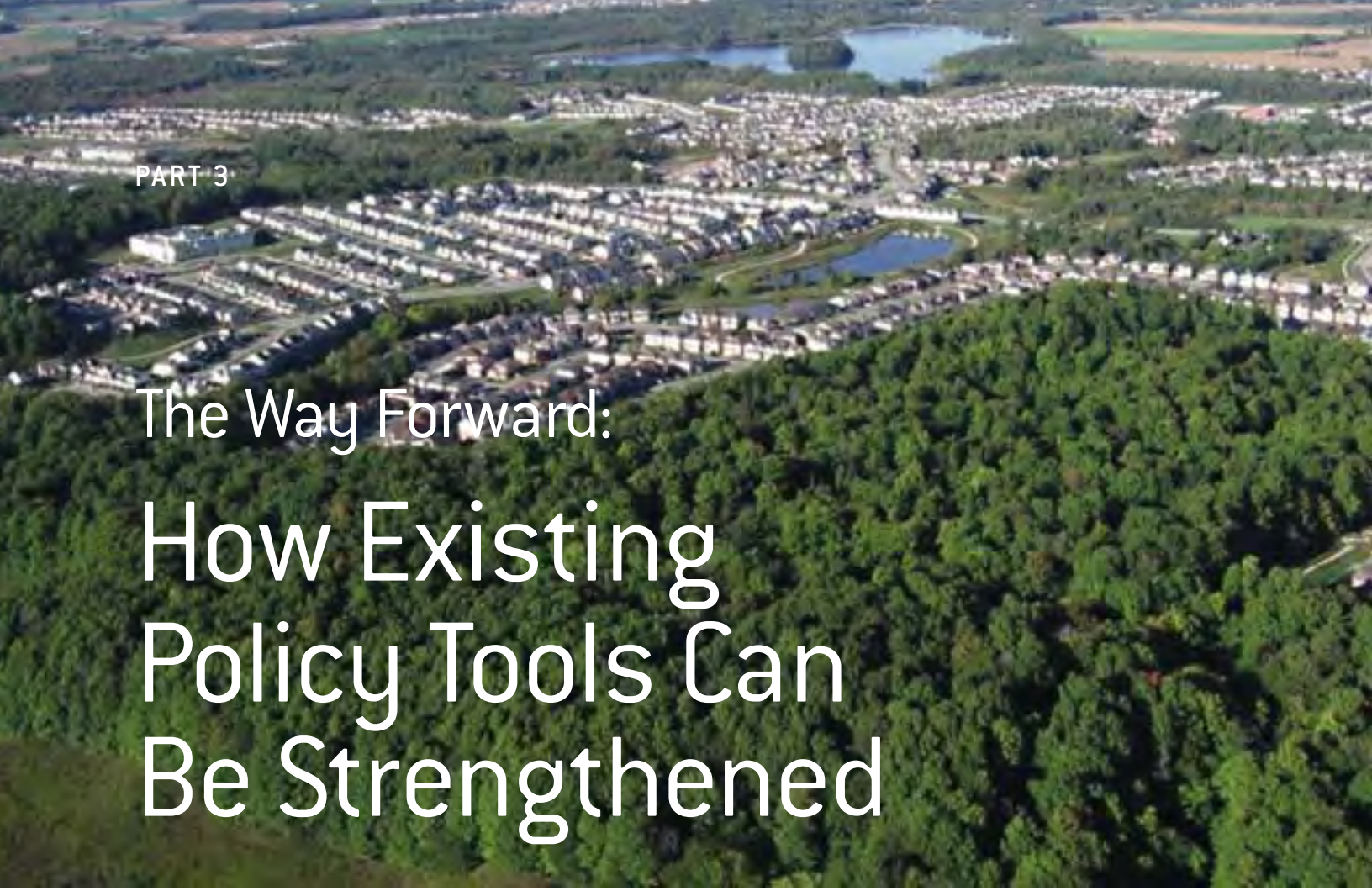
113 Wilson, *Ontario's Wealth, Canada's Future*, executive summary.

114 Millennium Ecosystem Assessment, *Ecosystems and Human Well-Being*, introduction.

115 Ontario Nature. 2008. *Healthy Perspectives: Your Greenbelt/Your Health*. Report for Friends of the Greenbelt Foundation.

116 Ontario Nature, *Healthy Perspectives*.

117 Ontario Nature, *Healthy Perspectives*.



PART 3

The Way Forward: How Existing Policy Tools Can Be Strengthened

We rely on systems for nearly every aspect of our physical well-being and safety, from the internal circulatory system that pumps blood through our bodies to the external transportation system that directs vehicles and pedestrians to stop and go in an orderly fashion. Plants, animals and other life forms rely on systems as well, from the fascinating system of photosynthesis to the intriguing (and terrifying, depending on your perspective) system of the food web. Perhaps it is little wonder, therefore, that a landscape crowded with all these forms of life now relies on systems to guide development, industry and natural heritage protection.

The concept of natural heritage system planning is a relatively new construct in Canada and Ontario. Based on the fundamental principle of maintaining and enhancing natural passageways across the landscape, this type of planning is intended to ensure that remaining natural areas can function at the highest level possible in the provision of ecosystem services. A landscape that contains few connections among natural areas shows a significant loss in the provision of services, including wildlife habitat, soil retention and water drainage.[118] In the 1980s, as studies began to come to light regarding these losses of function, a shift in thinking about planning and development began to occur in Ontario, setting the stage for the Oak Ridges Moraine Conservation Plan and the Greenbelt Plan twenty years later.

Previously, the focus for most local, regional and provincial natural area strategies was the protection of cores — large natural areas such as parks, conservation areas and nature reserves, or well-stewarded private properties where woodlands, wetlands and other natural features had

"Perhaps the time has come to cease calling it the "environmentalist" view, as though it were a lobbying effort outside the mainstream of human activity, and to start calling it the real-world view."
— E. O. Wilson

118 R. F. Noss, H. B. Quigley, M. G. Hornocker, T. Merrill and P. Paquet. 1996. Conservation biology and carnivore conservation in the Rocky Mountains. *Conservation Biology* 10: 949–963.

been restored or maintained. Unfortunately, as road construction and housing development and industrial activities crept ever closer to the perimeter of these cores, populations of species within those natural areas became cut off from nearby ecological areas on which they formerly relied for food, breeding and other parts of their life cycle. Without the ability to move around the landscape, these populations were increasingly vulnerable to the effects of disease, drought and disturbance.

In 1986, Forman and Godron's *Landscape Ecology* detailed the lack of function within these increasingly fragmented areas of North America, illustrating the link between a disconnected landscape and vulnerable populations of species. This new school of thought, coupled with provincial landscape assessments that illustrated the decreasing natural cover in southern Ontario, prompted the Ontario government to begin examining the current land use regime and start coordinating planning decisions across the landscape.[119] In Ontario, this planning method is called natural heritage system planning.

Natural heritage system planning was first formally discussed by the Ontario government in 1991, enshrined in policy in the Provincial Policy Statement in 1997 and further refined in large land use plans, such as the amendment to the Niagara Escarpment Plan, the Oak Ridges Moraine Conservation Plan and the Greenbelt Plan. All three of these plans within the Greenbelt are rooted in the protection and restoration of natural cores and corridors that provide habitat for species at risk and other plants and animals.

Corridors or linkages connect the core areas to each other, increasing the habitat value of smaller or more fragmented core areas by allowing species to move away from threats, to breed with populations outside their immediate surroundings, and to locate different food sources.

Large natural areas, or cores, are critically important to species at risk. These core areas "form a nucleus of habitat critical to the survival of species."[120] For these cores to fully function as habitat, however, natural corridors must also be present on the landscape. Corridors or linkages connect the core areas to each other, increasing the habitat value of smaller or more fragmented core areas by allowing species to move away from threats, to breed with populations outside their immediate surroundings, and to locate different food sources. Like cores, the size of corridors can vary depending on the surrounding landscape, though larger corridors are more likely to provide safe passage for species and withstand pressures from nearby human activities. There are numerous recognized core areas with established linkages between them in all three plans within the Greenbelt. Though they vary in size depending on their landscape context, they have all been identified as significant given their high concentration of natural heritage values and their ability to provide habitat for a range of plant and animal species.[121]

Because of its complexity, the success of natural heritage system planning relies on more than the creation and implementation of policy frameworks such as the three plans within the Greenbelt. While these land use plans coordinate the high-level planning, complementary legislation such as the Endangered Species Act and the Species at Risk Act has also been put in place to protect and recover species at risk and their habitat. Further, a variety of individuals and organizations engaging in voluntary stewardship actions can help breathe life into policy, fostering communities that appreciate and conserve natural areas for their ecological values and their importance to human health and well-being.

119 Natural Heritage Information Centre.

120 Ontario Nature. *Cores and Corridors: The Importance of a Green System in Southern Ontario.* www.ontarionature.org/protect/PDFs/cores.pdf.

121 Greenbelt Plan.

Plans and Policies for the Greenbelt

Working at a landscape level to protect individual species and biodiversity requires legislation and policy that provide a comprehensive overview and coordinated approach as well as specific direction on activities. It also requires efforts by individuals and organizations to meaningfully implement both regulations and voluntary activities. This section will evaluate the three land use plans of the Greenbelt; the policy that supports and adds to the objectives of those plans; and the individual and community actions that are contributing to the protection of biodiversity within the Greenbelt.

NIAGARA ESCARPMENT PLAN, 1985

The Niagara Escarpment Plan (NEP) was the first large-scale environmental land use plan adopted in Ontario, and indeed in Canada. It protected a significant landform across municipal jurisdictions and recognized the importance of cores and corridors in land use planning. Its establishment was a significant accomplishment in the history of conservation in Ontario, in part because it set an important precedent for landscape-level planning and in part because it protected an important landform in the province. The NEP was born of citizens' concerns regarding large aggregate operations up and down the spine of the escarpment. As early as 1962, public concern regarding the effect of pits and quarries on the Niagara Escarpment had begun to grow, coming to a head when an aggregate operator blasted away a large chunk of the escarpment in the Halton Region that was clearly visible from the heavily travelled Highway 401.[122] Public outcry from local residents and organizations such as Ontario Nature (formerly Federation of Ontario Naturalists) led to the Ontario government commissioning several studies, appointing a task force to make recommendations based on those studies and passing the Niagara Escarpment Planning and Development Act in 1973.

The NEP was born of citizens' concerns regarding large aggregate operations up and down the spine of the escarpment. As early as 1962, public concern regarding the effect of pits and quarries on the Niagara Escarpment had begun to grow.

The NEP is the only large-scale land use plan in Ontario that is overseen by its own independent commission, which was created when the legislation was passed in 1973. The Niagara Escarpment Commission (NEC) is a provincial agency composed of 17 people appointed by the Ontario Cabinet and paid staff that has the central duty of administering the NEP. The NEC has four major functions: approving or rejecting applications for development permits; reviewing proposals for amendments to the plan; assessing land uses both inside and outside of the plan area; and coordinating plan-related activities with other government activities. The NEC is advised by a public interest advisory committee, which is intended to provide a cross-section of public opinion from a variety of sectors, including industry and conservation.[123] The NEC has the mandate to monitor and amend the plan based, in part, on the advice of the public committee.

122 Attridge and others, *Protecting the Niagara Escarpment: A Citizen's Guide*, p.20.

123 Niagara Escarpment Foundation and the Coalition on the Niagara Escarpment. 2004. *Protecting the Niagara Escarpment: A Success Story*. Report prepared for the George Cedric Metcalf Foundation.

As the NEP has been in place for more than 25 years, it is possible to gauge its success in protecting the habitat of species at risk by doing baseline assessments. Though aggregate extraction is prohibited in many parts of the escarpment plan area, some significant habitat destruction has still occurred as a result of aggregate extraction in selected regions, and strong pressure still exists for the development of more aggregate extraction sites in the region.[124] A comparative study done in 2004 showed that more shoreline and woodlands have been protected in the escarpment plan area than in its immediate surroundings — outside the plan area, 44.4 kilometres of shoreline had been developed (24.6 per cent of the total area), while inside, only 3.6 kilometres had been altered (3.3 per cent). In addition, forested area within the plan area had increased by more than double the rate outside.[125]

OAK RIDGES MORAINE CONSERVATION PLAN, 2001

The plan area specifically designates natural cores, linkages, and countryside and settlement areas, with varying uses that can occur within each designation.

The Oak Ridges Moraine Conservation Plan (ORMCP) was created to help protect the rolling hills and green valleys located at the northern edge of Greater Toronto. Much of the moraine remains in a natural state and provides habitat to many of the Greenbelt's species at risk. In addition, its groundwater and surface water provide drinking water for many people in Ontario. The particular geological processes that formed these aquatic features left behind numerous deposits of sand and gravel, making the area a popular location for aggregate extraction. Further, its location at the north end of metropolitan Toronto made it an ideal location for urban commuters to settle, resulting in an increasing rate of urbanization.

In 1989, a public interest group, Save The Oak Ridges Moraine (STORM), was formed to raise concerns about the increasing stress placed on the sensitive ecological system of the moraine. In the years that followed, numerous studies were conducted, task forces were struck and reports were published that highlighted the need for special protection on the moraine. Bolstered by a growing public outcry, the campaigns of elected officials and the support of groups like Ontario Nature (formerly Federation of Ontario Naturalists), STORM was successful in 2001 in its bid for the creation of the Oak Ridges Moraine Conservation Act, establishing the ORMCP.[126]

The ORMCP requires municipalities within it to develop watershed plans to help safeguard important hydrological areas. These plans are intended to reflect the carrying capacity of each area; that is, community expansion and land use decisions must consider the ecological function of the area. Like the NEP before it, the ORMCP focused on restoring and protecting natural connections across the landscape. The plan area specifically designates natural cores, linkages, and countryside and settlement areas, with varying uses that can occur within each designation. Specific natural features within these areas are also identified and given individual protection, if necessary.

In most cases, development and site alteration cannot occur in or immediately beside key natural heritage areas. Aggregate extraction cannot occur in areas designated as natural cores, but it is permitted to occur in areas designated as natural linkage, despite the function these areas perform for species at risk. As well, infrastructure projects can occur in both natural cores and natural linkages.

Though the ORMCP has been in place for nearly 10 years, its requirement to develop a monitoring framework to assess its efficacy in accomplishing objectives has yet to be fulfilled. The lack of

124 M. Winfield and A. Taylor. 2005. *Rebalancing the Load: The Need for an Aggregates Conservation Strategy for Ontario*. Report for the Pembina Institute. Toronto, Canada.

125 Niagara Escarpment Foundation, *Protecting the Niagara Escarpment: A Success Story*, p.60.

126 Moraine for Life.

monitoring makes it difficult to determine whether species at risk and their habitat have benefited from the plan.

GREENBELT PLAN, 2005

The Greenbelt now refers to the entire area covered by all three plans, encompassing the NEP area, and the ORMCP area and additional Greenbelt lands. The specific zoning designations and policy requirements of the NEP and ORMCP prevail within their boundaries. The Greenbelt Plan is a specific set of policies intended to complement and support those of the other two plans.

The goal of the Greenbelt Plan to protect both natural heritage and agricultural land is unique in the three plans and was created as a result of extremely high projections regarding increasing settlement in Toronto and its surrounding region. Public concern regarding the effect these new housing developments and services would have on already swiftly disappearing natural and agricultural areas resulted in striking the Greenbelt Task Force in 2004. It recommended that a plan be created to include both environmental and agricultural protection. Though both of the preceding plans outline and support the importance of protecting farmland, neither emphasizes it to the same degree as the Greenbelt Plan.

In addition to its strong protection for wetlands, the Greenbelt Plan requires the identification and protection of many surface and underground watercourses that serve as the source of water in the area.

The Greenbelt Plan is designed to direct urbanization away from important natural heritage features within its natural and agricultural systems. It identifies key natural heritage and key hydrological features and their interrelationships, and restricts, for the most part, potentially damaging activities both on and adjacent to these features and systems. Development and site alteration that adversely affect the function of or connectivity among natural features, such as habitat for species at risk, woodlands, wetlands and grasslands, are not permitted. The Greenbelt Plan's definition of woodlands can be used to capture a range of tree stands, depending on the landscape context.

The two major policy components of the Greenbelt Plan clearly show the plan's emphasis on systems rather than individual features: the natural heritage system and the agricultural system. Covering nearly a quarter of the total Greenbelt area, the natural heritage system is the backbone of the Greenbelt Plan for species at risk and their habitat. Significant habitat for all species at risk (endangered, threatened and special concern) is considered a key natural heritage feature. As a result, development and site alteration cannot occur in these areas unless it can be demonstrated that these activities will have no negative effects on the feature or its function. As well, connectivity between these habitat areas is required to be maintained.

Wetlands are also considered a key natural heritage feature; that is, the same protections apply as they do for significant habitats. In addition to its strong protection for wetlands, the Greenbelt Plan requires the identification and protection of many surface and underground watercourses that serve as the source of water in the area. By considering the natural system in its entirety, and prompting decisions on this basis, the Greenbelt Plan protects the complex ecology that humans, plants and animals need to survive. The natural heritage system in the Greenbelt Plan allows regions to move forward with detailed natural heritage system planning that, at times, has exceeded the requirements of the Greenbelt Plan.

As a result, the natural heritage system of the Greenbelt Plan protects headwaters of all major watersheds in the areas extending from the west end of Toronto that were not previously protected under the other plans; by doing so, it connects and enhances existing protection and supports designated urban growth centres. As well, habitat for species at risk, such as the Jefferson salamander, that was previously at the western edge of the Niagara Escarpment Plan is now included.

In 2009, the Ministry of Municipal Affairs and Housing (MMAH) developed a set of criteria to encourage municipalities to put forward requests to expand the Greenbelt into areas that would enhance the existing natural heritage or hydrological systems of the plan. Six municipalities are now entertaining the option of submitting requests: Brampton, Guelph, Hamilton, Mississauga, Oakville and Toronto. In several cases, the municipalities are considering requesting that public lands along major river systems within their boundaries be included in the Greenbelt.

It is important to note that many populations of species at risk exist on the boundary of the Greenbelt. As such, the development of a framework to allow municipalities to make requests to grow the Greenbelt is a positive step. Though habitat for species at risk and other species has not been, to date, the first consideration for Greenbelt expansion requests, the habitat of many species will likely be included if draft requests go forward. For example, Toronto's consideration of public lands along the Humber and Don rivers will have a positive benefit by formally incorporating the entirety of the river valley corridors into the water resource system where known redside dace populations are present.

Like the NEP and the ORMCP, the Greenbelt's principles are laid out in the high-level plan and implemented through more detailed municipal official plans where geographic decisions and designations are clearly outlined in maps and descriptions. This process is lengthy. More than five years after the Greenbelt Act's enactment, most regional municipalities have only recently completed their new official plans. Many smaller municipalities, which must conform to their upper tier's plan, have only just begun the process of aligning their policies with the Greenbelt Plan.

Despite the protections offered through the Greenbelt Plan's natural heritage system, infrastructure development, transportation corridors and aggregate extraction are all permitted within it. Aggregate extraction continues to present one of the most significant threats to the landscape resiliency of the Greenbelt,[127] but all of these large-scale activities have the potential to significantly affect the habitat of species at risk, both now and in the future. The increasing road mortality rates for many reptiles, amphibians and small mammals with habitat close to highway corridors is only one example of the challenges presented by these permitted uses within the Greenbelt Plan.

Finally, though the Greenbelt Act requires a full-scale extensive monitoring framework to be developed and implemented to ensure the plan's objectives are being met, the province currently has released only a draft version of the framework, and no results have been collected or analyzed. As a result, it is difficult to evaluate the impact that the Greenbelt has had on the habitats and biodiversity of the Greenbelt Plan area.

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127 Maureen Carter-Whitney. 2010. *Ontario's Greenbelt in an International Context.* Report to the Friends of the Greenbelt Foundation. Canadian Institute for Environmental Law and Policy. Toronto, Canada. p.64.

ENDANGERED SPECIES ACT, 2007

Given the significant number of species at risk in the Greenbelt, the strengthening of Ontario's Endangered Species Act (ESA) in 2007 will help planners and the public fulfill the broad objectives of the Greenbelt Plan in two ways. The first is the protection of the species themselves from harm or harassment. The second is through the development of recovery strategies and habitat regulations.

The ESA's greatest potential for protecting Greenbelt species is its reliance on science as the deciding factor for the listing of species at risk. Under Ontario's previous endangered species legislation, which was passed in 1971, only 42 species were listed as of 2008. Only 12 of the identified Greenbelt species at risk were listed, including the prothonotary warbler, Henslow's sparrow and loggerhead shrike.[128] Other species, such as the northern bobwhite, barn owl and wood turtle, were acknowledged by the Ministry of Natural Resources (MNR) as being in peril, but no legal protection was granted to them. Ontario's new ESA has assigned listing decisions to the Committee on the Status of Species at Risk in Ontario (COSSARO), resulting in a significant increase in listed species to its current count of over 200. In addition, the ESA provides mandatory habitat protection for all threatened and endangered species, though many land use activities can still continue within regulated habitat. The previous Act's inability to offer any flexibility in land uses within regulated habitat made many decision-makers leery of listing species at all.[129] This flexibility is a strength of the new ESA, though it must be used carefully to ensure that development activities do not undermine the ecological function of these habitat areas.

The ESA's greatest potential for protecting Greenbelt species is its reliance on science as the deciding factor for the listing of species at risk.

Activities that previously might not have been permitted in habitat can now go forward by permit, agreement or another instrument (i.e., an authorization under another piece of legislation such as the Aggregate Resources Act). Permits can be issued for the purpose of human health or safety; the protection or recovery of species; overall benefit for the species (that is, significant measures must be taken to ensure that more good than harm will come to the species); and significant social or economic benefit to Ontario. Agreements can be granted for the sake of stewardship that might involve unintentional harm to a species at risk, but will ultimately assist in the protection or recovery of the species. Instruments allow for activities permitted under other acts to go forward despite their impact on the habitat of species at risk or a member of the species, with the permission of the Minister of Natural Resources, so long as the same general conditions as those for permits are met and the minister believes that the action will not jeopardize the survival or recovery of the species.

The ESA is a huge step forward for the protection of biodiversity in the Greenbelt and beyond. There is, however, potential for the spirit and intent of the ESA to be undermined if flexibility measures are used too freely. For example, since the passing of the ESA, permits have been used to allow for activities that damage or destroy habitat for species at risk, often with little regard for the cumulative impact that a series of individual permits might have.[130]

In the case of redside dace, four permits and two agreements have been issued for developing buildings, sewers, roads, municipal drains and stormwater management.[131] The permits were 'overall benefit' permits, setting a high standard for activities to go forward. Yet, like many species at risk, the redside dace relies on a wide variety of factors for its life cycle, and damage to one part of the system may not be offset by improvement to another part. As the redside dace is under significant

128 Bell and DeMarco, *Waiting for the Ark*, pp.13–14.

129 Environmental Commissioner of Ontario. 2009. *The Last Line of Defence: A Review of Ontario's New Protections for Species at Risk.* Special Report to the Legislative Assembly of Ontario. Toronto, Canada.

130 Environmental Registry (accessed Feb. 16, 2011). www.ebr.gov.on.ca.

131 Environmental Registry (accessed Feb. 16, 2011). www.ebr.gov.on.ca.

pressure in almost all of its occupied areas, and the MNR has yet to develop guidelines on the thresholds to disturbance that populations of redside dace can withstand, it is impossible to confirm whether the mitigation measures within the permits will be enough to help populations survive.[132]

Fortunately, the ESA also appears to be driving significant reforms in planning and decision-making for redside dace habitat. The redside dace habitat regulation protects both direct and indirect habitat for the species, including the headwaters that feed the streams and rivers on which the fish relies as well as historical habitat where redside dace populations may reasonably reoccur. Because many redside dace populations occur in areas under high demand for development, this regulation is also accompanied by recommendations of best management practices for the development industry. One of these recommended practices is the development of sub-watershed plans within redside dace habitat, which would complement the watershed plans that are already required under the ORMCP and help refine the existing protections for hydrological systems in both the Greenbelt Plan and the NEP. This recommendation is a significant step forward in the integration of habitat protection and land use planning, as it requires that the full effect of actions on an entire system be considered. This approach should be applauded as a strong precedent for implementation of the act.

It is critical that science inform the implementation of the ESA, whether through the assessment of applications for permits that allow potential harmful activities to move forward or through guidelines for industry and private citizens to ensure that a full understanding of the required habitat is used to inform land use decisions in and around species at risk.

SPECIES AT RISK ACT

Protection under SARA is limited to federal lands for most species, but aquatic species and migratory birds are protected everywhere across the country.

The provincial ESA is complemented at the national level by federal species at risk legislation. Although the Species at Risk Act (SARA) has not had many immediate ramifications for Greenbelt species at risk or their habitat, it is a potential mechanism for their protection in the future. Habitat protection under SARA is limited to federal lands for most species, though aquatic species and their habitats are also offered some protection. It is also possible for SARA's "safety net" to be employed; however, it has not been used to date for any species in Canada.[133] This provision in SARA is a discretionary measure that enables the federal minister to protect habitat outside of federal lands that is facing significant threats of destruction. Its lack of deployment is, in part, why provincial legislation to protect species at risk is so critical.

SARA was enacted in 2002; its responsible agencies are Environment Canada, Parks Canada and the Department of Fisheries and Oceans. As of May, 2011, there were 635 species listed as at risk in Canada by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC); but, as of October 2011, only 492 of those were listed under SARA (i.e. listed on Schedule 1 of the Act). Those not listed, including several Greenbelt species, do not fall under the provisions of the federal legislation.

As recovery strategies are required under both the ESA and the federal SARA, recovery strategies developed under SARA are used as the basis for recovery strategies for Greenbelt species under the ESA . The sharing of information is a good indicator of how the two laws can be used cooperatively to enhance the scientific understanding of species at risk in Ontario and other jurisdictions in Canada. The transfer of knowledge may also help reduce the substantial workload attached to the development of recovery strategies and other regulations under both laws.

132 COSEWIC, *Report on the Redside Dace,* p.28.

133 Wojciechowski et al., 2011.

However, the potential to develop joint recovery strategies has also resulted in red tape bogging down the process. Two recovery strategies under the ESA (for eastern pondmussel and red knot) have been delayed "to allow for cooperation" at the federal level, putting off protection for these species in Ontario.[134] The notice on the Environmental Registry states that provincial strategies for both species will be completed within nine months of finalizing the federal strategy, but no further timeline is provided. The notice was posted in December 2009.[135]

PLANNING ACT AND PROVINCIAL POLICY STATEMENT, 2005

The Planning Act and, under it, the Provincial Policy Statement (PPS) guide land use planning throughout Ontario. The Planning Act is the regulatory framework; the PPS provides direction for municipalities that must implement the policy in municipal official plans. The Greenbelt Plan, NEP, ORMCP and all supporting policy must be read in coordination with the Planning Act's policy directives in the PPS.

The PPS ensures the overall goals and objectives for community development are fulfilled at every level of municipal decision-making, from the footprint of infrastructure for stormwater management and waste diversion to the protection of natural areas for both recreational and ecological purposes.

Section 2.0 of the PPS is intended to be the touchstone for municipal planning departments making natural heritage policy decisions. Municipalities must follow the requirements of the PPS on areas outside the Greenbelt and follow the PPS and the designated land use plan within the Greenbelt. The province encourages municipalities to develop policies for their communities that support the natural heritage systems within the Greenbelt through good policy decisions for areas outside of it. The increased emphasis of the importance of natural heritage systems was a significant step forward in the 2005 version of the PPS.

The PPS ensures the overall goals and objectives for community development are fulfilled at every level of municipal decision-making, from the footprint of infrastructure for stormwater management and waste diversion to the protection of natural areas for both recreational and ecological purposes. The process of making decisions that can meet goals for economic development, environmental protection and social well-being warrants this comprehensive approach.

The PPS guides municipalities at a very high level; it does not delve into detailed explanations of how its requirements are to be met. Further, though it suggests that natural heritage systems should be protected, there is no requirement to do so within its policies. Natural heritage systems are not defined or contained by the borders of a town or city or even by the designations of the Greenbelt Plan. Watercourses run inside and outside of the Greenbelt; forests straddle the Greenbelt's boundaries. Though the PPS does recognize that natural systems do not follow lines drawn on maps by policy-makers, it is up to municipal planners to make decisions on whether natural heritage systems should extend beyond Greenbelt boundaries. Given the economic and social pressures facing many municipalities, areas outside the Greenbelt are generally awarded less protection to accommodate industry and urban growth.

A requirement, rather than a recommendation, to protect natural heritage systems would help Greenbelt planners to protect the necessary components that would support the Greenbelt's natural heritage system across their municipalities.

134 Environmental Commissioner of Ontario. 2010. Supplement to *Redefining Conservation: Annual Report 2009/2010*. Report to the Legislative Assembly of Ontario. Toronto, Canada.

135 Environmental Registry 010-8464 (accessed Feb. 17, 2011). www.ebr.gov.on.ca/ERS-WEB-External/displaynoticecontent.do?noticeId=MTA4MzA4&statusId=MTYyNjk2&language=en.

Further, the PPS currently has no requirement that planners consider the cumulative impact of a series of relatively small decisions on the natural heritage system, which can eat away at species habitat and the natural heritage system as a whole.

Finally, though the current PPS requires that municipalities protect habitat for species at risk in their official plans, restricting development within specified zones, the method for coordinating these protections with those under the ESA and SARA is not always clear to planning agencies. Some Greenbelt aquatic species, for example, may require the protection of tributary streams outside of the Greenbelt to ensure water quantity and quality are appropriate. In the absence of clearly defined habitat provisions in a recovery strategy under the ESA, planners may unknowingly be required to make decisions that could have an adverse effect on Greenbelt species at risk.

GROWTH PLAN FOR THE GREATER GOLDEN HORSESHOE

While the PPS provides high-level guidance to planners for urban growth areas, the Growth Plan for the Greater Golden Horseshoe (Growth Plan) details where development can occur. The Growth Plan was designed to work in concert with the Greenbelt Plan to ensure that communities can accommodate new settlement while still protecting the natural areas that provide critical ecosystem services for residents, such as clean air and water.

Problems with the Growth Plan arise when the ecological carrying capacity of areas designated as urban growth centres are not taken into account — an issue identified in many of the forecasted growth regions, perhaps none as startling as the Paris and Galt moraines on the western edge of the Greenbelt's Protected Countryside.

The Growth Plan was prepared under the Places to Grow Act, 2005. By issuing specific directives regarding where development can occur (that is, in urban growth centres), the plan is intended to protect "key building blocks of the GGH's natural systems ... rivers and streams, forests and natural areas will be protected and accessible for residents to enjoy their beauty." The Growth Plan is provided to help municipalities make educated decisions on where it is appropriate to build and expand their communities, forecasted to grow significantly in the next 20 years. The strategy, to anticipate and plan for growth rather than attempt to retroactively combat the effects of unplanned development, has the overall goal of reducing sprawl in the Greater Golden Horseshoe (GGH).

The Growth Plan provides the smart-growth underpinnings of development in the GGH. Problems with the Growth Plan arise when the ecological carrying capacity of areas designated as urban growth centres are not taken into account[136] — an issue identified in many of the forecasted growth regions, perhaps none as startling as the Paris and Galt moraines on the western edge of the Greenbelt's Protected Countryside.

The Paris and Galt moraines cover more than 560 square kilometres from Caledon to Norfolk — approximately one-third of the moraines are currently in the Greenbelt Plan. Like the Oak Ridges Moraine, this area stores and filters a large amount of groundwater, thereby supporting a huge network of cold water streams and wetlands throughout the Grand River watershed. Despite requests from the Grand River Conservation Authority that the entire moraine be protected to ensure that human activities would not undermine the ecological function of the area,[137] only one-third was included in the Greenbelt.

The Growth Plan has identified five urban growth centres on the Paris and Galt moraines. The Environmental Commissioner of Ontario has commented that these sites clearly illustrate the "tension between meeting Growth Plan population targets and protecting the water resources of watersheds."

136 Environmental Commissioner, *Report 2009/2010*.

137 Ministry of the Environment. 2009. *EBR Review Response: Paris and Galt Moraines.* Report to the Ministry of the Environment. Queen's Printer for Ontario. Toronto, Canada.

The moraines, already under significant pressure from high levels of aggregate extraction, may not be able to withstand the increased demand that expanding communities will certainly place upon its hydrology. A recent report completed by the Ministry of the Environment failed to examine these potential cumulative environmental effects and their implications for species with nearby populations in the Greenbelt, like the Jefferson salamander and Blanding's turtle that rely on the water flow of the moraines for their habitat.[138]

Section 4.2.1 of the Growth Plan[139] requires municipalities and communities to develop sub-area assessments to identify and protect natural heritage systems, including habitat for species at risk. To date, however, no assessments have been completed, resulting in a limited approach to planning for growth that may have a negative effect on species in areas like the Paris and Galt moraines.

Failing to develop these assessments once again highlights how a lack of coordination can lead to a lack of systemic planning in the complex landscapes of southern Ontario. Though each part of the landscape performs a multitude of functions, decision-making bodies are often focused on isolated aspects of the ecological or economic systems, resulting in piecemeal decisions.[140]

Much of the policy discussed in this section is still relatively new, in place for less than a decade. The Greenbelt Plan was passed in 2005 to provide a solid regulatory framework for a shift in thinking for land use planning and to establish support for its associated policies, the ORMCP and the NEP. Many municipalities within the Greenbelt are still going through their own reviews to incorporate the changes required by policy. Both the Greenbelt Plan and the ORMCP have the potential to meet and perhaps even exceed the ecological gains achieved by the NEP and to crystallize public support and understanding for the protection of a natural heritage system across southern Ontario. In coordination with supporting law and policy, such as the ESA, the Greenbelt Plan is positioned to make significant positive enhancements in the protection of biodiversity in southern Ontario.

Community-led conservation initiatives and private stewardship are also critical. Without a show of support and resulting actions from the public regarding the need for healthy plant and animal populations in the Greenbelt, protection for biodiversity will be nowhere near as strong as it could be in the Greenbelt and beyond. Stewardship action on private and public lands serves two purposes. First, these efforts help people use their wisdom, physical strength and force of will to accomplish key objectives to protect and restore habitat. Second, and perhaps even more importantly, these actions help connect people to natural areas, instilling an ethic of conservation that goes beyond the activity itself.

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138 Ministry of Environment, *EBR Review Response*.

139 Growth Plan for the Greater Golden Horseshoe. 2006. *Places to Grow: Better Choices, Brighter Future.* S.O. 2006. Queen's Printer for Ontario. Toronto, Canada.

140 Environmental Commissioner, *Report 2009/2010*.

Taking it to the People

As a large-scale land use goal that relies on municipal implementation and community support, the protection of biodiversity within the Greenbelt hinges on the contribution of local knowledge and action. The integration of community-led efforts with the regulatory regime accomplishes two things. First, decision-makers can be both heartened and inspired by on-the-ground support for high-level policies. Second, natural heritage systems can be strengthened in ways that make sense scientifically and socially, leading to the increased resilience of the system and an increased understanding of the beneficial role nature plays in healthy communities.

A program operates with greatest strength if its actors can do whatever they do best to help accomplish a common goal. In the southern section of the Greenbelt, a partnership of individuals, conservation groups, planning authorities and funding organizations is doing just that. Each partner has been able to contribute a specific component to get a large landscape-level project off the ground that combines the purchase of properties by land trusts and voluntary efforts on private and public land that provides natural connections.

The area is the last remaining region on the Greenbelt where wetlands are still contiguous to Lake Ontario, and its connectivity provides Carolinian habitat for Greenbelt species at risk such as the hooded warbler, Jefferson salamander, monarch butterfly and eastern spiny softshell turtle.

COOTES TO ESCARPMENT PARK SYSTEM

Nothing can better illustrate the complexities of land use planning in southern Ontario than the vision for the Cootes to Escarpment Park System, which covers 1,500 hectares, involves nine partners and attempts to accomplish the major ecological and community goals of the Greenbelt plan.[141] The project's goal is to connect nine existing protected areas to form a migratory and recreational corridor from Hamilton Harbour and Cootes Paradise to the Niagara Escarpment. The area is the last remaining region on the Greenbelt where wetlands are still contiguous to Lake Ontario, and its connectivity provides Carolinian habitat for Greenbelt species at risk such as the hooded warbler, Jefferson salamander, monarch butterfly and eastern spiny softshell turtle. The area is also used by many more common bird, amphibian and reptile populations.

The project is in early days, with a recent publication of its vision and strategy. Early funding for the strategy's development has come from the project partners: Bruce Trail Conservancy, City of Burlington, City of Hamilton, Conservation Halton, Hamilton Conservation Authority, Hamilton Harbour Remedial Action Plan, Hamilton Naturalists Club, Region of Halton and the Royal Botanical Garden, as well as the Friends of the Greenbelt Foundation and, in 2011, the Ontario Trillium Foundation. The coordinated effort has a key goal of creating "stronger and more sustainable protection for species at risk and their sensitive ecological communities." The strategy will involve protection through the purchase and management of properties by land trusts, education and outreach for property owners within the project area and coordinated voluntary stewardship efforts on public and private land. These efforts will help restore and maintain the natural integrity of the core areas and associated corridors, many of which may be found on private land, to enhance the ecological system in the

141 Cootes to Escarpment. 2009. *Cootes to Escarpment Park System: A Conservation Vision*. Report to Cootes to Escarpment.

region. A collaborative project like the this one has the potential to make a significant contribution to the protection of species at risk and their habitat in the Greenbelt.

VOLUNTARY STEWARDSHIP PROGRAMS

Private land stewardship is an important component of natural heritage protection in southern Ontario. The role of private landowners in stewardship cannot be overestimated in the Greenbelt, where significant sections of environmentally sensitive land are owned by private citizens. Many programs coordinated by government and non-profit organizations provide willing landowners with information and partial or full funding to implement positive ecological actions on their land.

LYNDE CREEK BIODIVERSITY REHABILITATION PROJECT

Using preliminary funding from the Oak Ridges Moraine Land Trust, Ontario Streams has identified the important hydrological corridor of Lynde Creek for its myriad ecological values, not least of which is the habitat provided for redside dace.[142] Lynde Creek, which originates on the Oak Ridges Moraine, is one of the urban watercourses with protected headwaters within the Greenbelt but an unprotected watercourse. At its northern extent, it flows through a fairly rural landscape before running into the increasingly urban centres of Brooklin and Whitby.

Brooklin is surrounded by "whitebelt lands" — areas where Greenbelt protection does not apply and which abut existing urban settlement boundaries. Since the passing of the Greenbelt Plan, many of these whitebelt areas have been purchased by developers operating under the assumption that urban growth will soon push into these areas. The increased development interest has caused concern for both Ontario Streams and private landowners on Lynde Creek and resulted in the creation of the Lynde Creek Biodiversity Rehabilitation Project. In 2009, Ontario Streams contacted numerous landowners, subsequently enrolling five in the initial project. Rehabilitation plans for five properties have been developed, based in part on habitat assessment.

In 2010, a 430-metre buffer strip was planted on a stream that flows into Lynde Creek. Previously, the property had supported a livestock operation and cattle were permitted to graze right down to the stream's edge, damaging terrestrial and hydrological system in the area. The buffer extends horizontally 30 metres on both sides of the water's edge along the watercourse, leading to increased soil retention and cooling of the freshwater stream. The initiative is the first to be completed under the project and will set the precedent for other plans to follow.[143]

These projects will feature a number of actions for stream restoration, including planting vegetated buffers (with a direct benefit for shade-dwelling species like the redside dace), removing debris and potential sources of contamination adjacent to the stream and creating in-stream structures to encourage spawning or other life processes for species at risk as well as more common species.[144]

142 Ontario Streams: *Lynde Creek Biodiversity Rehabilitation Project*. www.ontariostreams.on.ca/Lynde%20Creek.htm.

143 Interview with Christine Pritchard, Ontario Streams, Jan. 27, 2011.

144 Interview with Christine Pritchard.

CONSERVATION LAND TAX INCENTIVE PROGRAM AND MANAGED FOREST TAX INCENTIVE PROGRAM

The Conservation Land Tax Incentive Program (CLTIP) is managed by the Ministry of Natural Resources to provide tax relief to private landowners with specific natural features on their land.[145] Landowners with portions of the Niagara Escarpment natural zones, wetlands, areas of natural or scientific interest (ANSIs) and habitat for endangered species can apply for 100 per cent tax relief on the eligible portions of their land. All conservation land must be at least one-fifth of a hectare.

The Managed Forest Tax Incentive Program (MFTIP) is coordinated by stewardship councils across the province to enhance woodlands on private property. To qualify for the tax credits associated with MFTIP, landowners must own at least four hectares of land and prepare a forest management plan for those areas under the guidance of the stewardship councils. Areas enrolled in MFTIP are taxed at 25 per cent of the local municipal rate for residential properties.

In 2004, the province announced improvements to CLTIP and MFTIP to help support the then-proposed Greenbelt Plan. Conservation organizations were able to apply for CLTIP, and the assessment process for MFTIP was refined. Unfortunately, the landowners with threatened or special concern species are still not eligible for benefits under CLTIP. This omission is significant, because a concerted effort to protect habitat for species listed as special concern or threatened might help enhance their survival and recovery, ultimately leading to them being taken off the list of species at risk.[146] In 2010, only 60 properties in the province received tax relief under this section of the CLTIP because they had endangered species on their property.[147]

The Ministry of Natural Resources does not release statistics on regional enrollment or land types currently in the program, but in 2011, there were 19,050 participants in the program with over 237,320 hectares enrolled across the province.

In November 2008, the Ministry of Natural Resources announced the creation of a funding pool designed to help private landowners restore or enhance species at risk habitat on their properties.

SPECIES AT RISK FARM INCENTIVE PROGRAM AND CANADA FARM STEWARDSHIP PROGRAM

In November 2008, the Ministry of Natural Resources announced the creation of a funding pool designed to help private landowners restore or enhance species at risk habitat on their properties. The announcement coincided with the end of the Greenbelt Farm Stewardship Program that had previously been funded by the Friends of the Greenbelt Foundation. This program had been providing funding of a similar type exclusively to farms within the Greenbelt.

The initial pilot for the Species at Risk Farm Incentive Program (SARFIP) was awarded $800,000, to be administered by the Ontario Federation of Agriculture and delivered by the Ontario Soil and Crop Improvement Association (OSCIA). It could fund up to 100 per cent of the costs of a habitat improvement project worth up to $20,000. As the program moved forward, it was restructured to emphasize cost-sharing over full payment for habitat improvement. Currently, the program funds up to 50 per cent of the costs. In areas identified as a priority, such as the Lake Simcoe watershed, federal funding can also be accessed to cover additional costs.

SARFIP was designed to run in tandem with the federal Canada Farm Stewardship Program. To qualify for both programs, farmers are required to put together an Environmental Farm Plan (EFP), to assess and prioritize which environmental actions should take place on their farm and put a plan

145 Ministry of Natural Resources.
146 Environmental Commissioner, *Last Line of Defence*, p.54.
147 Environmental Commissioner, *Last Line of Defence*, p.54.

in place to accomplish these tasks. Often, the OSCIA helps farmers to determine whether federal or provincial funding is available to complete components of their EFP to ensure that as much landscape restoration as possible is done in a fiscal year.[148] The purpose of both the Canada Farm Stewardship Program and the SARFIP is, in part, to engage farmers in species at risk protection, as well as numerous other farm stewardship practices that can have positive environmental benefits. High enrollment rates indicate a great interest and desire in the agriculture community to do just that.[149]

SARFIP does not require landowners to prove that species at risk are present on their property or to restore habitat based on the needs of targeted species. As a result, successful SARFIP-funded projects over the last two years have resulted in greater landscape cover that may be used as habitat, such as wetlands, woodlands and grasslands, but no numbers are available on usage of this land by species at risk.[150]

GREENBELT FARM STEWARDSHIP PROGRAM

From 2006 to 2008, the Greenbelt Farm Stewardship Program, funded by the Friends of the Greenbelt Foundation, helped farmers accomplish projects associated with their EFP. The program, delivered by the OSCIA, helped to lay the groundwork for SARFIP by encouraging farmers to complete their EFPs and to consider how improved farm practices, such as planting trees for windbreaks, creating stream buffers and improving nutrient management, could achieve the benefit of creating habitat for species at risk.[151]

Over its two-year run, 700 projects were completed. These projects covered a range of objectives and included 20,000 trees planted on 20 farms.

Over its two-year run, 700 projects were completed. These projects covered a range of objectives and included 20,000 trees planted on 20 farms. The trees were often planted as windbreaks. Windbreaks offer numerous habitat benefits as increased tree cover provides nesting and feeding grounds for bird species and can also help regulate the temperatures of stream corridors, depending on their location on the farm.[152]

Nutrient management was also a popular project under the Greenbelt Farm Stewardship Program. Plans were developed on 6,000 acres of farmland in the Greenbelt for farmers to manage chemicals, fertilizers and other potentially toxic material in a way that does not damage water and soil. Further changes to grazing practices can also help keep waterways clean for species at risk; for example, refined rotational grazing practices on nine farms prompted a change in livestock management, and 12 producers erected 18 kilometres of fencing to keep livestock out of riparian areas. The relocation of three livestock buildings away from water sources was also completed to help keep hydrological corridors intact.[153]

Finally, the Greenbelt Farm Stewardship Program prompted a 30 per cent reduction in pesticide use on 53 farms (constituting 4,000 acres) in the Niagara Region and additional pesticide reduction (on 47,000 acres) in other regions of the Greenbelt.[154] Many farmers were aware of and motivated by the fact that their work in planting trees, managing nutrients and reducing pesticides would have positive peripheral benefits for species at risk.[155]

148 Interview with Andrew Graham, Ontario Soil and Crop Improvement Association, Feb. 3, 2011.
149 Interview with Tom Parker, Species at Risk Farm Incentive Program participant, Feb. 3, 2011.
150 Personal communication from Andrew Graham, Ontario Soil and Crop Improvement Association, Feb. 3, 2011.
151 Personal communication from Andrew Graham.
152 Personal communication from Shelley Petrie, Friends of the Greenbelt Foundation, Feb. 1, 2011.
153 Personal communication from Shelley Petrie.
154 Personal communication from Shelley Petrie.
155 Personal communication from Shelley Petrie.

Overall, stewardship incentive programs, whether they be payment for projects, cost-sharing for priorities of the EFP or services by qualified agencies to help coordinate and advise on environmental actions, are beneficial to the Greenbelt's biodiversity. The results of these programs are difficult to measure, however, partly because of the lack of a requirement in the Greenbelt Plan for the province to put in place a cohesive and comprehensive monitoring framework to gauge changes over time in the plan area.

Section 5.8 of the Greenbelt Plan requires the Ontario government to create and implement a framework to evaluate the effectiveness of the Greenbelt Plan in achieving its goals.[156] Though a discussion paper on the draft framework was posted by the government in April 2010 for public consultation, no final version of the framework has been released to date. Without a framework, it is difficult to assess the achievements of the Greenbelt policies.

Monitoring the effectiveness of both regulatory and voluntary actions that provide habitat protection for species at risk is a critical component of effective implementation of the Greenbelt Plan. These results can help groups and individuals to adjust their activities. They can also enhance the development and implementation of policy. While some groups that work closely with specific areas are well positioned to provide consistent data on what is working and what is not — data that can help inform improvements to the Greenbelt — the need remains for a coordinated monitoring framework to help understand the current strengths and weaknesses of Greenbelt policies.

Monitoring the Greenbelt

DURHAM REGION COASTAL WETLANDS MONITORING PROJECT

The purpose of the project is to gather and analyze data over time in the coastal wetlands to ensure that trends can be adequately understood and management plans can be developed for the future.

The Durham Region Coastal Wetlands Monitoring Project has been gathering consistent results over time that could provide data for Greenbelt monitoring. Led by the Central Lake Ontario Conservation Authority (CLOCA), the program was created to help address significant losses in Durham's coastal wetlands, which have been heavily affected by encroaching development.[157] Environment Canada, the Toronto Region Conservation Authority and the Ganaraska Region Conservation Authority all partner with CLOCA to monitor the coastal wetlands of Durham.

The purpose of the project is to gather and analyze data over time in the coastal wetlands to ensure that trends can be adequately understood and management plans can be developed for the future. Key threats and the impact of nearby activities on the wetlands and their associated habitat for many species, including those at risk, are a critical component of the long-range study.

The partners use geological and biological indicators, including the health of plants, fish, breeding birds and amphibian communities, to develop rankings of water quality, quantity, vegetation and more. They pay specific attention to the impact that restoration efforts have had on the health of the wetland, to ensure that adaptive management practices are used in maintaining and restoring these critical hydrological systems.

156 Greenbelt Plan, p.45.

157 Central Lake Ontario Conservation Authority, *Durham Region Coastal Wetlands.*

Systemic Planning and Social Action

The strongest hope for the protection of biodiversity in the Greenbelt and beyond is the implementation of system-based land use planning and concerted social action to connect natural cores and corridors on both a terrestrial and a hydrological level.

The Greenbelt Plan and supporting policies are a huge step forward in land use planning in Ontario. Without the requirements and tools to identify and protect habitat for known species at risk and the natural heritage systems that support them, imperilled species could become extirpated (locally extinct) because of the rapid urbanization of regions of the Greenbelt.[158] If implemented effectively and strengthened in key respects, existing policies in southern Ontario can provide municipal, regional and provincial decision-makers with the ability to protect the Greenbelt and the multitude of species at risk and their habitats within it. Concerted efforts to create and coordinate funding for land securement, private stewardship efforts and stewardship incentive programs can also help breathe life into policy for the Greenbelt's plants and animals.

The directive and the opportunity granted to public entities and private citizens to use science-based thresholds to determine whether and how land use changes should occur, such as the requirement for community watershed plans to be developed under the ORMCP, are the most critical components of existing policy — and they must continue to be used in concert with stewardship incentive programs, educational activities and land securement initiatives to ensure that habitat for species at risk within the Greenbelt can be protected and restored.

The devil is in the details, however. Ontarians have many of the necessary tools to protect the plants, animals and other life forms within the Greenbelt. It is critical, therefore, that education and awareness of the need for protecting systems be provided to Ontarians. Without the political will to uphold and properly implement these policies, the worth of natural capital will continue to be an abstract concept to most people. Making certain that complementary policies are integrated at every level of their implementation can help ensure that the fundamental principles of the Greenbelt Plan are upheld.

The time has come to celebrate the benchmarks in protecting biodiversity that have been achieved, but, also, to talk of the various ways protecting wildlife habitat can be strengthened in the Greenbelt. This report will conclude with recommendations for doing just that.

158 Numerous species in the Greenbelt have been listed as vulnerable by the Natural Heritage Information Centre, including the Jefferson salamander, hooded warbler, redside dace, Blanding's turtle and rapids clubtail. Increased stresses for these populations could lead to their extirpation.

Conclusion

If Ontarians understand and acknowledge the many benefits of protecting habitat for plants, animals and other life forms, the Greenbelt can fulfill its promise and become a model of ecological and economic innovation for communities across Canada and the rest of the world.

THE GREENBELT FACES PRESSURES. Fragile plants grow on the edge of busy freeways; birds make their nests on the ledges of apartment buildings; rare trees cling to cliffs overlooking an expanse of natural and developed lands. The beauty and diversity of the Greenbelt's vast acreage could never be replicated by human hands — but it is in our power to protect all that remains on the landscape.

Small actions can make a huge difference. In some cases, mere acknowledgement of the connection between the natural world and human health will help build communities that adhere to, rather than exceed, the carrying capacity of the landscape in which they are situated. In others, big actions, such as the banning of DDT, have resulted in large changes. Given that so many species at risk remain, the time for concerted action to protect the Greenbelt's biodiversity is now.

These species need help to survive. Habitat loss and fragmentation are an ongoing threat. Roads, disturbances and development are taking their toll. Wetlands, woodlands and agricultural lands are experiencing the eroding pressures of urbanization. Without a resilient landscape, the approaching threat of climate change becomes ever more significant.

Strong policy currently exists that grants both public entities and private citizens an opportunity to build and maintain strong natural heritage systems. The Greenbelt Plan and supporting policies must continue to be implemented thoughtfully in concert with stewardship incentive programs, educational activities and land securement initiatives to ensure that habitats within the Greenbelt can be protected and restored.

If Ontarians understand and acknowledge the many benefits of protecting habitat for plants, animals and other life forms, the Greenbelt can fulfill its promise and become a model of ecological and economic innovation for communities across Canada and the rest of the world.

Recommendations

For the Greenbelt Plan and associated policy to effectively protect species at risk and their habitat, the Ontario government must take several steps:

RECOMMENDATION 1 — Make natural heritage system planning a requirement under the Provincial Policy Statement to ensure municipalities are clearly directed to develop system-based plans both inside and outside the Greenbelt.

RECOMMENDATION 2 — Strengthen the Greenbelt Plan during the 2015 review to better address the negative impacts of infrastructure development and aggregate extraction.

RECOMMENDATION 3 — Work with municipalities to refine requests to grow the Greenbelt so that they capture habitat for species at risk.

RECOMMENDATION 4 — Develop a comprehensive monitoring program to assess the extent to which the Greenbelt is accomplishing its objectives, including the protection of species at risk, and to enable and inform adaptive management to better meet those objectives.

RECOMMENDATION 5 — Increase funding for stewardship incentive programs, so that opportunities to leverage the interest and goodwill of landowners are not lost, and refine program objectives to more explicitly address the protection and restoration of habitat for species at risk.

RECOMMENDATION 6 — Coordinate incentive programs, stewardship activities, outreach programs and municipal policy on species at risk with recommendations in recovery strategies, so that efforts are strategically organized and delivered.

RECOMMENDATION 7 — Broaden the Conservation Land Tax Incentive Program to include habitat for threatened species.

RECOMMENDATION 8 — Coordinate the implementation of the Growth Plan with the implementation of the Greenbelt Plan through the development of sub-area assessments so that features which support the Greenbelt natural heritage system are protected for the long term and not overwhelmed by growing populations.

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INTERVIEWS AND PERSONAL CORRESPONDENCE

Andrew Graham, Ontario Soil and Crop Improvement Association, Feb. 3, 2011.

Fiona McKay, Ministry of Natural Resources, Conservation Land Tax Incentive Program, Feb. 4, 2011.

Tom Parker, participant, Species at Risk Farm Incentive Program, Feb. 3, 2011.

Shelley Petrie, Friends of the Greenbelt Foundation, Feb. 1, 2011.

Christine Pritchard, Ontario Streams, Jan. 27, 2011.

This report is the fourth in a series that studies natural capital and ecosystem services in Canada's urban centres. It reviews the state of species protection in southern Ontario and examines the benefits of protecting natural habitat in the internationally renowned Ontario Greenbelt. The report also provides recommendations on how to ensure that the Ontario Greenbelt fulfill its promise and become a model of ecological and economic innovation for communities across Canada and the rest of the world.

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