

Long Point Walsingham Forest: Situation Analysis

Setting the Context for the Conservation Implementation Plan



Cover Photo: Sunrise at the Big Creek National Wildlife Area, ©Britney MacLeod, 2018

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GLOSSARY OF TERMS

Definitions are from the *Open Standards for the Practice of Conservation Version 4.0* (Conservation Measures Partnership, 2020) and the *Foundations of Success Training Manual* (FOS, 2009).

Action – A general term used to refer to the work of conservation teams. This includes strategies, activities, and tasks.

Action Plan – A description of a project’s goals, objectives, and strategies to abate identified threats and make use of opportunities.

Activity – A specific action or set of tasks undertaken by project staff and/or partners to reach one or more objectives. Sometimes called an action, intervention, response, or strategic action. (See relationship to strategies.)

Adaptive Management – The incorporation of deliberate learning into professional practice to reduce uncertainty in decision making. Specifically, it is the integration of design, management, and monitoring to enable practitioners to systematically and efficiently test key assumptions, evaluate the results, adjust management decisions, and generate learning. The *Conservation Standards* explicitly bring adaptive management principles into conservation practice.

Assumption – An explicit statement of what a team assumes is true. The logical sequences linking project strategies to one or more targets as reflected in a theory of change. Assumptions may also include a team’s expression of how they anticipate external variables may influence the achievement of results (see also risk factor). Assumptions are also present in situation models linking presumed influencing factors to other factors. A project’s core assumptions are the logical sequences linking project strategies to one or more targets as reflected in a results chain diagram. Other assumptions are related to factors that can positively or negatively affect project performance – see also risk factor.

Biodiversity Target – A synonym for conservation target.

Conceptual Model – A synonym for situation model.

Conservation Target – An element of biodiversity (species, habitat, or ecological system) at a project site on which a project has chosen to focus. All targets should collectively represent the biodiversity of concern at the site. (Synonymous with biodiversity target, conservation focus, or conservation value.)

Direct Threats – Primarily human actions that immediately degrade one or more conservation targets (e.g., illegal logging or unsustainable fishing). They can also be natural phenomena altered by human activities (e.g., increase in extreme storm events due to climate change). Typically tied to one or more stakeholders. (Sometimes referred to as a “pressure” or “source of stress.” Compare with indirect threat.)

Evaluation – An assessment of a project or program in relation to its own previously stated goals and objectives. (See monitoring and compare to audit.)

Factor – A generic term for an element of a situation model including direct and indirect threats, opportunity. It is often advantageous to use this generic term since many factors – for example tourism – could be both a threat and an opportunity. (See also root causes or drivers.)

Goal – A formal statement detailing a project’s desired, such as the desired future status of a target. A good goal meets the criteria of being *specific, measurable, achievable, results-oriented, and time-limited* (SMART).

Impact – The desired future state of a conservation target. A goal is a formal statement of the desired impact.

Indicator – A measurable entity related to a specific information need, such as the status of a target, change in a threat, or progress toward an objective, or association between one or more variables. A good indicator meets the criteria of being: *measurable, precise, consistent, and sensitive*.

Indirect Threat – A factor identified in an analysis of the project situation that is a driver of direct threats. Often an entry point for conservation actions. For example, logging policies or demand for fish. (Sometimes called a root cause or underlying cause. Compare with direct threat.)

Intervention – A synonym for a specific or targeted strategy.

Key Attribute – Aspects of a target’s biology or ecology that if present, define a healthy target and, if missing or altered, would lead to the outright loss or extreme degradation of that target over time. (Also known as key ecological attribute).

Key Ecological Attribute (KEA) – Synonym for key attribute.

Monitoring – The periodic collection and evaluation of data relative to stated project goals and objectives. (Also referred to as monitoring and evaluation (M&E) or monitoring, evaluation and learning (MEL).)

Objective – A formal statement detailing a desired outcome of a project such as reducing a critical threat. A good objective meets the criteria of being specific, measurable, achievable, results-oriented, and time-limited (SMART). If the project is well-conceptualized and-designed, realization of a project’s objectives should lead to the fulfillment of the project’s goals and ultimately its vision. Compare to vision and goal.

Outcome – The desired future state of a threat or opportunity factor. An objective is a formal statement of the desired outcome. (Synonym for result).

Program – A group of projects which together aim to achieve a common broad vision. In the interest of simplicity, this document uses the term “project” to represent both projects and programs since these standards of practice are designed to apply equally well to both.

Project – A set of actions undertaken by a defined group of practitioners – including managers, researchers, community members, or other stakeholders – to achieve defined goals and objectives. The basic unit of conservation work. (Compare with program.)

Project Area – The place where the biodiversity of interest to the project is located. It can include one or more conservation areas or areas of biodiversity significance as identified through ecoregional assessments. Note that in some cases, project actions may take place outside of the defined project area.

Results Chain – A visual diagram of a project’s theory of change. A results chain includes core assumptions and the logical sequence linking project interventions to one or more targets. In scientific terms, it lays out hypothesized relationships or theories of change.

Scope – The broad geographic or thematic focus of a project.

Situation Model – A visual diagram of a situation analysis. A situation model (diagram) represents relationships between key factors identified in a situation analysis believed to impact or lead to one or more conservation targets. A good model should link the conservation targets to threats, opportunities, stakeholders, and key intervention points. (See also conceptual model.)

Stakeholder – Any individual, group, or institution that has a vested interest in or can influence the natural resources of the project area and/or that potentially will be affected by project activities and have something to gain or lose if conditions change or stay the same. Stakeholders are all those who need to be considered in achieving project goals and whose participation and support are crucial to its success.

Strategic Plan – The overall plan for a project. A complete strategic plan includes descriptions of a project’s scope, vision, and targets; an analysis of project situation, an Action Plan, a Monitoring Plan, and an operational plan.

Strategy – A set of activities with a common focus that work together to achieve specific goals and objectives by targeting key intervention points, optimizing opportunities, and limiting constraints. A good strategy meets the criteria of being: *linked, focused, feasible, and appropriate*. (See also intervention.)

Target – Shorthand for conservation target.

Theory of Change – A series of causally linked assumptions about how a team thinks its actions will help it achieve both intermediate results and longer-term conservation and human well-being goals. A theory of change can be expressed in text, diagrammatic (e.g., results chains), or other forms.

Threat – A human activity that directly or indirectly degrades one or more targets. Typically tied to one or more stakeholders. (See also direct threat and indirect threat.)

Viability Assessment – A flexible and powerful methodology based on sound ecological principles that helps address the challenges of defining healthy targets and setting appropriate and measurable goals.

Vision – A description of the desired state or ultimate condition that a project is working to achieve. A complete vision can include a description of the biodiversity of the site and/or a map of the project area as well as a summary vision statement.

Vision Statement – A brief summary of the project's vision. A good vision statement meets the criteria of being *relatively general, visionary, and brief*.

GLOSSARY OF ACRONYMS

ALUS – Alternative Land Use Services

BSC – Bird Studies Canada

CCC – Carolinian Canada Coalition

CIP – Conservation Implementation Plan

COSEWIC – Committee on the Status of Endangered Wildlife in Canada

CCVA – Climate Change Vulnerability Assessment

CWS – OR – Canadian Wildlife Service Ontario Region

ECCC – Environment and Climate Change Canada

EHJV – Eastern Habitat Joint Venture

ESA – Endangered Species Act

HSP – Habitat Stewardship Fund

IBA – Important Bird Area

IUCN – International Union for Conservation of Nature

KEA – Key Ecological Attribute

LPCIP – Long Point Causeway Improvement Program

LPPAA – Long Point Phragmites Action Alliance

LP RCA – Long Point Region Conservation Authority

LPWF – Long Point Walsingham Forest

NACP – Natural Area Conservation Program

NAWMP – North American Waterfowl Management Plan

NCC – Nature Conservancy of Canada

NWA – National Wildlife Area

NWCF – National Wetland Conservation Fund

OMAFRA – Ontario Ministry of Agriculture, Food and Rural Affairs

OMECF – Ontario Ministry of Environment, Conservation and Parks

OMNRF – Ontario Ministry of Natural Resources and Forestry

SAR – Species at Risk

SARA – Species at Risk Act

SARSF – Species at Risk Stewardship Fund

SARFIP – Species at Risk Farm Incentive Program

SFD – Snake Fungal Disease

UNESCO – United Nations Educational, Scientific and Cultural Organization

ACKNOWLEDGEMENTS

I. Land Acknowledgement

We recognize that the Long Point Walsingham Forest Priority Place is situated upon the Treaty Lands and Territory of the Mississaugas of the Credit First Nation and the Traditional Territory of the Haudenosaunee and Huron-Wendat. We recognize and acknowledge the continued impacts of colonialism and residential schools that disrupted Indigenous Peoples relationships with the lands. Southern Ontario is home to many First Nations and Métis Peoples and through this acknowledgement it is our intent to show respect for the people who have stewarded these lands and waters since time immemorial and those who continue to care for them. Through this acknowledgement, we are reminded of our connection to this land and commit ourselves to learn and work together in the spirit of reconciliation.

II. Contributors

Fifty-three individuals representing twenty-three organizations contributed their expertise to the development of the Long Point Walsingham Forest Situation Analysis. The following individuals and organizations are thanked for their time and input.

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1. INTRODUCTION

1.1 Overview

The federal government, in collaboration with the provinces and territories, has agreed to the implementation of the Pan-Canadian Approach to Transforming Species at Risk Conservation in Canada. This new approach will shift from a single-species approach to conservation to one that focuses on multiple species and ecosystems. Efforts are being concentrated on priority places, species, sectors and threats across Canada, enabling conservation partners to work together to achieve better outcomes for species at risk (SAR) (ECCC, 2018).

Priority Places are defined geographic areas of high biodiversity value with a recognizable ecological theme and social relevance, identified as a distinct place by the people who live there. Priority Places across Canada were selected based on a number of criteria, including: biodiversity values, conservation status, boundary optimization, achievability of conservation outcomes, and leadership and partnership opportunities.

The goal of the Priority Place initiative is to increase conservation outcomes for SAR, migratory birds and their habitats. This will be achieved by integrating Canadian Wildlife Service (CWS) and partner planning while targeting resources, funding and action to Priority Places in a collaborative, adaptive management forum using a stewardship first approach. Expected results for the Priority Place initiative include: better conservation outcomes for SAR, improved return on investment, and increased co-benefits for biodiversity, ecosystems, and climate change mitigation. Each Priority Place will undertake collaborative planning to develop a Conservation Implementation Plan using an adaptive management framework such as the Conservation Standards.

1.2 Selecting a Priority Place for Ontario

In August 2017, Long Point Walsingham Forest (LPWF) was selected as CWS-Ontario Region's (CWS-ON) Priority Place. It was selected based on a variety of factors including: high biodiversity, a concentration of mobilized and engaged conservation organizations, and the presence of significant threats requiring management.

The Priority Place was first identified using the CWS-ON Biodiversity Atlas (ECCC, 2017b), a geospatial representation of the CWS biodiversity portfolio developed in collaboration with the Nature Conservancy of Canada (NCC) (ECCC, 2015). It includes a landscape assessment completed at various scales (from Ecozone to

Box 1. The CWS Biodiversity Portfolio

The values used to measure the CWS-ON biodiversity portfolio are:

1. SAR richness
2. SAR count
3. SAR irreplaceability
4. Globally rare species locations
5. Coastal wetland locations
6. Colonial nesting waterbird locations
7. Landbird stopover locations
8. Shorebird stopover locations
9. Waterfowl stopover locations
10. Forest bird density
11. Open country bird density
12. Shorebird density
13. Waterbird density
14. Waterfowl density

2 ha hexagon), to assess habitats (forest, wetland, grassland), SAR and migratory bird attributes (see Box 1). LPWF was identified as a High Value Biodiversity Area in Ontario, containing high quality forest, wetland and grassland as well as being important for SAR and migratory birds.

Based on input received from partners during the planning process, various boundary optimization considerations were assessed. This led to the original August 2017 boundary being expanded to ensure inclusion of the entire Norfolk Forest Complex Important Bird Area and the Long Point Peninsula and Marshes Important Bird Area.

1.3 What is a Situation Analysis?

Within the context of the adaptive management framework *Open Standards for the Practice of Conservation (Conservation Standards)*, the Situation Analysis is a process for analyzing and creating a common understanding of a project's context. This includes the biological, social, economic, political and institutional systems that affect local biodiversity. By understanding both the local biological and human context within a project area, the most effective conservation strategies and actions that achieve the overall conservation goals can be established (WWF, 2006).

1.3 What is a Conservation Implementation Plan?

Integrated Conservation Implementation is premised on implementing conservation actions through a structured and repeatable adaptive management process, such as the *Conservation Standards*. The planning phase of the *Conservation Standards* describes developing an Action Plan which defines the goals, objectives, strategies, and monitoring plan of a project. Using the *Conservation Standards*, the LPWF Conservation Implementation Plan (CIP) was developed and refined based on input from over twenty-three local organizations and Ontario-based governments. The CIP is an iterative –or evergreen – document that identifies the highest priority strategies and actions for improving ecosystem health and conserving SAR in LPWF.

The following Situation Analysis will serve as the introduction to the LPWF CIP. Please refer to the CIP for details on strategies, actions and measuring progress.

2. METHODS

2.1 Open Standards for the Practice of Conservation

The adaptive management framework *Open Standards for the Practice of Conservation* (herein referred to as *Conservation Standards*) is being used to guide the development and implementation of the LPWF Priority Place project. The *Conservation Standards* is a science-based five step adaptive management cycle which brings together common concepts, approaches, and terminology in conservation project design, management and monitoring. The specialized software Miradi was used to develop key components of the Situation Analysis and Conservation Implementation Plan including: the viability assessment, threat assessment, situation models, and results chains. The *Conservation Standards* is an iterative process that

uses best available information. Due to the adaptive nature of the framework, the Situation Analysis and CIP can be updated at any time as information gaps are filled.

Box 2. Climate-Smart Conservation Practice

The Climate-Smart Conservation Practice is a guidance document that was developed to complement the *Conservation Standards*. It supports practitioners in considering climate change at each of the five steps of the *Conservation Standards* adaptive management cycle while undertaking conservation action planning (GIZ, 2021). Climate change impacts and adaptation measures have been incorporated throughout the Situation Analysis and CIP.

2.2 Integrated Conservation Implementation Planning

The Situation Analysis and associated CIP were developed collaboratively through the following workshops:

1. Workshop 1: The first two-day workshop held in February, 2018 was attended by local science experts. Participants discussed conservation targets, key ecological attributes for the viability assessment and completed a quick threat assessment.
2. Workshop 2: The second two-day workshop held in March, 2018 was attended primarily by local stewardship practitioners and focused on reviewing and building upon the work completed at the first workshop. Discussions focused on the draft vision, conservation target goals, opportunities, and conservation strategies.
3. Workshop 3: This one-day workshop held in Port Rowan on November, 2018 was focused on developing the agricultural strategies, actions and results chains specifically in relation to the threat of agricultural runoff.
4. Workshop 4: This one-day workshop held in Port Rowan in July, 2019 was focused on discussing selected strategies and identifying gaps in the CIP.
5. Workshop 5: This virtual workshop was hosted by the Climate Risk Institute in March 2021 and focused on gathering expert input to refine the Climate Change Vulnerability Assessment.

Several experts also provided their expertise into the development of the Situation Analysis and associated CIP. In particular, their input addresses the following priority threats:

1. Invasive species (*Phragmites australis* and others) (led by the Nature Conservancy of Canada)
2. Fire suppression (led by Natural Resource Solutions Inc.)
3. Roads (led by the Ontario Road Ecology Group)
4. Logging and Wood Harvesting (led by Birds Canada)
5. Climate Change (led by the Climate Risk Institute)
6. Housing and Urban Areas (led by the Long Point Basin Land Trust).

3. REGIONAL CONTEXT

3.1 Ecological Context

Geographic Extent

LPWF is situated in Southwestern Ontario along the northern shores of Lake Erie in Norfolk County. The area is 86,715 ha in size, and includes the Long Point sand spit (which extends over 30 km into Lake Erie) and the Norfolk Forest Complex (Figure 1). It is located within the Carolinian Life Zone, which makes up less than 1% of Canada's total land area but contains a greater number of flora and fauna species than any other vegetation zone in Canada. The LPWF Priority Place also overlaps with the Nature Conservancy of Canada's Southern Norfolk Sand Plain Natural Area, the Long Point World Biosphere Reserve and two Important Bird Areas (Norfolk Forest Complex and Long Point Peninsula and Marshes).

Physiography

There are two physiographic regions within the Priority Place; the Norfolk Sand Plain and the Erie Spits. The Norfolk Sand Plain formed 13,000 years ago with sediment deposits from advancing and retreating ice fronts during the Late Wisconsinan glacial period. It consists of silty sand and gravel with low runoff (LESPR, 2008). The Erie Spits was formed 4,000 years ago by longshore currents from the west.

Land Cover

Historically the landscape was covered by a mosaic of oak savannah, sand barrens, Carolinian forests, and wetlands. However, during the 19th century much of Norfolk County was deforested or cleared for agriculture. Due to the region's characteristic sandy soils, this led to extensive wind erosion and a resulting sand wasteland. Efforts to restore the landscape began in the early 20th century. The St. Williams Forestry Station was established in 1908 to support reforestation efforts by providing trees for planting and establishing demonstration forests. Today, the LPWF area maintains relatively high natural cover as compared to the rest of southwestern Ontario, and is characterized by forests, agricultural lands, tallgrass communities, wetlands and coastal dunes (Figure 2).

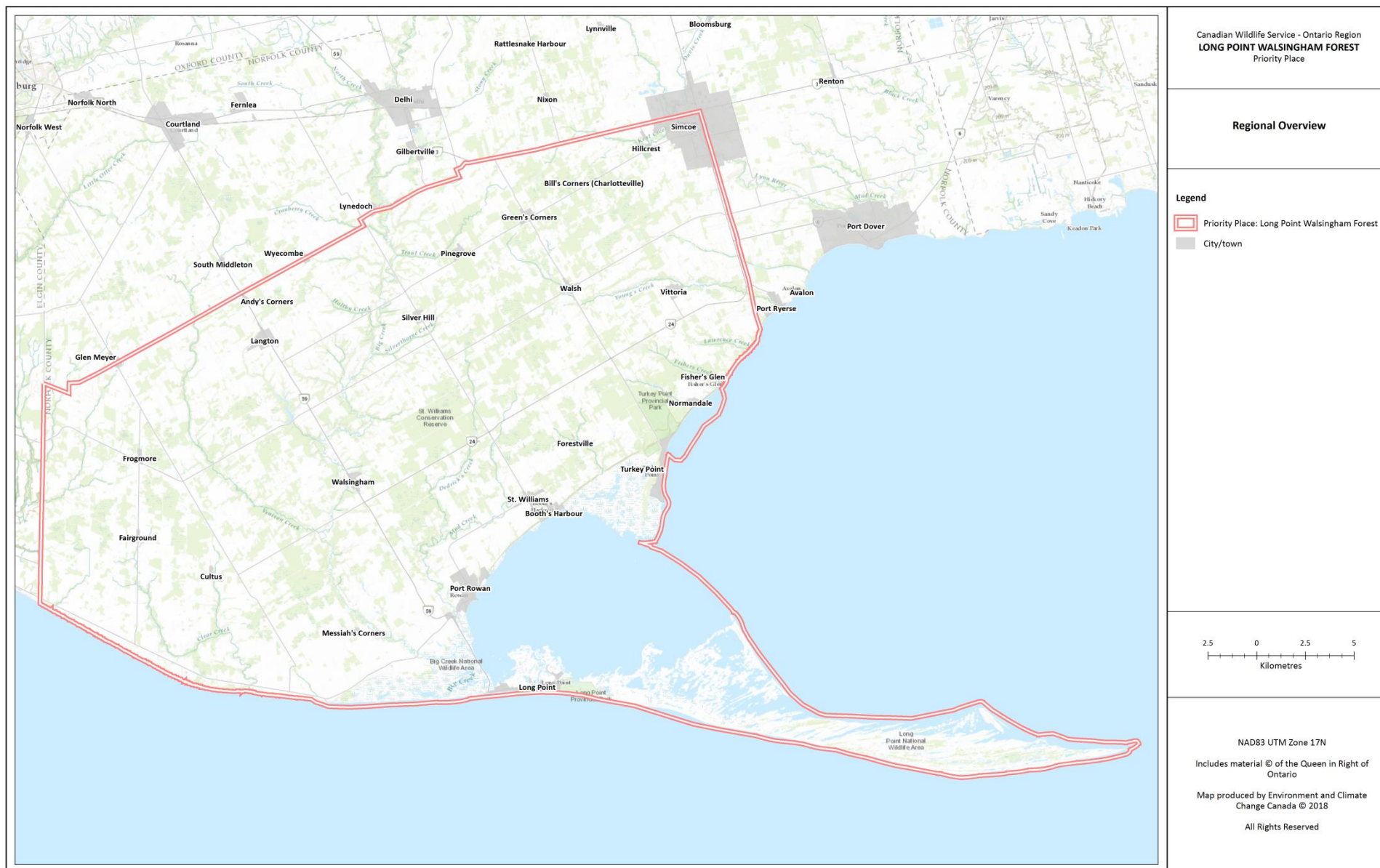


Figure 1. The Long Point Walsingham Forest Priority Place (area: ~86,715 ha).

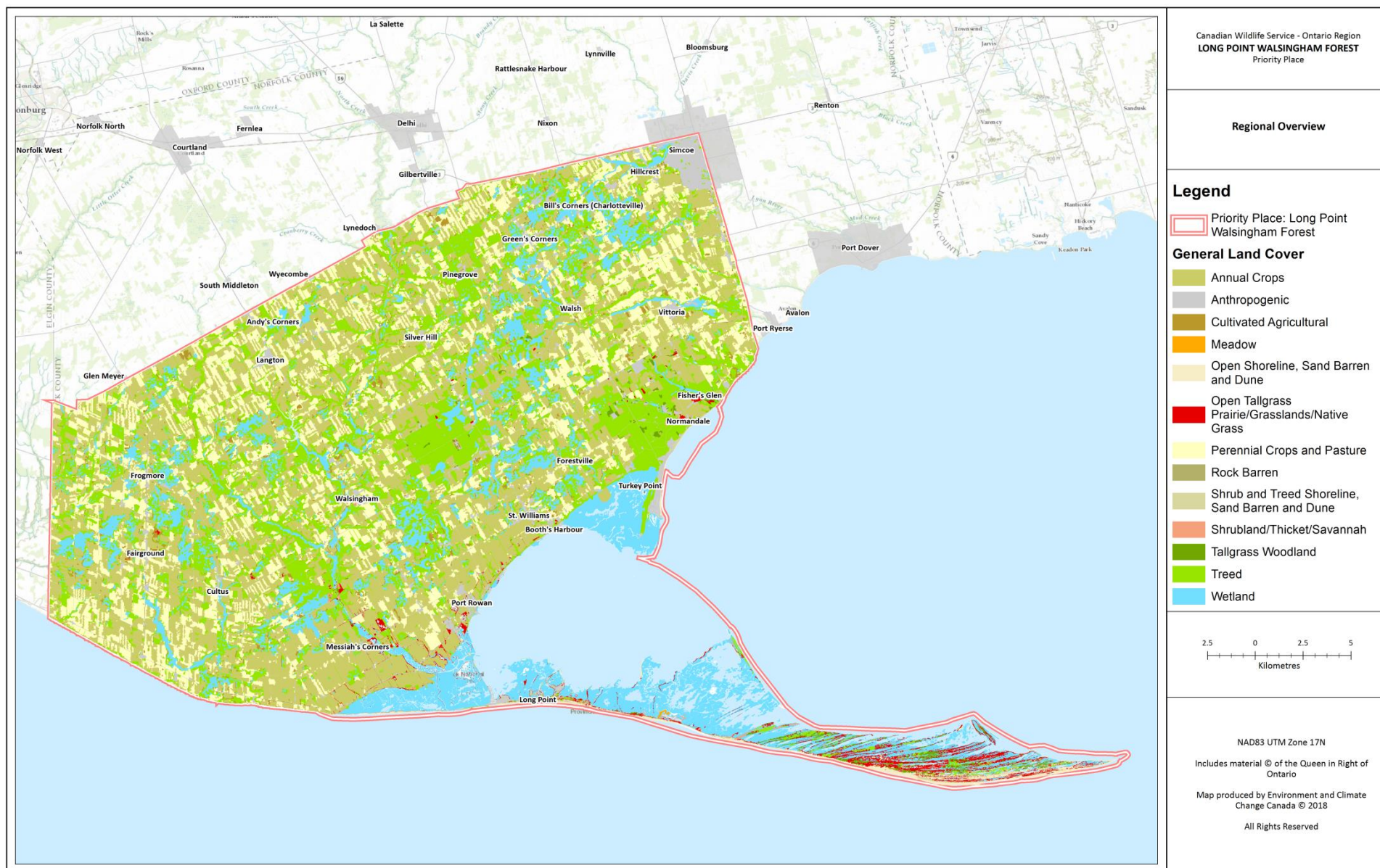


Figure 2. General Land cover in the Long Point Walsingham Forest Priority Place.

Forests

Historically, forest was the predominant habitat across the Mixedwood Plains. Remnants of this forest now exist in a fragmented state, with patches of various sizes distributed across a highly settled landscape. Today, Norfolk County contains a significant amount of forest cover compared to the rest of southwestern Ontario, and a large portion is found within LPWF.

Forest cover accounts for approximately 17.5% of the Priority Place. These forests are predominately deciduous and mixed; composed of species such as maple, beech, ash and oak. The large forest tracts in the area include Backus Woods and the South Walsingham Sand Ridges (NHIC, 2014). There also are a number of red pine plantations which played an important role in Norfolk County's forest management history.

Wetlands

Wetlands account for approximately 16.6% of the LPWF Priority Place. Wetlands provide important wildlife habitat and ecosystem services such as shoreline stabilization, storm protection, flood control, recreation, and nutrient cycling (Rokitnicki-Wojcik & Grabas, 2014). Wetlands in LPWF include treed swamps and marshes, located inland and along the Lake Erie coastline.

The Long Point wetland complex which accounts for a significant portion of the wetland coverage in the Priority Place, is one of the most important wetlands in Canada for migrating waterfowl. It has been internationally recognized as a Ramsar site, an Important Bird Area and a UNESCO World Biosphere Reserve. There are also a number of Provincially Significant wetlands inland including the Backus Woods Wetland Complex, Clear Creek Wetland, Barth Sideroad Swamp, Marston Wetland, South Walsingham Swamp, Langton Wetland, Kent Creek Wetland Complex, Green's Corner Wetland, Vittoria Wetland Complex, Forestville Creek Complex, and St. Williams Wetland (NHIC, 2014).

Beaches and Coastal Dunes

The beaches and coastal dunes found along Lake Erie occupy <1% of the Priority Place. These systems are typically sand-dominated found between the low-water line and upland. Long Point has some of the most extensive dunes in Ontario, most of which are located on the southeastern side of the sand spit, where wind erosion and deposition have crafted a unique mosaic of dunes and swales. Though beaches and coastal dunes are predominantly sandy habitats, they also have sparsely distributed grasses, herbs and shrubs. In some areas, scattered trees also grow such as Eastern Red Cedar, Eastern Cottonwood and the regionally rare Common Hoptree (Bakowsky & Henson, 2014).

The beaches and coastal dunes of Long Point provide important habitat for wildlife such as the Fowler's Toad (Environment Canada, 2019) and formerly supported a breeding population of Piping Plover *circumcinctus* subspecies (Environment Canada, 2006).

Tallgrass Prairie, Savannah and Woodland

Tallgrass prairie, savannah and woodlands occupy <1% of the LPWF landscape. These communities primarily consist of graminoids; however tallgrass savannah and woodland communities also feature forbs and trees (Lee et al., 1998). Despite never being spatially extensive in southern Ontario, these ecosystems provide significant ecological benefits such as erosion control, wildlife habitat and carbon sequestration (OBORT, 2005). Additionally, nearly 20% of Ontario's rare plants grow in tallgrass ecosystems.

Only 3% of the historical coverage of tallgrass communities remains in Ontario, having mostly been replaced by agriculture in southern Ontario. Between 1950 and 1970, continuing fire suppression and extensive tree planting due to government-led incentives for the purpose of increasing productivity and decreasing erosion accelerated habitat alterations led to widespread loss of native open habitat in Ontario (Catling, 2013). The loss of these communities limits the available habitat for some species such as Henslow's Sparrow, Northern Bobwhite, American Badger, and Eastern Foxsnake (Tallgrass Ontario, 2005).

Agriculture

Agriculture is the main land use and sector in LPWF, accounting for approximately 47% of the area. Most of the production is annual row crops, including oilseeds and grains, vegetables, and specialty crops. Livestock and pasture account for a small portion of the local agricultural production.

Due to the significant loss of native prairie in North America, many grassland bird species now use agricultural grasslands as surrogate habitat (Nocera & Koslowsky, 2011). Agricultural areas provide significant habitat for grassland birds and play an important role in conserving biodiversity. Approximately 32% of Ontario's Bird Conservation Region (BCR) 13 priority bird species utilize cultivated and managed areas for nesting and feeding. Agricultural lands are also used as hunting and foraging grounds by wildlife such as hawks, owls, and badgers. SAR characteristic of agricultural landscapes include Bobolink, American Badger, Gray Ratsnake, and Monarch (OBORT, 2005).

Species at Risk

LPWF is home to plants and animals characteristic of the Carolinian Life Zone, many of which are provincially, nationally and globally rare. Under the Accord for the Protection of Species at Risk signed in 1996, the federal, provincial, and territorial governments work together on legislation, programs, and policies to protect wildlife SAR throughout Canada. There are 88 SAR found in LPWF. This includes species assessed by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) or listed provincially by the Endangered Species Act (ESA) or federally by the Species at Risk Act (SARA) as Special Concern, Threatened, Endangered or Extirpated. A list of SAR can be found in APPENDIX A: Table A-1.

Migratory Birds

Located on the Atlantic flyway, hundreds of thousands of birds visit Long Point annually, representing 75% of all migrating birds in Ontario. Over 400 different species have been recorded at Long Point (BSC, 2018), 80 of which are known local breeders, including the Bald Eagle (ECCC, 2017a).

The Long Point Peninsula and Marshes is one of the most important waterfowl staging areas in North America (Petrie, 1998). It is recognized as an Important Bird Area (IBA) for its globally significant concentrations of both waterfowl and landbirds. It hosts significant portions of the global populations of species such as Tundra Swan, American Black Duck and Canvasback (IBA Canada, 2017). Daily counts of waterfowl at Long Point can reach 100,000 during migration periods (IBA Canada, 2017).

Inland, the Norfolk Forest Complex IBA is recognized for its nationally significant numbers of threatened and congregatory species (IBA Canada, 2017). The complex is comprised of several forests, including Backus Woods, St. Williams Forest, the Big Creek Valley – South Walsingham Sand Ridge and the Turkey Point Forest. This IBA is among the most biodiverse in southern Ontario featuring over 100 species of breeding birds, several of which are reaching their northernmost boundary. Forest birds at risk found within the Norfolk Forest Complex IBA include the Prothonotary Warbler, Louisiana Waterthrush and Cerulean Warbler. Notably, the forest complex also hosts the largest Canadian concentration of Acadian Flycatchers (BSC, n.d.).

3.2 Cultural and Socioeconomic Context

Agriculture

Agriculture is the main land use and one of the dominant industries in Norfolk County (Norfolk Environmental Advisory Committee, 2006). Norfolk County features a sandplain area with well-drained soils, numerous streams, and abundant groundwater providing ideal conditions for crop growth. The local environmental conditions are well suited to agriculture with a long growing season of 135 days as well as 920-980 mm of annual rainfall (NCC, 2008). Though livestock farming takes place, Norfolk County farms predominantly produce oilseeds and grains (corn, soy, and wheat), vegetables and melons, and specialty crops (e.g., tobacco) (Statistics Canada, 2016).

Norfolk County was a timber haven from the early to mid-1800s, after which agriculture practices dominated the cleared landscape (Niewójt, 2007). Farmers initially grew wheat, however the sandy soils were rapidly depleted of their nutrients and production could not compete within a market dominated by western Canadian wheat (Wilcox, 1993). As land productivity decreased, farmers attempted to diversify their practices by raising livestock, which intensified soil erosion (Niewójt, 2007). By the late 19th century, the lands in Norfolk County were heavily eroded (McQuarrie, 2014). For years the area was labelled as a “wasteland” of blowing sands, which forced many farmers to move (McQuarrie, 2014), and marked a break in agricultural land use for Norfolk County.

At the beginning of the 20th century, a shift in cultural norms would revive agricultural practices in Norfolk County. After the First World War, cigarette smoking became common practice and consequently the booming tobacco industry would completely revive agriculture in the County starting in 1922 (Niewójt, 2007; Wilcox, 1993). Tobacco crops thrive in well-drained and minimally fertile soils (Niewójt, 2007), but required fertilizers and pesticides. Researchers estimate that about 40% of the DDT sprayed in Ontario was in Norfolk County. These practices had a number of environmental repercussions, affecting waterways (Wall et al., 1984) and birds (Niewójt, 2007). Tobacco remained the dominant crop until the early 2000s due to the profitability of the industry (NCC, 2008).

Today, Norfolk County is the 5th largest agricultural region in Ontario (by number of farms) (Feltracco & Harmon, 2011). Agriculture retains its importance in the county, accounting for 14% of the employment and 75% of the land (NCC, 2008). Nearing the end of the 20th century, the demand for tobacco decreased substantially as studies highlighting health repercussions emerged and the government began enforcing anti-tobacco policies. The changing industry pushed most farmers to diversify their crops and, as of 2016, less than 8% of the 1,307 farms in Norfolk County were tobacco farms. Over 41% of farms were classified as oilseed and grain farm types, of which nearly 76% were cultivating corn and soybean (Statistics Canada, 2016a). Norfolk County is also the largest grower in Ontario of cabbage, sweet potatoes, sweet corn, strawberries, zucchini, squash, pumpkin, peppers, sour cherries, asparagus, blueberries, rye, and Saskatoon berries (Feltracco & Harmon, 2011). Ginseng has also become a common crop due to its popularity in China and Taiwan (Niewójt, 2007). Figure 3 depicts crop diversity in the Priority Place in 2016.

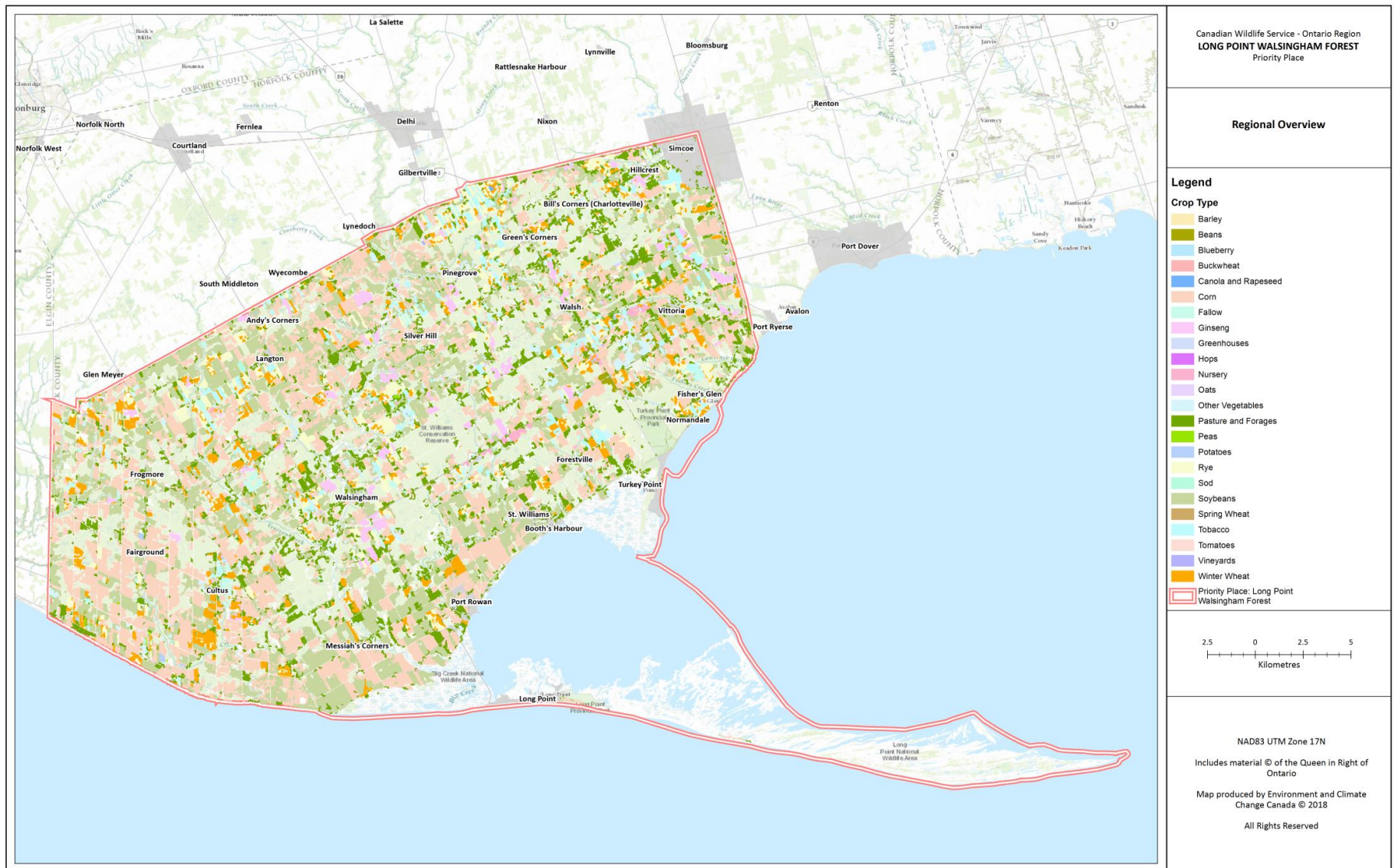


Figure 3. Annual Crop Inventory in the Long Point Walsingham Forest Priority Place (Agriculture and Agri-Food Canada, 2016).

Timber Industry

Historically, Norfolk County was 90% forested, predominantly with white pine (Burgener, 2016). White pine was excellent for the timber industry as they could be used to build boats, which attracted settlers. By the 1820s, timber was a leading industry in the Long Point Region, first for buildings ships (Big Creek Valley Conservation, 1953) and later to expand the American Midwest (Niewójt, 2007). However, as the industry grew forest cover was rapidly disappearing, and by 1901 only 11% remained. The timber industry also impacted local agriculture, as lack of tree cover contributed to soil erosion (Burgener, 2016).

Restoring forest cover in Norfolk County has been an ongoing process since the early 20th century. In 1908, the Ontario government launched a successful tree planting program to restore the landscape and prevent further erosion. A forestry station was installed near St. Williams to provide tree seedlings, demonstration sites, and technical support for reforestation. Additionally, the program introduced the idea of planting trees as wind-barriers, a practice that farmers implemented in the tobacco agricultural revolution. By 1931, the tree cover in Norfolk County had partially recovered, reaching about 20%. Shortly thereafter, conservation authorities would be established around the province, and the Big Creek Conservation Authority would continue restoring the natural landscape of Norfolk County. Today, that conservation authority has merged with others to form the Long Point Region Conservation Authority (LPRCA) (Niewójt, 2007). Norfolk County currently has between 20-27% forest cover, which is among the highest in southwestern Ontario (NCC, 2008).

Hunting and Fishing

Throughout the 19th century, hunting was a prominent activity in Long Point as game species were abundant and restrictions were largely absent (Wilcox, 1993). In 1856, the Grand Trunk railway opened and readily connected Long Point to farther regions, thus growing the local hunting market (Harris, 1918). This expansion drastically impacted game species and, in only a few years, many abundant species, such as the Passenger Pigeon and Wild Turkey, were eliminated. In 1866, as the area became increasingly devoid of wildlife, the government sold a large portion of Long Point to a group of business men. Naming themselves the Long Point Company, they would implement strict hunting restrictions, which included enforcing seasonal hunting and trapping limitations as well as requiring mandatory hunting licenses. Expectedly, these restrictions were met with local opposition and frustration, however, the Long Point Company sought to gain public favour by permitting members to trap and hunt, as well as paying their employees good wages. Overall, the Long Point Company was successful in restoring Long Point and in just a few years, wildlife numbers were increasing, as were hunting profits (Barrett, 1977). Their management of the Long Point area markedly contributed to the long-term conservation of local biodiversity (NCC, 2008)

Fishing practices evolved fairly rapidly from the 1860s in conjunction with technological innovation. Similar to hunting, the Grand Trunk Railway brought new opportunities for the fishing market in Long Point, allowing fresh catch to be transported farther and faster. Efficient transportation systems combined with better nets and catching devices, such as nylon nets and radar, greatly increased catch sizes. Consequently, as growing market demands were met, fish

communities were drastically altered (Craig, 1993). By the 1900s, Lake Sturgeon and Lake Trout populations were no longer commercially viable and by the 1960s, neither were Lake Whitefish, Lake Herring and Blue Pike populations. Moreover, native species also had to contend with the threat of nonnative species, such as Rainbow Smelt, Carp and White Perch, especially as they began dominating the lake and commercial catch. Finding a balance between controlling nonnative species, restoring native communities, and maintaining a viable commercial catch remains a challenge, and is actively managed by the Lake Erie Partnership between the Canadian and American governments (EPA, 2018). Among the Great Lakes, Lake Erie is the most biologically diverse (ECCC, 2017c; OMNRF, 2017a).

Today, both hunting and fishing remain important activities in Norfolk County. There is an open season for hunting migratory game birds, small game, Wild Turkey, and White-tailed Deer. The Aylmer district currently provides 31,000 hunting permits annually for the area (OMNRF, 2017a). Fishing is popular almost year-round, with commercial fishing taking place in the spring and fall and sport fishing in the summer (Craig, 1993). Seasonal fishing opportunities exist for Bass, Perch, Pike, Salmon, and Trout and popular destinations include Turkey Point and Inner Long Point Bay. The LPWF area is home to Canada's largest freshwater marina, the MacDonald Turkey Point Marina at Turkey Point.

Tourism

Hunters and anglers were the first tourists in Long Point and began building summer cottages in the 1870s (Wilcox, 1993). In the following decades, other visitors travelled to Norfolk County for natural attractions, such as the lake (Niewójt, 2007) and the conservation areas established over the 20th century. These included the Big Creek National Wildlife Area and the Backus Heritage Conservation Area (Feltracco & Harmon, 2011). The natural and historic features of Norfolk County ensured its continued touristic appeal into the 21st century.

Tourism currently contributes to the Norfolk County economy through a wide range of attractions (NCC, 2015) that reflect both its cultural heritage, such as agricultural festivals and farmers markets (Norfolk County, 2018a), and its natural heritage, such as white sand beaches and nature trails (Wilcox, 1993). Norfolk County receives nearly a million tourists annually that generate about 61 million dollars (Norfolk County, 2012). Hunting remains a popular attraction, and is authorized in designated zones such as the Long Point Waterfowl Management Unit, the Lee Brown Marsh, and the Hahn Marsh.

Another major attraction is bird watching as Long Point is located on an important migration path and offers excellent viewing opportunities in the spring and the fall for waterfowl, songbirds, and hawks (Wilcox, 1993). Wildlife viewing opportunities also exist for Monarch migration and turtle nesting (ECCC, 2017). Looking ahead, the challenge for Norfolk County will be balancing the potential expansion of tourism and their long-term commitment to conservation (Edge & McAllister, 2009).

3.3 Conservation and Stewardship Context Before 2018

LPWF has retained much of its natural integrity due to the conservation and stewardship initiatives spearheaded by private landowners, government, conservation authorities, and not-for-profit organizations. Private landowners with environmental interests were the first stewardship practitioners in Long Point, and their management efforts have been crucial for long-term conservation in the area (Petrie, 1998). The Backhouse family first exemplified such stewardship and, since 1798, they have owned and protected large parcels of Carolinian forest in the region (Solymár et al., 2008). Today, their property has become the Backus Conservation Area and Backus Woods, managed by the LPRCA and NCC respectively, showcasing one of the best old growth forests in Southern Ontario (Norfolk County, 2018b). The Long Point Company provides a second example of stewardship, after purchasing large portion of Long Point in 1866, they enforced hunting restrictions and regulations for the area. While their main objective was to conserve nature for recreational purposes, their diligent stewardship has preserved critical marshlands to this day (Barrett, 1981). In 1979, they sold a substantial portion of their property to the CWS, which became the federally protected Long Point National Wildlife Area (Dakin & Skibicki, 1994). Both these examples highlight the significant history of private land stewardship in LPWF (Solymár et al., 2008) and emphasize the importance of cumulative landowner conservation efforts.

Government conservation work, through forestry initiatives, protected areas, as well as tax and funding incentives, has also contributed to protecting Long Point. In 1908, the provincial government established the St. Williams Forestry Station, an initiative to create seed nurseries which boosted the regional forest cover. The station success spurred the addition of a second station a few years later, called the Norfolk Forestry Station (Wilcox, 1993). In 1921, rising tourism encouraged the designation of recreational spaces, and thus Long Point Provincial Park was first established, followed a few decades later by Turkey Point Provincial Park. The Provincial Parks mandate eventually shifted to include a strong conservation angle while still promoting nature-friendly recreation. Conservation also became a priority with the federal government, and they designated several National Wildlife Areas (NWAs), including the Big Creek NWA (Dakin & Skibicki, 1994) and the Long Point NWA (ECCC, 2017a). By the late 1900s, several tax incentive and funding programs had been launched to encourage private stewardship of natural heritage. These included the Managed Forest Tax Incentive Program and the Conservation Land Tax Incentive Program. Since then various government initiatives have contributed to conservation and have encouraged stewardship practices in LPWF.

Private landowner and government conservation efforts have long been supported by Conservation Authorities and not-for-profit organizations in Long Point. The Big Creek Valley Conservation Authority and the Otter Creek Conservation Authority formed in the 1940s and 1950s respectively, and both acquired land for forest management (Puttock, 1999). By the 1960s, they were amalgamated into the Long Point Region Conservation Authority (LPRCA) (Dakin & Skibicki, 1994) which today owns more than 4,000 ha of conservation lands including forests, wetlands, and recreational areas (LPRCA, 2018a).

Several not-for-profit groups have also been active since the 20th century, including land trusts and organizations that provide opportunities for private landowners to get involved as nature stewards. A long time example in Norfolk County is NCC, that strives to conserve and connect natural areas. They have completed stewardship projects in agricultural field restoration, biological inventories, invasive species management and sustainable hunting across their properties (NCC, 2008). Another more recent example is Alternative Land Use Services (ALUS) Canada that works with farmers to implement environmental stewardship projects such as planting native grasslands, reforestation, and incorporating pollinator hedgerows (ALUS Canada, 2018). The efforts of both conservation authorities and not-for-profit organizations have been instrumental to engaging citizens in conservation and stewardship activities.

Government Protected Areas and Non-Government Conservation Land

Approximately 5,523 ha of land within LPWF is within a government protected area (National Wildlife Area, Provincial Park or Conservation Reserve). An additional 5,940 ha are considered non-government conservation lands which include lands owned or managed by the LPRCA, NCC, Ducks Unlimited Canada (DUCs) and the Long Point Basin Land Trust (LPBLT).

Federally, the Big Creek NWA and the Long Point NWA provide approximately 4,026 ha of protection. Both NWAs are owned by ECCC and managed by the CWS under the *Canada Wildlife Act*.

The Big Creek NWA was established in 1977 about 3 km south of Port Rowan and covers an area of 766 ha which is approximately 95% wetland and 5% woodland. This NWA is divided in two units: the Big Creek Unit and the Hahn Marsh Unit. As part of the largest sandspit-marsh complex in the Great Lakes, the Big Creek NWA is an important habitat for many wildlife species. Waterfowl such as Mallards, American Wigeons, Canada Geese, and Tundra Swans stopover in the Big Creek NWA during their migrations. Additionally, the wetlands shelter marsh birds, including SAR such as the Least Bittern and the King Rail during the early spring. The Big Creek NWA is also an important breeding area for amphibians such as the Fowler's Toad, and is an important roosting area for Monarchs. Recreational activities are seasonally restricted to bird-watching, hiking and photography. Limited waterfowl hunting also takes place (ECCC, 2017d).

The Long Point NWA was established in 1978 and remains Ontario's largest NWA at 3,263 ha. It contains diverse habitats that include marshes, dunes, forests and beaches and hosts a variety of wildlife. Positioned on the Atlantic Flyway, it is a significant migration area, receiving 75% of Ontario's migrating songbirds and waterfowl, as well as a significant breeding area, with over 80 species nesting on the point. The Long Point NWA also houses over 60 species of fish, many rare species living at the northern extent of their range, and numerous SAR. Recreational activities are seasonally restricted to beach walking and canoeing (ECCC, 2017a).

There are two provincial parks and one conservation reserve in LPWF. Long Point Provincial Park, located on the west end of the Long Point sand spit between the Big Creek NWA – Big Creek Unit and Long Point NWA – Thoroughfare Unit. It is approximately 147 ha and is the fourth oldest Provincial Park in Ontario. The Ontario Ministry of Environment, Conservation and

Parks (OMECP) administers the park lands as well as the adjacent Crown marsh. It is an important bird and waterfowl migration and staging area. Recreational activities allowed in the Park include: biking, birding, boating, canoeing, fishing, hunting, camping and swimming. Turkey Point Provincial Park is approximately 316 ha and is located on Lake Erie east of Highway 10. Recreational activities allowed in the park include hiking, camping, golfing, biking, birding, canoeing, and fishing.

St. Williams Conservation Reserve is approximately 1,034 ha and is made up of two sites: the Nursery Tract and the Turkey Point Tract. It is nationally renowned for its rare and sensitive ecosystems, including Carolinian forests. The Nursery Tract consists of Pine, Spruce, White Cedar, Walnut, Oak and Poplar species, and produces an estimated 50 million trees each year for reforestation (St. Williams Conservation Reserve, 2017).

Non-government conservation land includes various lands managed or owned by the LPRCA (2,222 ha), NCC (3,160 ha), DUCs (422 ha). The Long Point Basin Land Trust also has about 136 ha of conservation lands in the Priority Place spread across the Arthur Langford Nature Reserve, the Al (Pic) and Pat Robinson Nature Reserve, the Shirley and George Pond Nature Reserve, and the Strongman-Guiler Conservation Legacy.

Approximately 3,200 ha of the Long Point peninsula between Long Point Provincial Park and Long Point NWA are owned by the Long Point Company, a hunt club established in 1866. While not technically a conservation organization, the Long Point Company contributes to conservation of the marshes within its ownership.

Natural Heritage System Planning

Natural Heritage System (NHS) planning plays an important role in conserving natural features and habitats in Ontario. Under the *Planning Act*, the Provincial Policy Statement considers natural heritage to include those features and areas that are important for their environmental and social value, and states that “natural features and areas shall be protected for the long term” (OMMAH, 2014). Within the Priority Place, such natural features include: significant wetlands, significant coastal wetlands, significant woodlands, significant wildlife habitat, and significant areas of natural and scientific interest (ANSI).

The Norfolk County Official Plan was adopted May 9, 2006 and recently underwent a five year review in 2018. It contains policies related to the conservation of Natural Heritage Features, Provincially Significant Features, a Natural Heritage Systems Strategy, and the Long Point Biosphere Reserve Core Area.

Government Supported Stewardship

Several federal and provincial Grant and Contribution programs have supported conservation initiatives in the Priority Place. These programs fund local stewardship projects that address conservation priorities such as SAR and their critical habitat, wetland conservation, the Great Lakes, and waterfowl.

Habitat Stewardship Program (HSP)

From 2006-2017, approximately \$4 M of federal funding was distributed to 13 qualifying organizations through the HSP Species at Risk Stream for 18 projects either fully or partially completed at Long Point or in Norfolk County. These projects targeted approximately 96 species which included birds, mammals, vascular plants, fishes, molluscs, arthropods, reptiles and amphibians. Conservation actions were conducted under the following broad strategies: education and outreach, monitoring/inventories, habitat management, stewardship and threat mitigation. The key threats addressed included: transportation/roads, persecution, incidental and commercial collection, collisions, invasive species, natural system modifications, forestry, nest disturbance/predation, human disturbance, hydroelectric development, agriculture, housing development, knowledge gaps on the species population and range, recreational vehicles, climate change, recreational development, land conversion and sediment and nutrient loading.

From 2014-2016, 3 projects partially or fully completed at Long Point or in Norfolk County were funded through the HSP Prevention Stream. Two qualifying organizations received \$140,000 in funding for these projects. Actions were undertaken on the following topics: improving knowledge gaps on aerial insectivores, improving Brook Trout populations through habitat management and building capacity for the IBA and biodiversity area programs. Species targeted largely included BCR priority bird species and Brook Trout.

National Wetland Conservation Fund (NWCF)

From 2014-2018 the NWCF supported activities to restore degraded or lost wetlands and enhance the ecological function of degraded wetlands. The program also funded scientific monitoring of wetland functions and ecological services as well as encouraged wetland stewardship by industry and the Canadian public.

As of 2017, approximately \$1.5 M in federal funding was administered to 10 wetland enhancement or restoration projects, of which 8 were entirely completed in LPWF and 2 were partially within the boundary. In total, 1,036.5 ha of wetland habitat was restored and 600 ha of wetland habitat was enhanced. Eight of these projects focused on controlling and removing Phragmites and received \$938,000 of the administered funding.

Species at Risk Stewardship Fund (SARSF)

The OMECP administers the SARSF which encourages individuals and organizations in Ontario to get involved in protecting and recovering SAR through stewardship. Approximately \$1.2 M in provincial funding was administered for stewardship projects in Long Point from 2008-2014 (OMNRF, pers. comm.). The money funded conservation actions for SAR habitat stewardship, recovery of SAR reptiles and amphibians, Long Point Causeway improvements and the installation of ecopassages, the development of best management practices, ecosystem restoration, and invasive species removal.

Species at Risk Farm Incentive Program (SARFIP)

The SARFIP provides funding to agricultural landowners across Ontario interested in supporting SAR on their lands through habitat creation, enhancement, and protection. Activities can apply to cropland, wetland, woodland, shorelines, stream banks and grasslands. The program is supported by the OMECP through the SARSF and ECCC through the HSP for SAR. The program is delivered by the Ontario Soil and Crop Improvement Association. As of 2017, 9 projects under SARFIP were funded in Long Point and Norfolk County.

Great Lakes Protection Initiative

In 2018, the Great Lakes Program was updated to address water quality and health priorities. Funding is now offered through the Great Lakes Protection Initiative (GLPI) in 8 priority areas for action: working with others to protect the Great Lakes, restoring Areas of Concern, preventing toxic and nuisance algae, improving the health of coastal wetlands, identifying at-risk nearshore waters, reducing harmful chemicals, engaging Indigenous Peoples and engaging the public through citizen science. In 2018 ALUS Canada received \$600,000 for 3 years to establish 75 acres of projects in the Lake Erie Basin (wetlands, riparian buffers, tallgrass prairie and erosion control measures) to reduce phosphorus levels and improve water quality. Projects will be carried out in Norfolk and Middlesex Counties and Chatham-Kent.

Local Conservation Initiatives - Highlights

Nature Conservancy of Canada-Government of Canada Natural Area Conservation Program

The Natural Area Conservation Program (NACP) was a national matching fund initiative led by NCC and funded in part by the Government of Canada. The aim was to increase lands held under private conservation tenure in Canada. Phase one took place from 2007-2015 and Phase two from 2015-2019. During NACP Phase one, NCC secured 2,170 ha of land in the Southern Norfolk Sand Plain Natural Area and as of 2016, under NACP Phase 2, NCC secured 27.68 ha.

Long Point Causeway Improvement Project (LPCIP)

The LPCIP was a community led initiative to reduce the impact of the 3.6 km Long Point Peninsula causeway on reptiles, with a focus on SAR. The causeway was previously among the deadliest animal crossings in North America and surveys by the CWS found that up to 10,000 animals were killed by vehicles annually, most of which were reptiles. In response, the LPCIP was launched in 2006 and was managed by a Steering Committee with representatives from a number of local organizations. The committee rose \$2.7 M for the project, which was managed by the Long Point World Biosphere Reserve Foundation. These funds were used over ten years to install 12 culverts and 6 km of fencing (LPCIP, 2016), effectively reducing turtle presence on the road by 89% and snake presence by 53% in areas with full fencing. Next steps will involve monitoring wildlife, maintaining fences, and developing mitigation strategies to divert wildlife from the road in areas where full fencing is not feasible (Markle et al., 2017).

Long Point Phragmites Pilot Control Project

European Common Reed (*Phragmites australis*, hereafter Phragmites) was declared the worst invasive plant species in Canada by researchers at Agriculture and Agri-Food Canada in 2005 (Catling, 2005) and poses a serious threat to biodiversity in LPWF. Phragmites thrives in wetlands, riparian areas and beaches, outcompeting native plant species and forming dense monoculture stands (Mazerolle et al., 2014). Growing up to 6 m in height and in densities exceeding 200 stems/m², Phragmites provides limited habitat for wildlife and is particularly damaging to sensitive areas, such as coastal wetlands, and SAR (OMNRF, 2011). LPWF SAR particularly impacted by Phragmites include: Virginia Rail, Least Bittern, Fowler's Toad and Spiny Softshell (Robichaud & Rooney, 2017; Wilcox et al., 2003). Phragmites spread rapidly at Long Point starting in the mid-1990s, likely facilitated by anthropogenic disturbance as well as water-level declines in Lake Erie which exposed shoreline sediment (Jung et al., 2017).

Since 2016 the Ontario Ministry of Northern Development, Mines, Natural Resources and Forestry (OMNRF) has been working with NCC and other partners in Long Point to manage the threat of Phragmites using the herbicide Roundup® (active ingredient glyphosate) under an Emergency Use Registration. This permit was issued by Health Canada's Pest Management Regulatory Agency as an urgent response to protect sensitive wetland biodiversity and SAR against Phragmites. First active in 2016, the permit allowed herbicide spraying through aerial and ground treatments across invaded wetland areas. Mitigation measures, such as avoiding spraying during seasonal migrations of birds and critical insect life stages, were followed to minimize harm to non-target species. The pilot project continued in 2017, with a second OMNRF permit to spray in new areas at Turkey Point and the Lower Big Creek Watershed, and to re-treat previously treated areas where Phragmites persisted. As part of an integrated pest management approach and best practices, remaining biomass was removed through cutting, rolling, and administering prescribed burns (OMNRF, 2017b; Veenhof, 2017). Control efforts continued in 2018 by targeting lingering populations of Phragmites and removing residual biomass on provincial crown and private lands (Cleland, 2018).

The success of the Phragmites Pilot Control Project can be attributed to the strong collaborative nature of the effort. Numerous organizations and private land owners have been involved in control efforts at Long Point. In 2015, NCC also established the Long Point Phragmites Action Alliance (LPPAA) to help coordinate the effort to manage Phragmites. The LPPAA includes over 25 partners from the government (federal, provincial and municipal), not-for-profit organizations, conservation authorities, universities, and hunting clubs. Members contribute funding, equipment, and labour to complete management activities including herbicide application and physical removal of Phragmites.

Southern Ontario's Forest Birds at Risk Program

The Southern Ontario's Forest Birds at Risk Program, led by Bird Studies Canada (BSC), aims to mitigate threats to forest birds at risk in the Carolinian Zone of the Norfolk Sand Plain. BSC has monitored birds in the region since 2011, maintaining Canada's most comprehensive database for these species. This program focuses on four SARA-listed priority species, Acadian

Flycatchers, Louisiana Waterthrush, Cerulean Warblers and Prothonotary Warblers, however it also benefits several other at risk species in the Priority Place. Moreover, BSC engages landowners by promoting stewardship and best management practices. They published *Beneficial Management Practices for Southwestern Ontario Forest Birds at Risk*, a guide for landowners to implement such practices on their properties (Stewart, 2017). The Forest Birds at Risk Program has received funding and support from ECCC through the Habitat Stewardship Fund, the OMECP and the United States (U.S.) Fish and Wildlife Service.

National & International Conservation Initiatives

There are a number of National and International Conservation Initiatives for which activities may have been implemented in LPWF or for which have goals in common with the LPWF CIP. These initiatives are summarized below for reference.

Canada-U.S. Water Quality Agreement

The Great Lakes are immensely valuable to Canadians for social, economic and environmental reasons, and ensuring their sustainability for future generations is vital. To address this priority, the Great Lakes Water Quality Agreement between Canada and the U.S. was signed in 1972 and amended in 2012. Through this Agreement, both countries reaffirmed and agreed to strengthen their previous commitments as a measure against current and eventual water quality threats. To coordinate the renewed binational effort, the Great Lakes Nearshore Framework was initiated to assess the nearshore health of each lake by identifying cumulative impacts and stresses to better inform restoration activities. Lakewide Action and Management Plan Reports are released annually reporting progress with binational effort.

The Canadian effort to address phosphorus loadings in Lake Erie is organized under the Canada-Ontario Lake Erie Action Plan. In 2016, Canada set targets to reduce spring loads of total phosphorus from the priority tributaries and from the central basin by 40% (compared to 2008 levels). These objectives will be achieved through an adaptive management strategy focusing on effective policies, programs and legislation, and improving the current knowledge base. Moreover, federal and provincial governments will collaborate with local partners and create awareness programs to engage conservation authorities, Indigenous communities, key sectors, interest groups, and the general public. The action plan will first be reviewed and adapted in 2023 and thereafter every five years (ECCC & OMECC, 2018).

North American Waterfowl Management Plan (NAWMP)

The NAWMP is an international partnership to conserve waterfowl populations and sustainable landscapes; it engages those committed to the conservation of waterfowl in Canada, the U.S. and Mexico. ECCC provides implementation funding for activities such as land acquisition, conservation easements, wetland restoration and habitat management.

Eastern Habitat Joint Venture (EHJV)

The EHJV is a partnership of governmental and non-government members aiming to secure and restore bird habitat in Eastern Canada. Operating under the NAWMP, the partnership has

representatives from the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), OMECP, ECCC through the CWS, BSC, DUC, and NCC. The objectives of this venture are to increase bird populations, promote healthy landscape for wildlife and people, as well as engage various stakeholders, including citizens and private industries. The EHJV prioritizes the conservation of waterfowl habitat, however it also protects habitat for shorebirds, waterbirds and landbirds. Funding for different projects comes from the U.S. North American Wetlands Conservation Act, U.S. Fish and Wildlife Service, ECCC and Wildlife Habitat Canada. Since 1989, the EHJV has spent \$158 million to protect over 400,000 hectares and restore over 190,000 hectares of degraded wetland habitats across Ontario.

4. BIODIVERSITY ANALYSIS

4.1 Conservation Targets

Seven conservation targets were selected for the LPWF CIP. Conservation targets are defined as elements of biodiversity at a project site that a project has chosen to focus on, and can be a species, habitat, or ecological system. Targets for LPWF are primarily ecosystem-based and represent overall biodiversity in LPWF. Nested species have been identified for each conservation target. Nested species are the species which may benefit from efforts to conserve and enhance the conservation targets and include both SAR and priority Bird Conservation Region species (Environment Canada, 2014).

Note, *Artificial Habitat Structures* was identified as a conservation target based on the desire to conserve human made structures important for the persistence of biodiversity and some species at risk. However, at this time the CIP does not include actions related to this target. Identifying agricultural land as a conservation target was also discussed due to some wildlife using agricultural land as habitat. Recognizing the importance of agriculture on the LPWF landscape and the fact that it does not fit well with the definition of a conservation target, *Agricultural Livelihoods* was ultimately identified as a Human-Wellbeing Target instead.

It was also debated on whether to add another non-natural system as a conservation target (agricultural land) due to some wildlife species requiring agricultural land to persist. Recognizing the importance of agriculture on the LPWF landscape, it was ultimately decided to include Agricultural Livelihoods as a Human-Wellbeing target instead.

1. **Forests and Treed Swamp:** Includes upland, lowland and cultural forests (mixed, deciduous and coniferous) as well as hedgerows. Upland and lowland forests are grouped together because they co-occur and provide a similar function to avifauna on the landscape. Cultural plantations are included because they contribute to overall forest cover (treed cover >60%) and connect forest patches on the landscape. They also represent large areas with the potential for native forest restoration (e.g., St. Williams Conservation Reserve is mapped almost entirely as plantation on land cover mapping). See Figure 4.

Nested Species:

- Amphibians: Jefferson Salamander, Unisexual Ambystoma Jefferson Salamander dependent population
- Arthropods: False-foxglove Sun Moth , Gypsy Cuckoo Bumble Bee, Nine-spotted Lady Beetle , Transverse Lady Beetle , Yellow-banded Bumble Bee
- Birds: Acadian Flycatcher, American Woodcock, Baltimore Oriole, Black-billed Cuckoo, Canada Warbler, Cerulean Warbler, Chimney Swift, Common Nighthawk, Eastern Whip-poor-will, Eastern Wood-pewee, Golden-winged Warbler, Harris's Sparrow, Louisiana Waterthrush, Northern Flicker, Olive-sided Flycatcher, Prothonotary Warbler, Red-headed Woodpecker, Red-shouldered Hawk, Rose-breasted Grosbeak, Rusty Blackbird, Wood Thrush.
- Mammals: Grey Fox, Little Brown Myotis, Northern Myotis, Tri-colored Bat, Woodland Vole
- Reptiles: Eastern Foxsnake (Carolinian population), Eastern Hog-nosed Snake, Eastern Milksnake, Eastern Ribbonsnake (Great Lakes population), Gray Ratsnake (Carolinian population), Spotted Turtle
- Vascular Plants: American Chestnut, American Ginseng, Bird's-foot Violet, Black Ash, Broad Beech Fern, Butternut, Crooked-stem Aster, Cucumber Tree, Downy Yellow False Foxglove, Eastern Flowering Dogwood, Fern-leaved Yellow False Foxglove, Large Whorled Pogonia, Round-leaved Greenbrier (Great Lakes population), Smooth Yellow False Foxglove, Spotted Wintergreen

2. Open Country: Comprised of any vegetation community where the combined cover of trees and shrubs over 1 m tall is less than 60%, excluding agricultural land. Encompasses the tallgrass communities (prairie, savannah and woodland) which are maintained by fire, grazing or mowing and which once characterized the Carolinian landscape. Also includes the more common meadow and thicket/shrubland ecosystems which are typically transitional but can be maintained by mowing. See Figure 5.

Nested Species:

- Arthropods: American Bumble Bee, Eastern persius Duskywing, False-foxglove Sun Moth, Frosted Elfin, Gypsy Cuckoo Bumble Bee, Karner Blue, Monarch, Mottled Duskywing (Great Lakes Plains population), Nine-spotted Lady Beetle, Rusty-patched Bumble Bee, Transverse Lady Beetle, Yellow-banded Bumble Bee
- Birds: American Black Duck, American Kestrel, American Woodcock, Bank Swallow, Barn Owl (Eastern population), Barn Swallow, Black-billed Cuckoo, Blue-winged Teal, Blue-winged Warbler, Bobolink, Brown Thrasher, Chimney Swift, Common Nighthawk, Eastern Kingbird, Eastern Meadowlark, Eastern Towhee, Eastern Whip-poor-will, Field Sparrow, Golden-winged Warbler, Grasshopper Sparrow pratensis subspecies, Henslow's Sparrow, Killdeer, Mallard, Northern Harrier, Northern Rough-winged Swallow, Prairie Warbler, Purple Martin, Red-

headed Woodpecker, Sandhill Crane, Savannah Sparrow, Short-eared Owl, Vesper Sparrow, Yellow-breasted Chat virens subspecies

- Mammals: American Badger *jacksoni* subspecies
- Reptiles: Eastern Foxsnake (Carolinian population), Eastern Hog-nosed Snake, Eastern Milksnake, Gray Ratsnake (Carolinian population)
- Vascular Plants: Bird's-foot Violet, Colicroot, Common Hoptree, Downy Yellow False Foxglove, Fern-leaved Yellow False Foxglove, Small White Lady's-slipper, Smooth Yellow False Foxglove, Virginia Goat's-rue

3. Coastal Wetlands and Inner Bay: The coastal wetlands are defined based on the wetland classification system for southern Ontario as wetlands directly influenced by waters of Lake Erie or its connecting channels. This includes: coastal meadow marshes, emergent marshes, scrub marshes, shallow open water, buttonbush thicket swamp, the lower Big Creek marshes (up to Concession 1) and Turkey Point bog. The Inner Bay covers approximately 28,000 ha of open water between the Long Point sand spit and the north shore. It is a globally significant staging area for migratory waterfowl and is one of the most important fish habitats in Lake Erie. See Figure 6.

Nested Species:

- Amphibians: Fowler's Toad
- Birds: American Bittern, American Black Duck, American Coot, American Woodcock, Bald Eagle, Bank Swallow, Barn Owl (Eastern population), Barn Swallow, Belted Kingfisher, Black Tern, Blue-winged Teal, Chimney Swift, Common Nighthawk, Forster's Tern, Great Blue Heron, Great Egret, Green Heron, Green-winged Teal, King Rail, Least Bittern, Louisiana Waterthrush, Mallard, Northern Harrier, Pied-billed Grebe, Prothonotary Warbler, Sandhill Crane, Sora, Virginia Rail, Wood Duck
- Reptiles: Blanding's Turtle (Great Lakes/St. Lawrence population), Eastern Foxsnake (Carolinian population), Eastern Musk Turtle, Eastern Ribbonsnake (Great Lakes population), Midland Painted Turtle, Northern Map Turtle, Queensnake, Snapping Turtle, Spiny Softshell, Spotted Turtle
- Vascular Plants: American Water-willow, Bent Spike-rush (Great Lakes Plains population), Horsetail Spike-rush, Swamp Rose-mallow

4. Watercourses and Riparian Areas: Includes the aquatic portion of the waterways that empty into Lake Erie, i.e., rivers, creeks and open constructed drains as well as the interface between the land and the watercourse, which has been identified as a 30 m strip on both sides of rivers and creeks and a 5 m strip for constructed drains. Five metres was selected for drains as a 15 foot right of way is required for all drains initiated under the *Drainage Act* and the LPWF ICA workshops participants expressed 30 m vegetated buffers adjacent to drains is unrealistic for farmers. Thirty metres was identified for rivers and creeks because it is commonly used to identify the 'riparian area'. It is also recommended by ECCC's *How Much Habitat is Enough?* guidelines: "both

sides of streams should have a 30-metre-wide naturally vegetated riparian area to provide and protect aquatic habitat” (Environment Canada, 2013). See Figure 7.

Nested Species:

- Arthropods: Laura’s Clubtail, Nine-spotted Lady Beetle, Riverine Clubtail (Great Lakes Plains population), Transverse Lady Beetle
- Birds: Acadian Flycatcher, Bald Eagle, Bank Swallow, Barn Swallow, Belted Kingfisher, Chimney Swift, Harris’s Sparrow, King Rail, Least Bittern, Louisiana Waterthrush, Northern Rough-winged Swallow, Olive-sided Flycatcher, Prothonotary Warbler, Spotted Sandpiper, Wood Duck, Yellow-breasted Chat virens subspecies
- Fishes: Brook Trout, Northern Brook Lamprey
- Mammals: Grey Fox, Little Brown Myotis, Northern Myotis, Tri-colored Bat
- Reptiles: Blanding’s Turtle (Great Lakes/St. Lawrence population), Eastern Foxsnake (Carolinian population), Eastern Milksnake, Eastern Musk Turtle, Eastern Ribbonsnake (Great Lakes population), Gray Ratsnake (Carolinian population), Midland Painted Turtle, Northern Map Turtle, Queensnake, Snapping Turtle, Spiny Softshell, Spotted Turtle
- Vascular Plants: American Water-willow, Broad Beech Fern, Butternut, Crooked-stem Aster

5. Beaches and Coastal Dunes: The sand-dominated systems along the Lake Erie shoreline which are maintained by longshore currents, wind action and sand deposition. Includes interdunal wet areas (swales/pans) and shoreline bluffs. See Figure 8.

Nested Species:

- Amphibians: Fowler’s Toad
- Birds: Common Nighthawk, Piping Plover circumcinctus subspecies
- Reptiles: Eastern Foxsnake (Carolinian population), Eastern Hog-nosed Snake,
- Vascular Plants: Bent Spike-rush (Great Lakes Plains population), Common Hoptree

6. Amphibians and Reptiles: Includes all amphibians and reptiles that are affected by road mortality, collection and human persecution. The nested species list includes Endangered, Threatened and Special Concern taxa as assessed by COSEWIC, SARA and the ESA and present in the Priority Place.

Nested Species:

- Amphibians: Fowler’s Toad, Jefferson Salamander, Unisexual Ambystoma Jefferson Salamander
- Reptiles: Blanding’s Turtle (Great Lakes/St. Lawrence population), Eastern Foxsnake (Carolinian population), Eastern Hog-nosed Snake, Eastern Milksnake,

Eastern Musk Turtle, Eastern Ribbonsnake (Great Lakes population), Gray Ratsnake (Carolinian population), Midland Painted Turtle, Northern Map Turtle, Queensnake, Snapping Turtle, Spiny Softshell, Spotted Turtle

7. Artificial Habitat Structures: Human-made structures (chimneys, barns, wells, hibernacula, bat houses and bird boxes) that support native biodiversity and for some species are pertinent to their continued existence and recovery.

Nested Species:

- Birds: Barn Swallow, Chimney Swift
- Mammals: Little Brown Myotis
- Reptiles: Eastern Foxsnake (Carolinian population), Eastern Milksnake, Gray Ratsnake (Carolinian population), Queensnake

4.2 Ecosystem Services and Human-Wellbeing Targets

In order to understand the important connections between the conservation targets and human-wellbeing in LPWF, ecosystem services and Human-wellbeing Targets were identified. Ecosystem services provided by the conservation targets include; wildlife habitat, water quality and quantity, climate regulation, flood control, recreation, erosion control and food. Currently two Human-Wellbeing Targets have been identified: Agricultural Livelihoods and Connection to Nature.

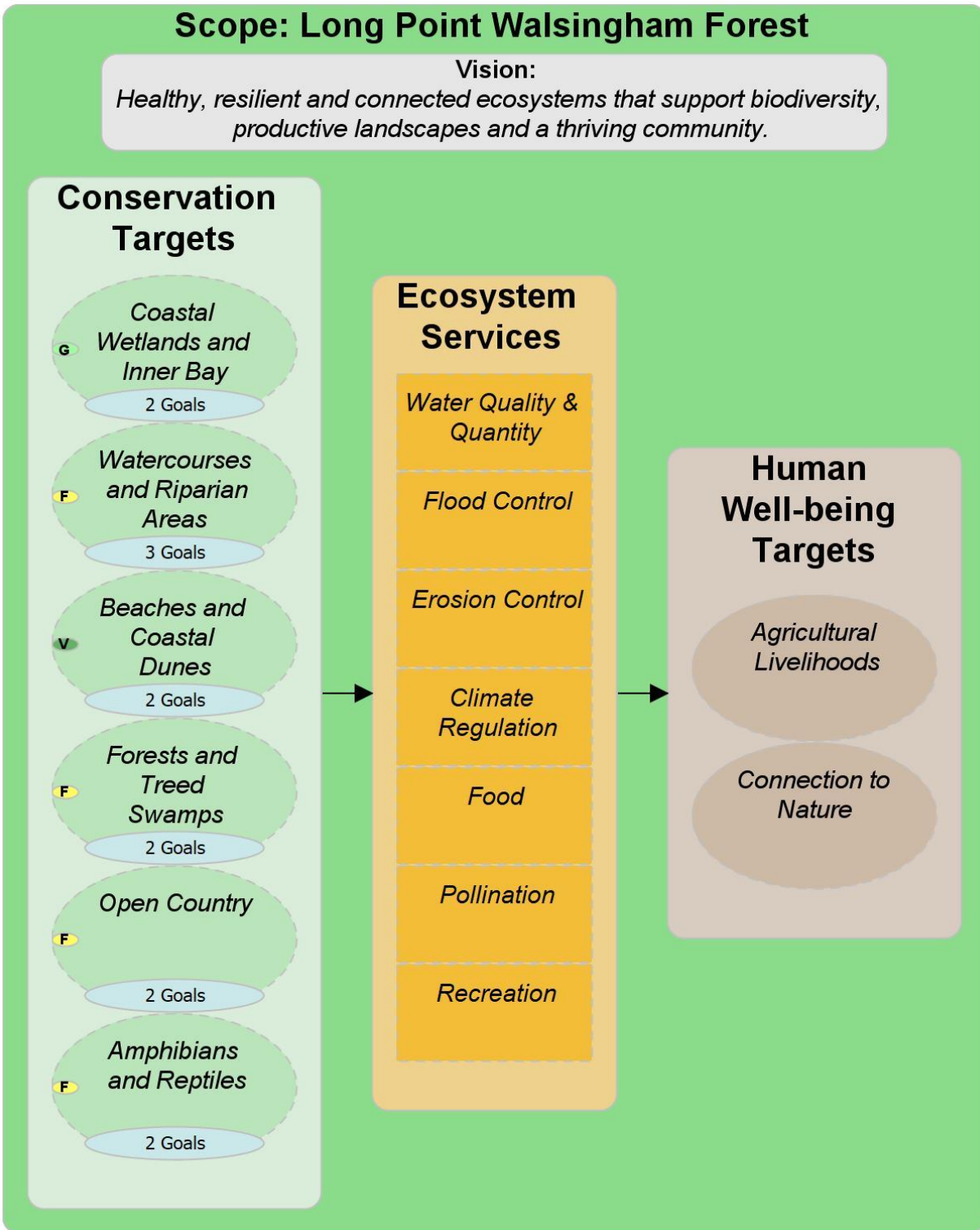


Figure 4. Situation Model showing Scope, Vision and Targets.

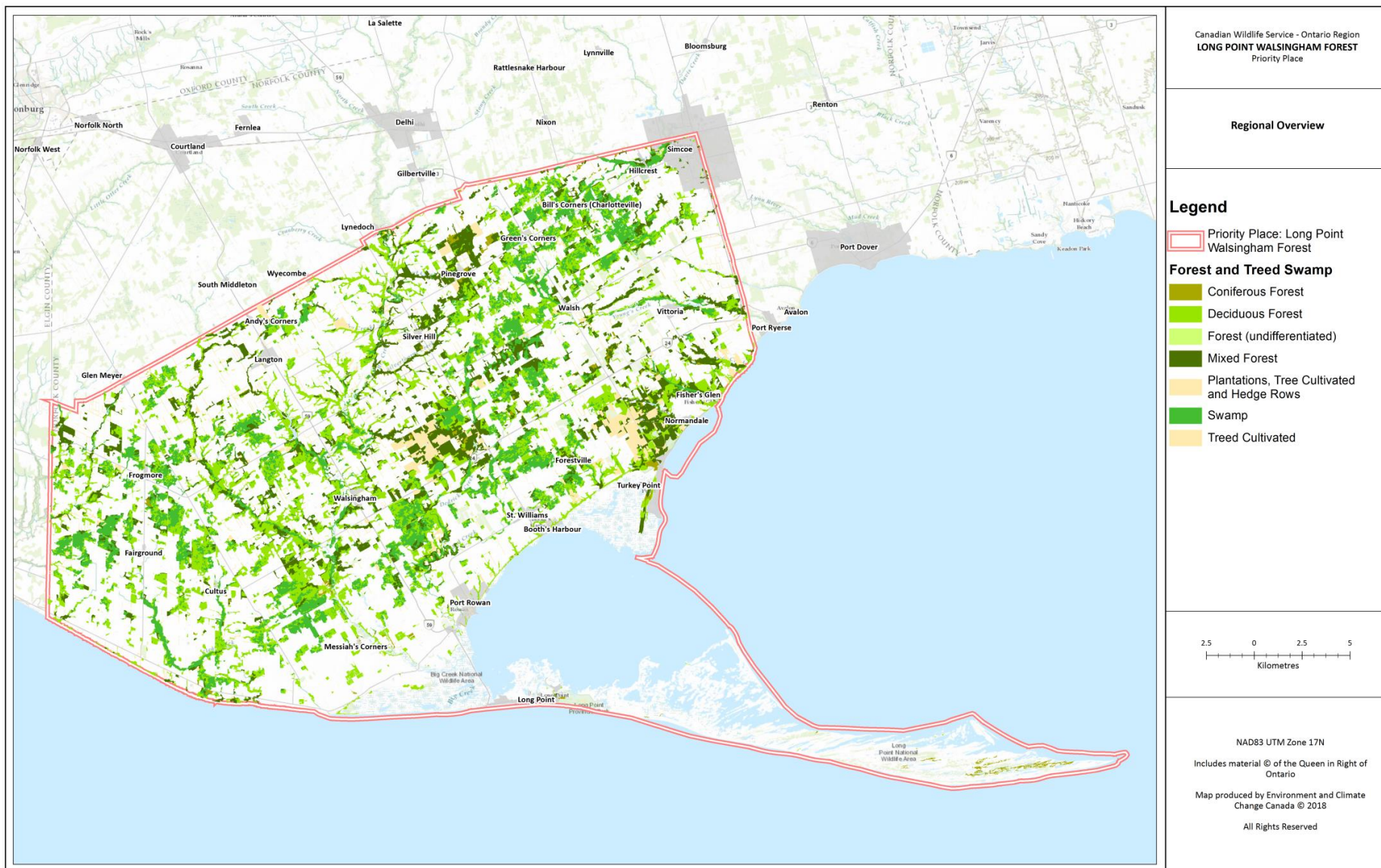


Figure 5. Conservation Target: Forests and Treed Swamp.

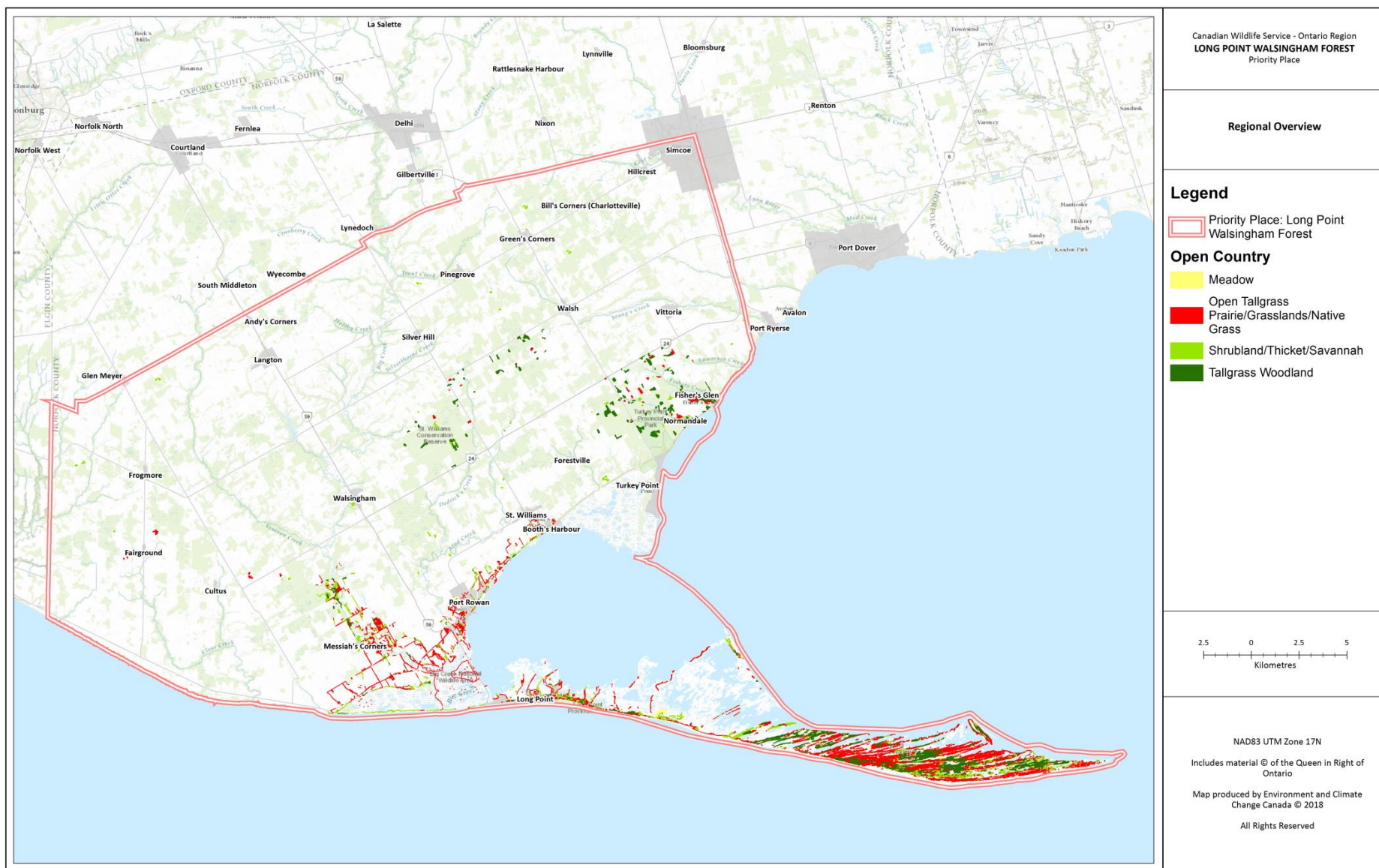


Figure 6. Conservation Target: Open Country.

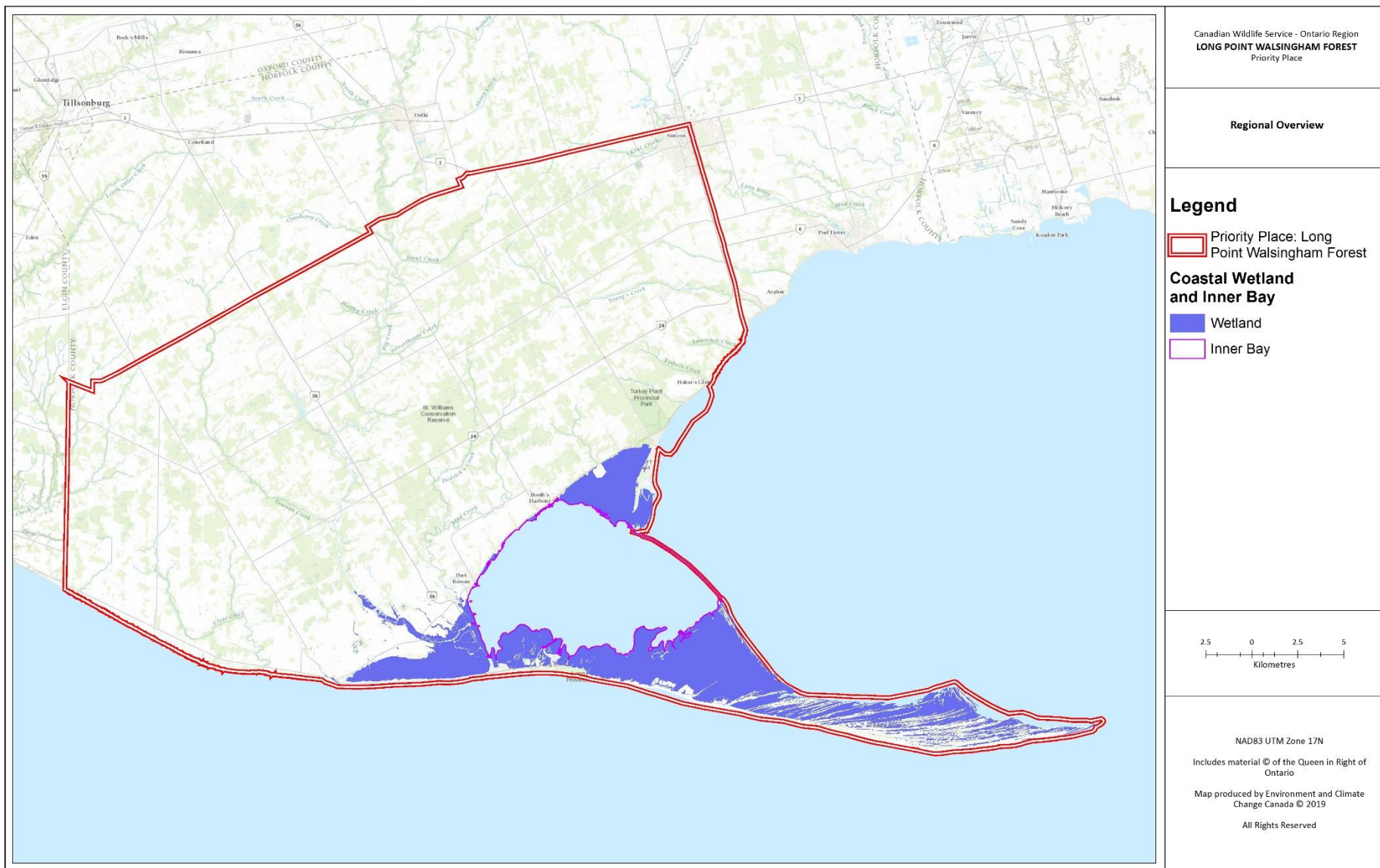


Figure 7. Conservation Target: Coastal Wetland and Inner Bay.

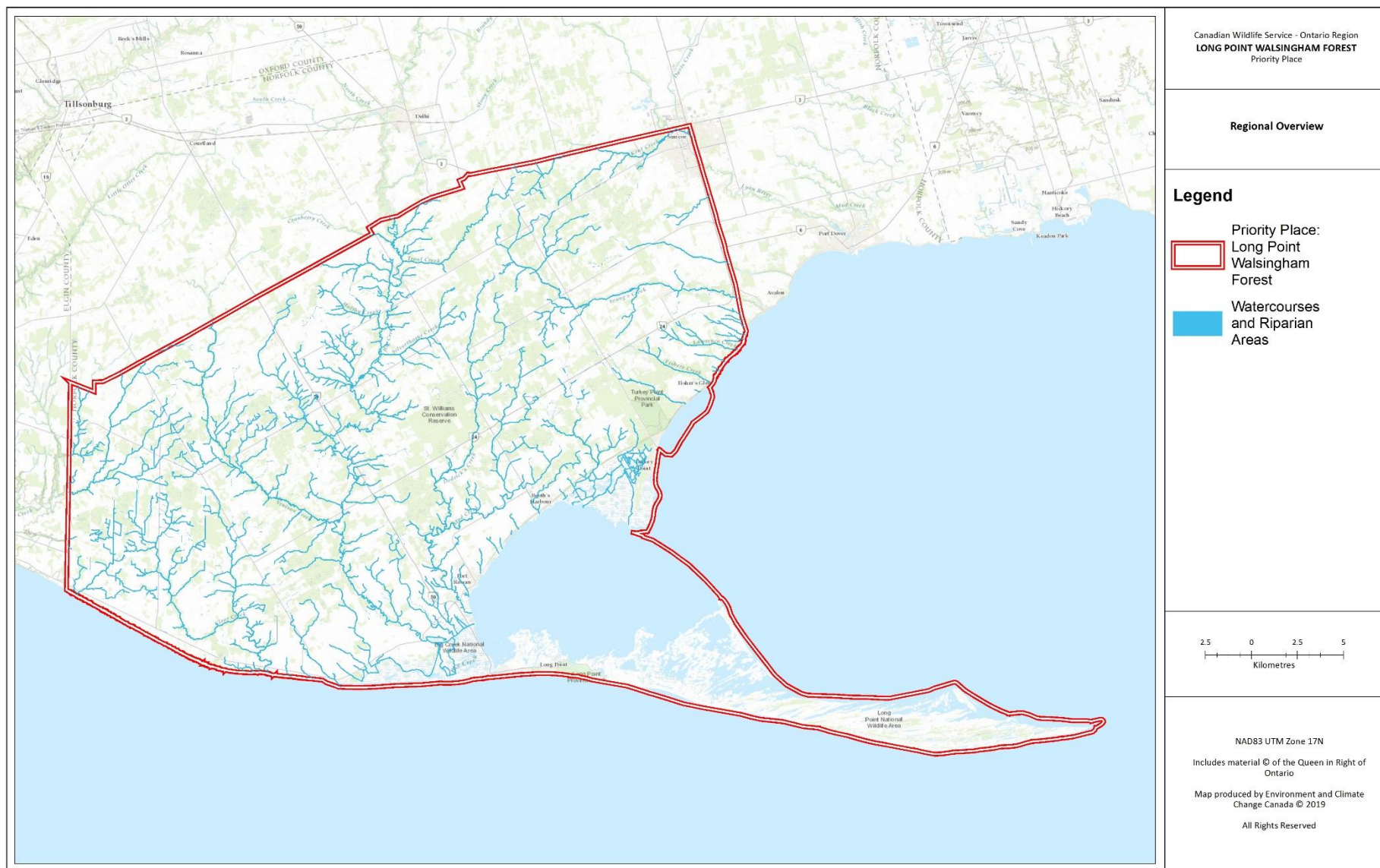


Figure 8. Conservation Target: Watercourses and Riparian Areas.



Figure 9. Conservation Target: Beaches and Coastal Dunes.

4.3 Direct Threats

Threat Rating and/or Assessment is a method which aims to explicitly and objectively identify and assess the threats impacting a conservation target (FOS, 2009). The direct threats to the conservation targets in LPWF were identified and assessed based on scope, severity and irreversibility in the Miradi software (Table 1). The threat assessment was completed at the February 2018 CIP workshop and was subsequently expanded on by the CWS and other local experts further engaged outside the workshop forum.

For consistency and comparison among conservation projects, the International Union for Conservation of Nature (IUCN) direct threat categories were used to the extent possible. Some threat names have been adjusted to make them more applicable to the threats in the LPWF Priority Place. Refer to APPENDIX C for additional information. Threats marked as Not Specified were identified but not rated due to time or expertise limitations at the workshops.

Box 3. Key Terminology – Threat Assessment

Direct Threat: “A human action that immediately degrades one or more conservation targets” (FOS, 2009). Types of Direct Threats include both Conventional and Climate Threats (Box 4).

Indirect Threat: “A factor identified in an analysis of the project situation that is a driver of direct threats. Often an entry point for conservation actions” (FOS, 2009).

Scope: “The proportion of the target that will likely be affected by the threat within 10 years under current circumstances” (FOS, 2009).

Severity: “Attempts to categorize the level of damage to the conservation target expected in the next ten years” (FOS, 2009).

Irreversibility: “The degree to which the effects of a threat can be reversed and the target affected by the threat restored, if the threat no longer existed” (FOS, 2009).



Box 4. Climate Threats

The Climate-Smart Conservation Practice (GIZ, 2021) distinguishes between two types of Direct Threats:

- Conventional Threats: human actions that immediately degrade one or more ecosystem targets.
- Climate Threats: natural phenomena altered by the mainly human-caused increase in global surface temperature and its projected continuation.

As climate change has the ability to broadly impact ecological systems, a Climate Change Vulnerability Assessment (CCVA) was conducted for the LPWF Priority Place to assess how climate change will impact the 6 Conservation Targets and exacerbate 4 Priority Threats: invasive species (*Phragmites australis*), roads, fire suppression, and agricultural runoff.

The following Climate Change Vulnerability/Risk Scenarios were developed for the LPWF Priority Place based on the CCVA:

1. Scenario 1: Increase of consecutive days with rainfall and extreme precipitation.
2. Scenario 2: Increase of average annual and seasonal air temperatures.
3. Scenario 3: Decrease of summer and fall precipitation.
4. Scenario 4: Increase of hot weather extremes.
5. Scenario 5: Increase of wind events.

These scenarios are detailed for the Priority Conventional Threats and Climate Threats below.

Table 1. Threat rating criteria (FOS, 2009).






	Threat Ratings*			
	Very High	High	Medium	Low
Scope	The threat is likely to be pervasive in its scope, affecting the target across all of most (71-100%) of its occurrence/population.	The threat is likely to be widespread in its scope, affecting the target across much (31-70%) of its occurrence/population.	The threat is likely to be restricted in its scope, affecting the target across some (11-30%) of its occurrence/population.	The threat is likely to be very narrow in its scope, affecting the target across a small proportion (1-10%) of its occurrence/population.
Severity	Within the scope, the threat is likely to destroy or eliminate the target, or reduce its population by 71-100% within 10 years or 3 generations.	Within the scope, the threat is likely to seriously degrade/reduce the target or reduce its population by 31-70% within 10 years or 3 generations.	Within the scope, the threat is likely to moderately degrade/ reduce the target or reduce its population by 11-30% within 10 years of 3 generations.	Within the scope, the threat is likely to only slightly degrade/reduce the target or reduce its population by 1-10% within 10 years of 3 generations.
Irreversibility	The effects of the threat cannot be reversed and it is very unlikely that the target can be restored, and/or it would take more than 100 years to achieve this.	The effects of the threat can technically be reversed and the target restored, but it is not practically affordable and/or it would take 21-100 years to achieve this.	The effects of the threat can be reversed and the target restored with a reasonable commitment of resources and/or within 6-20 years.	The effects of the threat are easily reversible and the target can be easily restored at a relatively low cost and/or within 0-5 years.

*(FOS, 2009)

Table 2. Threat Rating Summary.

Conservation Targets Direct Threats	Forests and Treed Swamps	Coastal Wetlands and Inner Bay	Watercourses and Riparian Areas	Beaches and Coastal Dunes	Open Country	Amphibians and Reptiles	Summary Threat Rating
 1.1 Housing & Urban Areas	Medium	Low	Not Specified	Medium		Medium	Medium
 1.2 Commercial & Industrial Areas	Low					Medium	Low
 1.3 Tourism & Recreation Areas	Not Specified	Low		Low		Low	Low
 2.1 Annual & Perennial Non-timber Crops			Not Specified			Low	Low
 2.3 Livestock Farming & Ranching						Not Specified	Not Specified
 4.1 Roads	Low	Low	Low	Low	Low	High	Medium
 4.2 Utility & Service Lines							Low
 5.1 Hunting & Collecting Terrestrial Animals						Medium	Low
 5.2 Gathering Terrestrial Plants					Low		Low

Conservation Targets Direct Threats	Forests and Treed Swamps	Coastal Wetlands and Inner Bay	Watercourses and Riparian Areas	Beaches and Coastal Dunes	Open Country	Amphibians and Reptiles	Summary Threat Rating
 5.3 Logging & Wood Harvesting	Medium		Low			Not Specified	Low
 5.4 Fishing & Harvesting Aquatic Resources			Low			Not Specified	
 6.1 Recreational Activities	Medium	Low	Low	Medium	Low	Not Specified	Low
 7.1 Fire Suppression	Low				Very High	Not Specified	High
 7.2 Dams & Water Management/Use	Low	Medium	Medium	Not Specified		Not Specified	Medium
 7.3 Shoreline Hardening & Beach Modifications		Low	Not Specified	Medium		Not Specified	Low
 8.1 Invasive Species	Medium	Very High	Medium	High	Medium	Medium	High
 8.2 Problematic Native Plants & Animals	Low	Medium	Not Specified	Not Specified	Low	Low	Medium
 8.4 Pathogens & Microbes	Not Specified					Low	Low
 9.1 Household Sewage & Urban Waste Water			Low	Low		Not Specified	

Conservation Targets Direct Threats	Forests and Treed Swamps	Coastal Wetlands and Inner Bay	Watercourses and Riparian Areas	Beaches and Coastal Dunes	Open Country	Amphibians and Reptiles	Summary Threat Rating
 9.3 Agricultural Runoff (point & non-point source)	Medium	Medium	Medium	Not Specified		Not Specified	Medium
 9.4 Garbage & Solid Waste	Low	Low	Low	Low		Low	Low
 9.5 Air-borne Pollutants	Low						Low
 9.6 Light & Noise Pollution	Low					Not Specified	Low
 11.3, 11.4, and 11.5 Climate Change and Severe Weather	Low		Low	Low		Not Specified	Low
Threat summary for each Conservation Target	Medium	High	Medium	Medium	High	Medium	High



1.1 Housing & Urban Areas

Threats from Housing & Urban Areas include threats from new development/expansion and existing housing. The growing population in Norfolk County (1.4% from 2011 to 2016) is resulting in residential development outside of urban centers such as Port Rowan (Statistics Canada, 2017). The increasing population is leading to the development of new facilities and structures, which heighten anthropogenic pressures in sensitive ecological areas. Current housing and structures adjacent to the beaches and coastal dunes can also lead to damaged vegetation and reduced breeding habitat for SAR such as the Fowler's Toad. For instance, previously seasonal cottages are being converted into larger residences for year-round occupation (COSEWIC, 2010a).

Under the Norfolk County Zoning By-Law, some zones are more susceptible than others to development depending on general restrictions. For instance, new buildings and structures are permitted in agricultural zones, which could reduce potential staging areas for migratory birds and waterfowl. However, Provincially Significant Wetlands or Hazard Lands are afforded additional protection because most development is prohibited. Construction in areas surrounding the Long Point Beaches is also unlikely due to limited road access for emergency services.



1.2 Commercial & Industrial Areas

Similar threats and impacts as *Housing & Urban Areas*.



1.3 Tourism & Recreation Areas

Tourists are attracted to the LPWF area for its spectacular natural beauty. Many tourists participate in outdoor activities at Turkey Point or Long Point. Tourism often requires the development of recreational areas and buildings (golf courses, campgrounds, beach resorts, and seasonal cottages) which are all found in LPWF and have the ability to impact surrounding ecosystems and facilitate the spread of invasive species (Norfolk County, 2018a). In 2013, the Long Point World Biosphere Reserve partnered with Norfolk County to develop, support and promote sustainable tourism strategies for Long Point with a grant from the Ontario Trillium Foundation (LPWBR, 2013).



2.1 Annual & Perennial Non-timber Crops

Soil erosion on agricultural land, and the use of fertilizer and pesticides threaten natural areas in LPWF, particularly aquatic ecosystems as croplands sometimes lack vegetated riparian buffers along waterways. Removing or restoring farm buildings can affect wildlife which use these structures as habitat, such as Barn Swallows and reptiles. Agricultural equipment can harm and kill wildlife, including SAR such as Blanding's Turtle, numerous grassland birds, and Snapping Turtle.



2.3 Livestock Farming & Ranching

Livestock farming is not a major agricultural activity in the LPWF area, however, some livestock farms do exist (e.g., sheep, cattle). Livestock access to waterways negatively impacts water quality by increasing nutrients and turbidity, while causing bank erosion. Poor management of livestock density can lead to overgrazing and result in increased erosion and nutrient runoff. Runoff from livestock yards or improper manure storage also contribute to nutrient loading in the aquatic systems.



4.1 Roads

Norfolk County manages approximately 4,100 lane-km (or 2,030 centreline-km) of roads and segments of provincial highways across the County's landscape (Provincial Highways 3, 6, and 24) and traffic volume on these roads has steadily increased over time (Norfolk County, 2014; MTO, 2016). The threat of linear infrastructure such as roads is a leading cause of mortality for reptiles and amphibians (Jackson, 2000). In Canadian federal and provincial recovery documents, road networks are recognized as a severe threat for most SAR herpetofauna. Roads and traffic negatively affect wildlife populations in four main ways: 1) habitat loss 2) traffic mortality 3) resource inaccessibility, and 4) population subdivision (Jaeger et al. 2005). The expansion of road networks also enhances other threats include the spread of invasive species, human access to natural areas, and contaminant runoff.



Box 5. Impact of Climate Change on Roads

Climate change is expected to increase extreme weather events which may alter existing road infrastructure and potentially impact amphibians and reptiles as detailed in the following vulnerability/risk scenario (CRI, 2021).

Scenario 1: Increase of consecutive days with rainfall and extreme precipitation

Extreme precipitation has the potential to result in flooding which leads to road washouts and the deterioration of culverts. Both of these outcomes may impact regular and new species migrations anticipated from climate change. This scenario may also result in additional construction work being required to repair, maintain or expand road infrastructure.

4.2 Utility & Service Lines



Waterfowl and shorebirds are among the most vulnerable bird groups to transmission line collisions (Rioux et al., 2013). The transmission lines in LPWF are low in altitude and voltage, and run alongside roads minimizing the possibility and consequence of collisions.



5.1 Hunting & Collecting Terrestrial Animals

The legal or illegal collection of reptiles from remnant prairies in LPWF threatens SAR and biodiversity. Some species are collected for the trade industry whereas others face persecution and are hunted. Generally, turtles, such as the Spiny Softshell and Spotted Turtle are collected, whereas snakes, such as the Eastern Milksnake and the Eastern Hog-nosed Snake, are intentionally killed and run over by vehicles.



5.2 Gathering Terrestrial Plants

Wildflowers may be collected from tallgrass communities in LPWF which physically degrades the limited remnant prairies reducing biodiversity in these ecosystems.



5.3 Logging & Wood Harvesting

Private and public landowners practice two types of wood harvesting in the LPWF Priority Place. Logging is the practice of removing wood by chainsaw and occurs at a small scale and in most cases has the least impact on the woodlot's forest floor and overall composition. Cutting firewood and salvaging dead wood are the main purposes for logging. Wood harvesting (or silviculture) is the practice of controlling tree growth, composition and structure, and quality of the forest. Wood harvesting is used in which the goal is to maintain the economic value, and ideally, the integrity of the forest. Wood harvesting for timber has the greatest environmental impact on the woodlot and understanding how this practice affects birds and other wildlife is important to maintaining the integrity of the forest.

Forest management on private and public lands in LPWF is fairly good. Norfolk County has the highest forest cover in southwestern Ontario at 25% and is home to the largest woodlot owners association in Ontario, the Norfolk Woodlot Owners Association. In 2008 and 2009 Norfolk County was recognized by the Canadian Forestry Association as the Forest Capital of Canada. Norfolk County has a Forest Conservation Service which conducts by-law enforcement, manages the Community County Forest Network, provides private land education and extension, and develops and maintains the Forest Conservation Strategy.

Norfolk County enforces a strong tree cutting by-law which reduces tree removal (COSEWIC, 2010b). However, unsustainable harvesting still occurs on the landscape, resulting in soil erosion, open canopies, as well as forest and riparian community changes. Current management practices are also resulting in a significantly greater extent of younger forests than would historically have been present. Forests with a younger plant community are less diverse, have a more open canopy and a modified structural diversity offering opportunities for invasive species establishment. The loss of old-growth forests is especially problematic in LPWF because the Carolinian forests support a high biodiversity of SAR, particularly forest birds that are rare in Canada. Such species include Acadian Flycatcher, Cerulean Warbler, and Wood Thrush (Environment Canada, 2012).



5.4 Fishing & Harvesting Aquatic Resources

Fishing practices in LPWF may threaten watercourses by removing fish, introducing non-native species, eroding banks, and potentially entangling wildlife in fishing lines. These practices also introduce the threats of by-catch and boat propellers which injure and kill turtles. To minimize fishing practices threats, several regulations have been introduced. For instance, fishermen are legally bound to live-release by-catch, which supports the survival and recovery of SAR (Gislason, 2010).



6.1 Recreational Activities



LPWF has many easily accessible natural areas which are popular for recreational activities such as ATVing, mudding and boating. All-terrain vehicles and mountain bikes compact and erode soils, damage sand placement on beaches, and trample vegetation and wildlife causing accidental mortalities. Recreational boating removes aquatic vegetation, creates water and noise pollution, and increases turbidity. Active recreation taking advantage of waterways either for travelling along or for mudding could have negative effects on productivity of species such as Acadian Flycatcher that nest relatively low over the water. Other activities with minor impacts are hiking and camping which trample vegetation and soil, as well as disturb wildlife.

Overall, the ease of access to natural areas attracts tourists to LPWF. For instance, Erie Boulevard on Long Point has free parking attracting visitors to the beaches. Tourism heightens threats associated with the aforementioned recreational activities and requires additional maintenance of the extensive trails run through the Priority Place, which also facilitates the spread of invasive species.



7.1 Fire Suppression

Fire is the main driving force behind the persistence of prairie and savannah communities (Reichman 1987, Sauer 1950). Fire is not a natural occurrence in LPWF and instead is used in a controlled way to maintain habitat using prescribed burns. There are many barriers that make it difficult to burn prairie and savannah communities and those barriers are different depending on the land tenure. Barriers to prescribed burns, leading to fire suppression include complicated logistics of prescribed burning, landowner support, public attitudes, safety, and cost. Landowner support for prescribed burning varies greatly within the LPWF area. Local fire departments may see prescribed burning as a threat or hazard but are generally satisfied by the professionalism by which the burns are conducted. Support from the agricultural community can be split; the burning off of thatch and enhanced hunting opportunities may be seen as positive outcomes while the threat of an escaped fire damaging personal property is understandably negative. The logistics of planning, funding and implementing prescribed burns are challenging and present a significant barrier to developing regular prescribed burn regimens. A one-day burn event in April typically involves site preparation, grant application and burn permitting (in some cases SAR permitting as well) in the year or more preceding the burn. Site monitoring and reporting are usually required following

the burn. Limited funding coupled with limited people with the required skills and training results in a deficiency in resources available for prescribed burning. For many organizations or individual landowners, the process of applying for grant funding, administering a grant, the creation of burn breaks, outreach, and leveraging in-kind contributions is cumbersome and results in prescribed burns occurring less frequently than required to maintain the habitat (if prescribed burning is pursued at all). On Crown Land, there are specific requirements for prescribed burns which require a 6 month planning process. Funding cycles are unpredictable, may prioritize or require sites where SAR are present, and short-term funding does not align well with long-term management plans. There is also a lack of interest and promotion of prescribed burning on private property and long-term management of tallgrass habitats on private land is challenging. However, prescribed burning on private lands is less structured than on Crown Lands and only requires permitting from the local fire department which takes about one week.



Box 6. Impact of Climate Change on Fire Suppression

Climate change is predicted to create further barriers to conducting prescribed burns, and lead to fire suppression through two possible vulnerability/risk scenarios (CRI, 2021).

Scenario 1: Increase of consecutive days with rainfall and extreme precipitation; and

Scenario 3: Decrease of summer and fall precipitation

Climate change may lead to decreasing seasonal precipitation, resulting in drought, or to an increase of the number of consecutive days with rainfall, resulting excess moisture. Either of these scenarios may result in fire suppression by altering burn conditions and challenging the ability to conduct prescribed burns from both environmental (e.g., wet conditions) and safety perspectives (e.g., fire escape) (CRI, 2021).



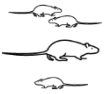
7.2 Dams & Water Management/Use

Water in the Priority Place is managed in agricultural areas, wetlands, and watercourses altering ecosystem hydrology. In agricultural areas, tile drainage has been extensively installed to prevent soil flooding, however it can diminish the quality of water and habitats downstream (Blann et al., 2009). NCC is closing tile drainage systems on their restored lands and the LPRCA is creating retention wetlands to naturally filter water from remaining drainage outlets. Several wetlands in LPWF are altered with dykes, culverts, and pumps, including those in the Big Creek NWA, which DUCs and the CWS use to manage water levels and wildlife habitat. The LPRCA also operates several small dams in various conservation areas, of which some have been decommissioned, but others remain for fishing and water level management. Water flow in watercourses is altered with actions including surface water diversions, channelization and ditching, all of which may compromise habitat and resource availability for wildlife.



7.3 Shoreline Hardening & Beach Modifications

Lake Erie has some of the most hardened shorelines in the Great Lakes, and though shorelines in the Priority Place are relatively underdeveloped, existing structures within and outside the priority place affect wave action and the persistence of the Long Point sand spit. Additional beach modifications, including grooming and maintenance activities with heavy machinery, reduce vegetation, threaten wildlife and destroy nesting habitat for SAR such as the Fowler's Toad and Snapping Turtle.



8.1 Invasive Species

Invasive species displace native species, decrease biodiversity and disrupt natural ecosystem processes. There are a significant number of invasive species, both terrestrial and aquatic plants and animals that threaten biodiversity in LPWF.

Non-native *Phragmites* is one of the most concerning invasive species in LPWF. *Phragmites australis* (Common Reed) is an invasive perennial wetland plant that has spread rapidly across the Great Lakes basin. Growing up to 6 m in height, *Phragmites* out-competes native wetland plants, resulting in expansive mono-culture stands of limited value to wildlife. *Phragmites* impacts breeding and foraging habitats, restricts wildlife movement and reduces the availability of open water. *Phragmites* also threatens the habitat of many native species and SAR in Ontario (both federal and provincial species) and is listed as a threat in 2 of the 23 SAR recovery plans at Long Point.

Invasive shrubs and trees are found throughout many of the forested areas of LPWF, including Autumn Olive (*Elaeagnus umbellata*), European Buckthorn (*Rhamnus cathartica*), Japanese Barberry (*Berberis thunbergii*) and Multiflora Rose (*Rosa multiflora*). Invasive woodland plants include Garlic Mustard (*Alliaria petiolata*), Periwinkle (*Vinca minor*), and Greater Celandine (*Chelidonium majus*). Garlic Mustard is present in most forests.

Invasive species are also the number one concern of woodlot owners (I. R. Fife, *pers. comm.* 2020). Specifically, EAB and gypsy moth (*Lymantria dispar dispar*) are the two most realized invasive threats to their woodlots as they affect not only forest structure but forest cover through defoliation. Emerald Ash Borer has decimated ash trees throughout southern Ontario and in the current situation there is little to stop the presence and spread. Similarly, gypsy moth affects trees through defoliation and causes serious growth loss and, in some cases, tree senescence (OMNRF 2019a).

Other invasive species include: Bittersweet Nightshade (*Solanum dulcamara*), European Frog-bit (*Hydrocharis morsus-ranae*), European Alder (*Alnus glutinosa*), Honey Locust (*Gleditsia triacanthos*), Hybrid Cattail (*Typha x glauca*), Flowering Rush (*Butomus umbellatus*), Lady's-thumb (*Polygonum persicaria*), non-native Willow complex (*Salix alba*, *S. fragilis*, and *S. x rubens*), Pale Yellow Iris (*Iris pseudacorus*), Purple Loosestrife (*Lythrum salicaria*), Reed-canary Grass (*Phalaris arundinacea*), and White Sweet Clover (*Melilotus alba*).

Feral cats and Mute Swans also threaten native wildlife in LPWF and their populations are managed using various control methods. Mute Swans (*Cygnus olor*) aggressively compete with waterfowl and waterbirds for limited breeding habitat (Petrie & Francis, 2003). Without native predators, their population continues to increase in the Long Point Crown Marsh (Badzinski et al., 2008). Mute Swans are discouraged from nesting and are removed by permit under the Migratory Birds Convention Act, 1994 (MBCA). Feral Cats (*Felis catus*) prey on birds, small mammals, amphibians and reptiles (Baker et al., 2005; Woods et al., 2003) and their large population is controlled with strategies include spaying, neutering, and euthanasia.



Box 7. Impact of Climate Change on Invasive Species (*Phragmites australis*)

The climate factors that are expected to further reduce the capacity of native communities to resist the encroachment of invasive species are detailed in following three vulnerability/risk scenarios (CRI, 2021).

Scenario 2: Increase of average annual and seasonal air temperature

Scenario 3: Decrease of summer and fall precipitation; and

Scenario 4: increase of hot weather extremes

Warming temperatures and extreme heat will lead to increased evaporation and decreased ice cover. These factors as well as declining seasonal precipitation all result in the drying of nearshore environments and wetland areas as well as in lower water levels in Lake Erie, thus favouring the establishment of *Phragmites* in drier areas.



8.2 Problematic Native Plants & Animals

Several problematic native species, many of which have flourished in human-altered and predator-deficient environments, directly degrade their habitats and also prey on other native species. The major problematic native species in the Priority Place is White-tailed Deer (*Odocoileus virginianus*) which has been overabundant in the Priority Place since the early 1900s. Through their generalist browsing behavior, deer have prevented herbaceous and woody understory species from regenerating. To restore overall habitat conditions, the CWS controls deer the population and conducts monitoring (Bowles & Bradstreet, 2016). Double-crested Cormorants (*Phalacrocorax auritus*) have also been overabundant in the Priority Place. Forming large colonies near feeding areas, they produce large amounts of guano which impacts native vegetation, especially by their nesting trees (Weseloh & Collier, 1995).

Common subsidized mesofauna, including the Northern Raccoon (*Procyon lotor*), the Striped Skunk (*Mephitis mephitis*), the Virginia Opossum (*Didelphis virginiana*), the Wild Turkey (*Meleagris gallopavo*) and the American Crow (*Corvus brachyrhynchos*), threaten wildlife and their nests. Raccoons are especially problematic, preying on turtle and bird nests. Most amphibians and reptiles in the Priority Place will be preyed upon by raccoons at some stage in their life, inhibiting population growth.



8.4 Pathogens & Microbes

Further research will be required to fully evaluate the threat of Pathogens & Microbes in LPWF. However, undiscovered pathogens and microbes in the Priority Place may currently affect wildlife and plants. For instance, amphibians and reptiles in LPWF may be threatened by Snake Fungal Disease (SFD), Chytridiomycosis (*Batrachochytrium dendrobatidis* and *B. salamandrivorans*) and Ranavirus. The Eastern Foxsnake, the Queensnake and the Gray Ratsnake are particularly vulnerable to SFD due to habitat fragmentation and, although SFD has not been confirmed in LPWF, it has been found at Rondeau Provincial Park and in Brant County, just north of Norfolk County (Stephen et al., 2017).

Several pathogens would also cause severe population declines for trees if they were in the Priority Place. Examples include Dogwood Anthracnose Fungus for Eastern Flowering Dogwood, Beech Scale for American Beech, and Hornbeam Anthracnose Fungus for Ironwood (Scarr, 2012).



9.1 Household Sewage & Urban Waste Water

Faulty and unmaintained septic tanks in LPWF are more likely to leak and contaminate watercourses, riparian areas, and beaches. Local by-laws and water treatment systems have been used in Norfolk County to minimize this threat.



9.3 Agricultural Runoff (point & non-point source)

Agricultural runoff refers to the by-products of farming practices that result in degradation of watercourses and wetlands. Pesticides, including neonicotinoids, fertilizers and cattle manure runoff the landscape into watercourses, wetlands and open water, reducing water quality and SAR habitat. These effluents contain nitrogen and phosphorus, which eventually accumulate in Lake Erie and contribute to eutrophication.

Seeds and insects treated with neonicotinoids and other pesticides are increasingly being found to be consumed by migratory birds and in some cases have detrimental effects on migratory behavior (Addy-Orduna et al. 2019, Eng et al. 2019, Humann-Guillemot et al. 2019). As of 2016, insecticide use such as neonicotinoids in Norfolk County has increased by 31% (Norfolk County 2019b). Additionally, other wildlife and SAR could see the effects of neonicotinoids on their populations. An amphibian's permeable skin allows them to take oxygen from the water, these pollutants could have detrimental effects on the genera and effect ephemeral wetlands. Additionally, many wildlife species use water resources for subsistence including birds such as Acadian Flycatcher, Louisiana Waterthrush and Prothonotary Warbler; species-at-risk that depend on aquatic invertebrates to feed themselves and their young. The effects of neonicotinoids are largely unknown. However, agricultural run-off has the potential for serious cause for decline among forest birds and wildlife by way of food resources.



Box 8. Impact of Climate Change on Agricultural Runoff

Climate change is predicted to amplify the impacts of agricultural runoff through four possible vulnerability/risk scenarios (CRI, 2021).

Scenario 1: Increase of consecutive days with rainfall and extreme precipitation

Changing precipitation patterns and extreme rainfall events may lead to soils being saturated and possibly flooded and cause an excess of nutrients entering wetlands and near-shore environments. This nutrient loading would alter the composition of wetland communities.

Scenario 2: Increase of average annual and seasonal air temperatures

Early seasonal warm spells may lead to rapid thaw and snow melt, which result in saturated soils, runoff and flooding. Additionally, temperature increases may result in dry periods with higher chances of drought, thus increasing irrigation needs to prevent crops failure.

Scenario 3: Decrease of summer and fall precipitation

Decreases in seasonal precipitation increase the possibility of droughts, which harden and compact soils, preventing them from absorbing rain. Under such conditions, runoff increases and nutrients are concentrated beyond wetland retention capacities. For instance, an excess of nitrogen inhibits wetlands from completing the denitrification process, resulting in the release of greenhouse gases such as nitrous oxide.

Scenario 5: Increase of wind events

Extreme weather events such as high winds could result in the erosion of soil and vegetation buffer strips, nutrient runoff, and in damages to irrigation systems, all of which could have detrimental impacts on crops during the growing season.



9.4 Garbage & Solid Waste

Residential garbage dumping and littering can negatively affect water quality, plants, and wildlife, especially reptiles. Turtles, such as the Spiny Softshell are particularly vulnerable to garbage because they ingest and get tangled in discarded plastic. Countermeasures include implementing by-laws prohibiting dumping and opening two transfer stations for garbage and recycling.



9.5 Air-borne Pollutants

Air pollution from vehicle emissions smog, wind dispersed pollutants or farm field sediments, and smoke from outdoor fires, forest fires, and wood stoves threaten species and ecosystems in LPWF. The excessive amounts of environmentally deposited nitrogen from agricultural and combustion sources altered nitrogen cycles, species composition, and ecosystem functions (Vitousek, 1997).



9.6 Light & Noise Pollution

Light pollution surrounding forests in the Priority Place can disorient migrating nocturnal songbirds resulting in collisions with buildings and surrounding infrastructure. Additionally, roads also cause loud noise which disrupts wildlife.



11.3, 11.4, & 11.5 Climate Change & Severe Weather

Climate change data project several trends in the upcoming decades compared to baseline data from 1981-2010. Annual total precipitation is also expected to increase by 3.3%, 6.2%, and 8.8% in 2020s, 2050s, and 2080s respectively (CRI, 2021), with the greatest changes project in winter and spring by 16 mm – 26 mm (equivalent to a 7% - 12% change) (Ryan, 2022). The number of extreme weather events (i.e., days when temperatures exceed 30°C, days when temperatures drops below -20°C, or days when precipitation exceeds 20 mm) will also increase (CRI, 2020). These projections inform several possible vulnerability/risk scenarios for the Priority Place.

Scenario 1: Increase of consecutive days with rainfall and extreme precipitation

Climate change will cause an increase in extreme precipitation events from a baseline of 8 times per year to 9 times per year, which is a 16% change. The maximum precipitation event is expected to increase by 1 mm – 4 mm (equivalent to a 3% - 8% change) from a baseline of 43 mm (Ryan, 2022). These extreme precipitation events will increase the risk of leeching and sedimentation for nearshore habitats around Lake Erie (Verma, 2015).

Scenario 2: Increase of average annual and seasonal air temperatures

Annual mean temperatures are expected to increase 2.5°C – 2.8°C, from a baseline of 9°C, which is equivalent to a 0.9% – 1% change. Seasonally, fall temperatures are projected to change the most, with a 2.7°C - 3°C increase from a baseline temperature of 10.8°C (equivalent to a 1% - 1.1% change), while winter, spring, and summer temperatures are projected to moderately increase by 2.4°C – 2.9°C (equivalent to a 0.9% - 1% change) (Ryan, 2022).

The baseline of days above a 30°C threshold was 9 days and had a projected increase of 21 – 35 days, with a projected increase of 237% - 388%. There were no days below a -25°C threshold in the baseline, which is not projected to change in the 2050s. Precipitation as snow is expected to decrease by 55 mm – 62 mm, from a baseline of 100 mm (equivalent to a 55% – 62% decrease) and frost-free days are expected to increase by 37 – 41 days from a baseline of 195 days (equivalent to a 19% – 21% increase) (Ryan, 2022).

Scenario 3: Decrease of summer and fall precipitation; and Scenario 4: Increase of hot weather extremes

The baseline Hogg's Climate Index of 40.8 mm is expected to drop to 24.7 mm – 27.5 mm, representing a 33% – 39% increase in drought (Ryan, 2022). Drier and hotter weather may increase the speed at which ephemeral wetlands are drying out (compounded by tile and municipal drainage), impeding amphibian breeding cycles and reptile life cycles. In forests, changes in air temperature and precipitation increase the intensity, frequency, and duration of forest fire activity. These changes alter forest species composition and leave forests vulnerable to threats such as invasive species.

In addition, increasing water temperatures and pollutant toxicity as well as decreasing water and dissolved oxygen levels (Ficke et al., 2007) will impact the hydrology and extent of wetlands and waterways. These changes will cause erosion and displace plant and wildlife communities.

Warming springs may also be causing aquatic insects to decline due to the mismatch with insect hatch dates and breeding cycles with other species that are relying on invertebrates for raising young. Aerial insectivores (the fastest declining group of birds in North America), like the Acadian Flycatcher, are affected (Shipley et al., 2020) as well as other species at risk including all amphibians and reptiles and some plant species (see nested species list in the Situation Analysis).

4.4 Viability Assessment

Viability assessment is a method identified by the *Conservation Standards* for assessing the health of a conservation target. It uses the best available information and does not require perfect information. The process is meant to be iterative and adaptive (FOS, 2009).

In order to determine the current health of the conservation targets in LPWF, a viability assessment was completed using the Miradi software. The following steps were taken:

1. Identification of at least three Key Ecological Attributes (KEAs) for each conservation target. KEAs fall within the categories: size, condition and landscape context.
2. Identification of measurable indicators for each KEA.
3. Identification of an acceptable range of variation for each indicator (the viability rating scale) (Table 3).
4. Identification of a measurement value for each indicator.
5. Documentation of rating and measurement sources.

Box 9. Key Terminology - Viability Assessment.

Viability: Broadly, the status or “health” of a population of a specific plant or animal species (FOS, 2009).

Key Ecological Attribute (KEA): An aspect of a target’s biology or ecology that, if missing or altered, would lead to the loss of that target over time (FOS, 2009).

Indicator: A unit of information measured over time that documents changes in a specific condition (here, changes in a KEA) (FOS, 2009).

Size: A measure of the area of the conservation target’s occurrence (for an ecosystem target) or abundance of the target’s occurrence (for a species or population target) (FOS, 2009).

Condition: A measure of the biological composition, structure and biotic interactions that characterize the space in which the target occurs (FOS, 2009).

Landscape Context: An assessment of the target’s environment including: a) ecological processes and regimes that maintain the target occurrence such as flooding, fire regimes and other kinds of natural disturbance and b) connectivity that allows species targets to access habitat and resources or allows them to respond to environmental change through dispersal or migration (FOS, 2009).

Viability Ratings: A project’s scale of what is very good, good, fair, or poor for a given indicator for a given target. Viability ratings are often quantitatively defined, but they can be qualitative as well. In effect, by establishing this rating scale, the project team is specifying its assumption as to what constitutes a “conserved” target versus one that is in need of management intervention (Miradi V. 4.4.0, 2017).

The viability assessment was completed using the best available information given the time and resources available. Data gaps and assumptions have been documented throughout. As the LPWF CIP is an adaptive plan, the viability assessment is expected to be further refined at different stages of the project. Table 4 summarizes the overall results of the viability

assessment and the detailed assessment can be found in Appendix B. Table 3 shows the viability rating scale.

Table 3. Viability rating scale - identifies the acceptable range of variation (FOS, 2009).

Viability Ratings*			
Poor	Fair	Good	Very Good
Restoration increasingly difficult; may result in extirpation of target	Outside acceptable range of variation; requires human intervention	Indicator within acceptable range of variation; some intervention required for maintenance	Ecologically desirable status; requires little intervention for maintenance

*(FOS, 2009)

Table 4. Viability Assessment Summary.

Conservation Target	Overall Status	Key Ecological Attribute		Indicator	Status
Forests and Treed Swamps	Fair	Size	Interior forest habitat	Number of large forest patches	Good
		Size	Ecosystem extent	Percent forest cover	Poor
		Condition	Presence/abundance of forest interior bird communities	Number of individuals of Acadian Flycatchers and Cerulean Warblers	Fair
		Landscape Context	Connectivity of forest patches	Amount of resistance to movement	Good
Coastal Wetlands and Inner Bay	Good	Size	Ecosystem extent	Percent coastal wetland cover	Good
		Condition	Native species composition	Obligate marsh-nesting bird species richness	Good
		Condition	Plant community integrity	Percent <i>Phragmites australis</i> cover	Good
		Landscape Context	Sediment stability and movement	Percent shoreline hardening	Very Good
		Landscape Context	Adjacent natural systems	Percent non-impervious cover within 120 m	Very Good
Beaches and Coastal Dunes	Very Good	Size	Adjacent vegetation	Percent non-impervious surface within 1 km of beach	Good
		Condition	Presence and status of rare plant communities	EO ranks of rare vegetation communities	Very Good
		Landscape Context	Sediment stability and movement	Percent shoreline hardening	Very Good
Watercourses and Riparian Areas	Fair	Size	Habitat integrity	Percent of 30 m buffer (adjacent to watercourses) naturally vegetated	Fair
		Size	Habitat integrity	Percent of 5 m buffer (adjacent to drains) naturally vegetated	Poor
		Condition	Surface water quality	Total phosphorus (mg/L)	Fair
		Landscape Context	Hydrologic regime	Natural flow regime	Fair
Amphibians and Reptiles	Fair	Size	Habitat availability	Extent of habitat identified as having potential to contain biophysical attributes required by nested targets to support one or more life stages (measures as the percent of LPWF)	Good
		Condition	Presence and persistence	Proportion of species assessed by COSEWIC as endangered	Poor
		Landscape Context	Ability to move across the landscape	Road mortality risk - Percent of total suitable habitat intersecting high risk roads	Poor
Open Country	Fair	Size	Ecosystem extent	Number of ha of Open Country communities	Poor
		Condition	Species composition	Open country bird species richness	Good
		Landscape Context	Disturbance regime	Percentage of Open Country habitats managed to maintain early successional stages	UNKNOWN
		Landscape Context	Habitat connectivity	Distance between habitat patches	Fair
		Size	Habitat patch size	Number of patches >5 ha	Poor

5. SITUATION MODELS

A situation model is a tool for visually identifying factors influencing biodiversity in a project area. A situation model shows the main factors driving threats that impact conservation targets. Situation models have been developed for four of the greatest threats in LPWF (agricultural runoff, fire suppression, invasive species (Phragmites) and roads). These situation models will be used to identifying key intervention points for conservation strategies in the CIP. Figure 9 provides a key for interpreting the situation models.



Figure 10. Situation Model Key.

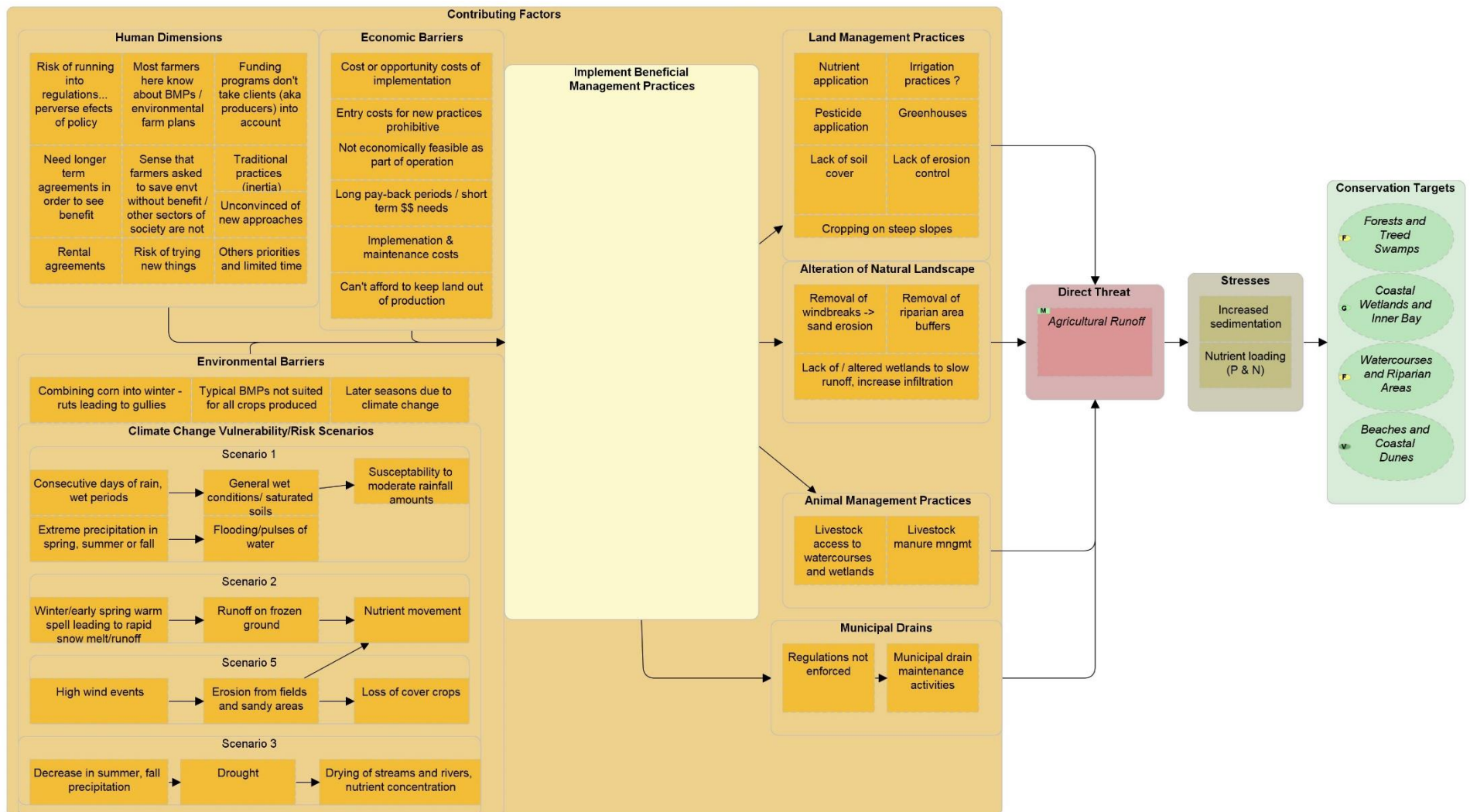


Figure 11. Situation Model: Agricultural Runoff

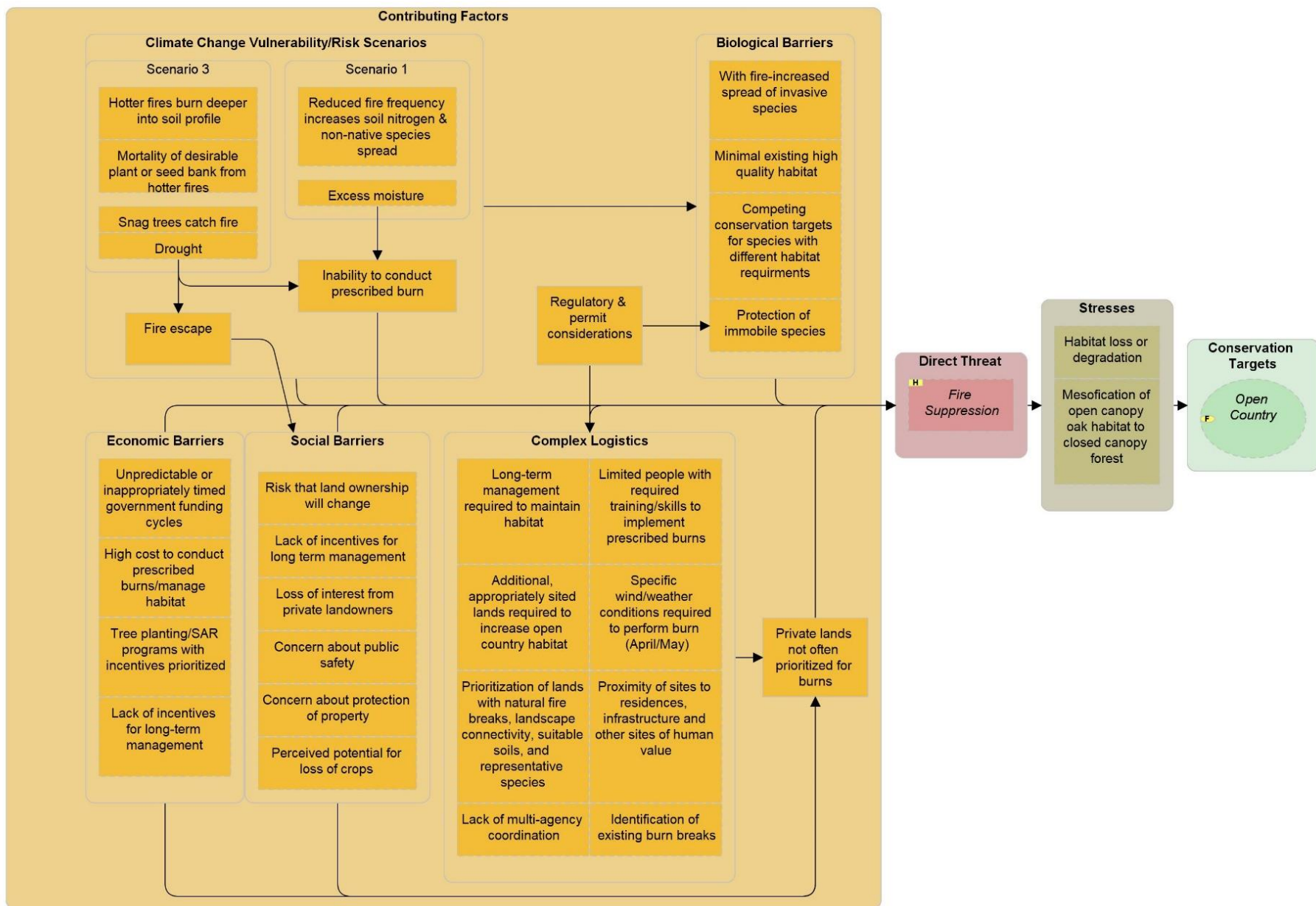


Figure 12. Situation Model: Fire Suppression

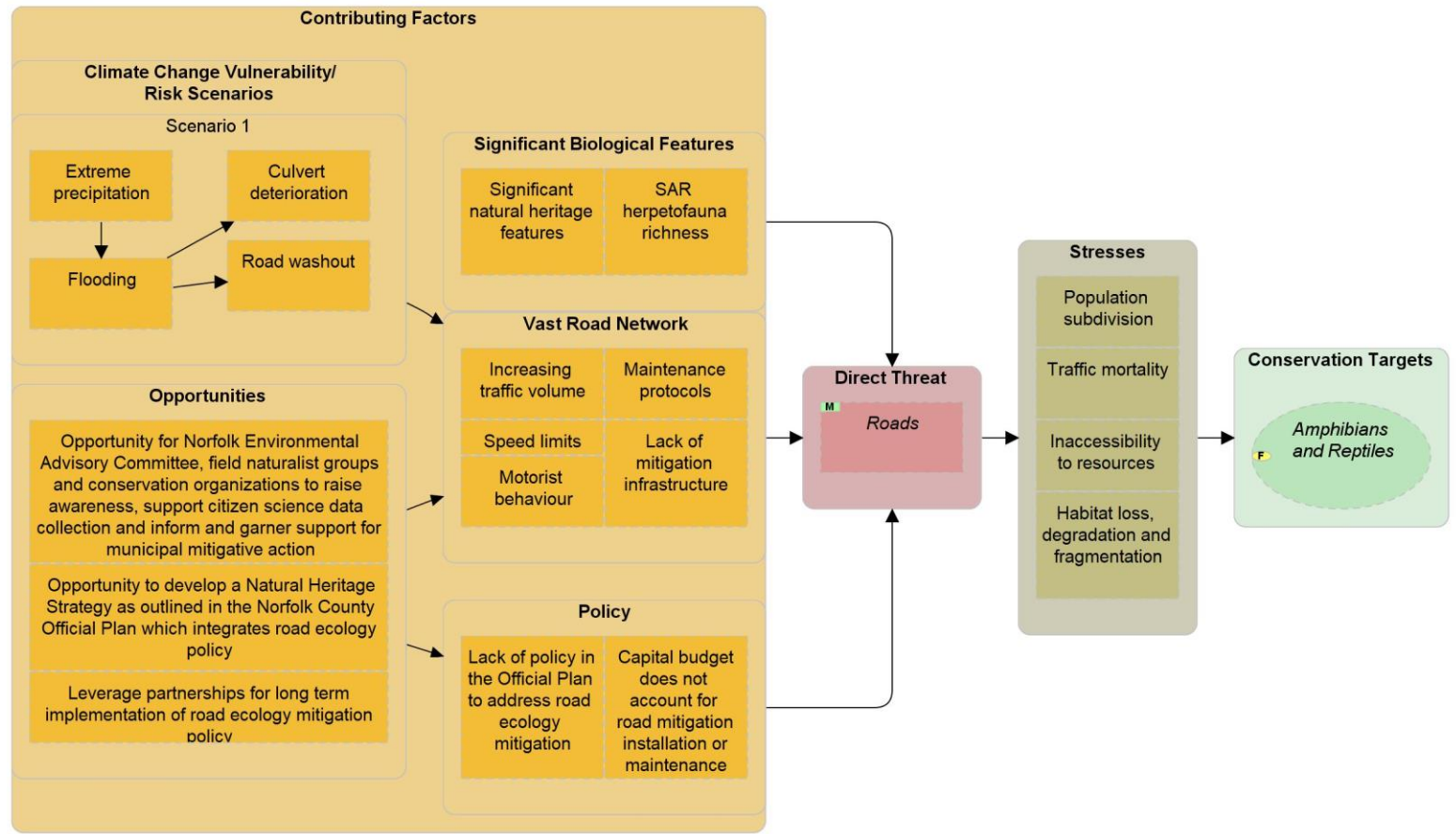


Figure 13. Situation Model: Roads

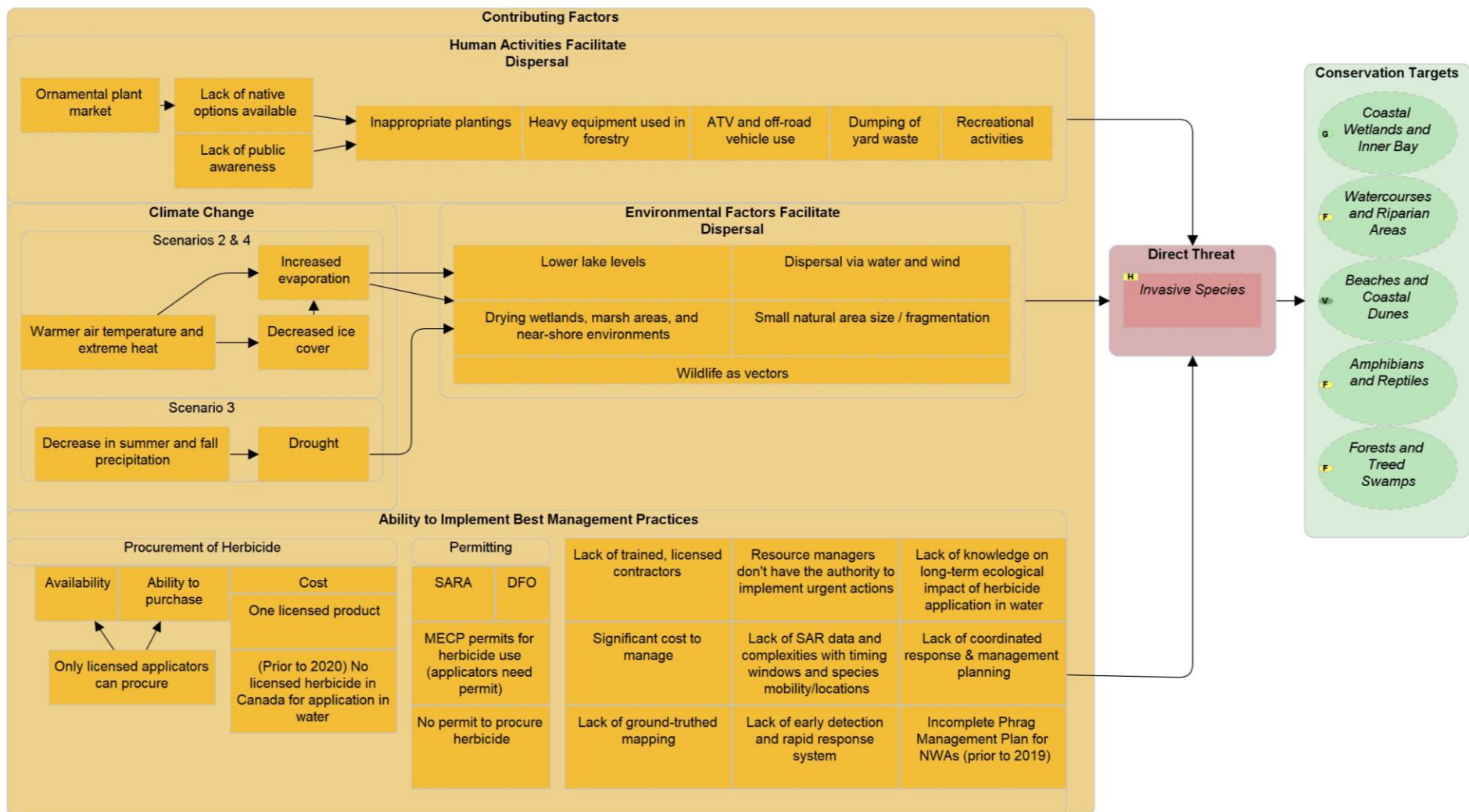


Figure 14. Situation Model: Invasive Species

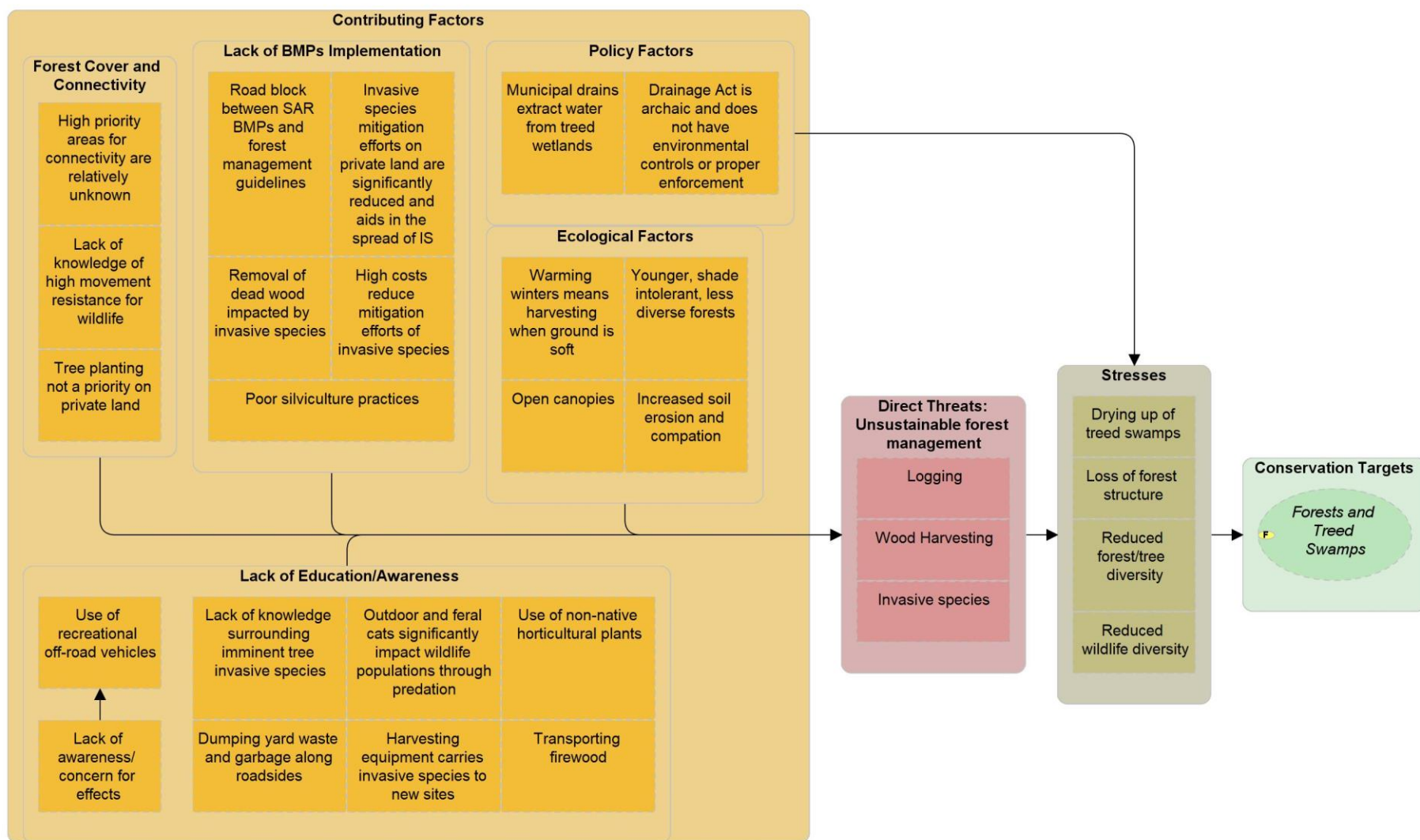


Figure 15. Situation Model: Logging and Wood Harvesting

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APPENDIX A: REFERENCE TABLES

Table A-1. Nested Species at Risk Targets.

Common Name	Scientific Name	Taxon	COSEWIC	SARA	ESA	Conservation Targets
Acadian Flycatcher	<i>Empidonax virescens</i>	Birds	Endangered	Endangered	Endangered	Forests and Treed Swamps Watercourses and Riparian Areas
American Badger jacksoni subspecies	<i>Taxidea taxus jacksoni</i>	Mammals	Endangered	Endangered	Endangered	Open Country
American Bumble Bee	<i>Bombus pensylvanicus</i>	Arthropods	Special Concern	No status	No Status	Open Country
American Chestnut	<i>Castanea dentata</i>	Vascular Plants	Endangered	Endangered	Endangered	Forests and Treed Swamps
American Ginseng	<i>Panax quinquefolius</i>	Vascular Plants	Endangered	Endangered	Endangered	Forests and Treed Swamps
American Water-willow	<i>Justicia americana</i>	Vascular Plants	Threatened	Threatened	Threatened	Coastal Wetlands and Inner Bay Watercourses and Riparian Areas
Bald Eagle	<i>Haliaeetus leucocephalus</i>	Birds	Not at Risk	No Status	Special Concern	Coastal Wetlands and Inner Bay Watercourses and Riparian Areas
Bank Swallow	<i>Riparia riparia</i>	Birds	Threatened	Threatened	Threatened	Coastal Wetlands and Inner Bay Open Country Watercourses and Riparian Areas
Barn Owl (Eastern population)	<i>Tyto alba</i>	Birds	Endangered	Endangered	Endangered	Coastal Wetlands and Inner Bay Open Country
Barn Swallow	<i>Hirundo rustica</i>	Birds	Threatened	Threatened	Threatened	Artificial Habitat Structures Coastal Wetlands and Inner Bay Open Country Watercourses and Riparian Areas
Bent Spike-rush (Great Lakes Plains population)	<i>Eleocharis geniculata</i>	Vascular Plants	Endangered	Endangered	Endangered	Beaches and Coastal Dunes Coastal Wetlands and Inner Bay
Bird's-foot Violet	<i>Viola pedata</i>	Vascular Plants	Endangered	Endangered	Endangered	Forests and Treed Swamps Open Country
Black Ash	<i>Fraxinus nigra</i>	Vascular Plants	Threatened	No Status	No Status	Forests and Treed Swamps
Black Tern	<i>Chlidonias niger</i>	Birds	Not at Risk	No Status	Special Concern	Coastal Wetlands and Inner Bay
Blanding's Turtle (Great Lakes / St. Lawrence population)	<i>Emydoidea blandingii</i>	Reptiles	Endangered	Endangered	Threatened	Amphibians and Reptiles Coastal Wetlands and Inner Bay Watercourses and Riparian Areas

Common Name	Scientific Name	Taxon	COSEWIC	SARA	ESA	Conservation Targets
Bobolink	<i>Dolichonyx oryzivorus</i>	Birds	Threatened	Threatened	Threatened	Open Country
Broad Beech Fern	<i>Phegopteris hexagonoptera</i>	Vascular Plants	Special Concern	No status	Special Concern	Forests and Treed Swamps Watercourses and Riparian Areas
Butternut	<i>Juglans cinerea</i>	Vascular Plants	Endangered	Endangered	Endangered	Forests and Treed Swamps Watercourses and Riparian Areas
Canada Warbler	<i>Cardellina canadensis</i>	Birds	Threatened	Threatened	Special Concern	Forests and Treed Swamps Watercourses and Riparian Areas
Cerulean Warbler	<i>Setophaga cerulea</i>	Birds	Endangered	Endangered	Threatened	Forests and Treed Swamps
Chimney Swift	<i>Chaetura pelagica</i>	Birds	Threatened	Threatened	Threatened	Artificial Habitat Structures Coastal Wetlands and Inner Bay Forests and Treed Swamps Open Country Watercourses and Riparian Areas
Colicroot	<i>Aletris farinosa</i>	Vascular Plants	Endangered	Endangered	Endangered	Open Country
Common Hoptree	<i>Ptelea trifoliata</i>	Vascular Plants	Special Concern	Special Concern	Special Concern	Beaches and Coastal Dunes Open Country
Common Nighthawk	<i>Chordeiles minor</i>	Birds	Special Concern	Threatened	Special concern	Beaches and Coastal Dunes Coastal Wetlands and Inner Bay Forests and Treed Swamps Open Country
Crooked-stem Aster	<i>Symphyotrichum prenanthoides</i>	Vascular Plants	Special Concern	Special Concern	Special Concern	Forests and Treed Swamps Watercourses and Riparian Areas
Cucumber Tree	<i>Magnolia acuminata</i>	Vascular Plants	Endangered	Endangered	Endangered	Forests and Treed Swamps
Downy Yellow False Foxglove	<i>Aureolaria virginica</i>	Vascular Plants	Endangered	No Status	No Status	Forests and Treed Swamps Open Country
Eastern Flowering Dogwood	<i>Cornus florida</i>	Vascular Plants	Endangered	Endangered	Endangered	Forests and Treed Swamps
Eastern Foxsnake (Carolinian population)	<i>Pantherophis vulpinus</i>	Reptiles	Endangered	Endangered	Endangered	Amphibians and Reptiles Artificial Habitat Structures Beaches and Coastal Dunes Coastal Wetlands and Inner Bay Forests and Treed Swamps Open Country Watercourses and Riparian Areas
Eastern Hog-nosed Snake	<i>Heterodon platirhinos</i>	Reptiles	Threatened	Threatened	Threatened	Amphibians and Reptiles Beaches and Coastal Dunes

Common Name	Scientific Name	Taxon	COSEWIC	SARA	ESA	Conservation Targets
						Forests and Treed Swamps Open Country
Eastern Meadowlark	<i>Sturnella magna</i>	Birds	Threatened	Threatened	Threatened	Open Country
Eastern Milksnake	<i>Lampropeltis triangulum</i>	Reptiles	Special Concern	Special Concern	No Status	Amphibians and Reptiles Artificial Habitat Structures Forests and Treed Swamps Open Country Watercourses and Riparian Areas
Eastern Musk Turtle	<i>Sternotherus odoratus</i>	Reptiles	Special Concern	Special Concern	Special Concern	Amphibians and Reptiles Coastal Wetlands and Inner Bay Watercourses and Riparian Areas
Eastern persius Duskywing	<i>Erynnis persius persius</i>	Arthropods	Endangered	Endangered	Extirpated	Open Country
Eastern Ribbonsnake (Great Lakes population)	<i>Thamnophis sauritus</i>	Reptiles	Special Concern	Special Concern	Special Concern	Amphibians and Reptiles Coastal Wetlands and Inner Bay Forests and Treed Swamps Watercourses and Riparian Areas
Eastern Whip-poor-will	<i>Antrostomus vociferus</i>	Birds	Threatened	Threatened	Threatened	Forests and Treed Swamps Open Country
Eastern Wood-pewee	<i>Contopus virens</i>	Birds	Special Concern	Special Concern	Special Concern	Forests and Treed Swamps
False-foxglove Sun Moth	<i>Pyrrhia aurantiago</i>	Arthropods	Endangered	No Status	No Status	Forests and Treed Swamps Open Country
Fern-leaved Yellow False Foxglove	<i>Aureolaria pedicularia</i>	Vascular Plants	Threatened	No Status	No Status	Forests and Treed Swamps Open Country
Fowler's Toad	<i>Anaxyrus fowleri</i>	Amphibians	Endangered	Endangered	Endangered	Amphibians and Reptiles Beaches and Coastal Dunes Coastal Wetlands and Inner Bay
Frosted Elfin	<i>Callophrys irus</i>	Arthropods	Extirpated	Extirpated	Extirpated	Open Country
Golden-winged Warbler	<i>Vermivora chrysoptera</i>	Birds	Threatened	Threatened	Special Concern	Forests and Treed Swamps Open Country
Grasshopper Sparrow, pratensis subspecies	<i>Ammodramus savannarum pratensis</i>	Birds	Special Concern	Special Concern	Special Concern	Open Country
Gray Ratsnake (Carolinian population)	<i>Pantherophis spiloides</i>	Reptiles	Endangered	Endangered	Endangered	Amphibians and Reptiles Artificial Habitat Structures Forests and Treed Swamps Open Country

Common Name	Scientific Name	Taxon	COSEWIC	SARA	ESA	Conservation Targets
						Watercourses and Riparian Areas
Grey Fox	<i>Urocyon cinereoargenteus</i>	Mammals	Threatened	Threatened	Threatened	Forests and Treed Swamps Watercourses and Riparian Areas
Gypsy Cuckoo Bumble Bee	<i>Bombus bohemicus</i>	Arthropods	Endangered	Endangered	Endangered	Forests and Treed Swamps Open Country
Harris's Sparrow	<i>Zonotrichia querula</i>	Birds	Special Concern	No Status	No status	Forests and Treed Swamps Watercourses and Riparian Areas
Henslow's Sparrow	<i>Ammodramus henslowii</i>	Birds	Endangered	Endangered	Endangered	Open Country
Horsetail Spike-rush	<i>Eleocharis equisetoides</i>	Vascular Plants	Endangered	Endangered	Endangered	Coastal Wetlands and Inner Bay
Jefferson Salamander	<i>Ambystoma jeffersonianum</i>	Amphibians	Endangered	Endangered	Endangered	Amphibians and Reptiles Forests and Treed Swamps
Karner Blue	<i>Plebejus samuelis</i>	Arthropods	Extirpated	Extirpated	Extirpated	Open Country
King Rail	<i>Rallus elegans</i>	Birds	Endangered	Endangered	Endangered	Coastal Wetlands and Inner Bay Watercourses and Riparian Areas
Large Whorled Pogonia	<i>Isotria verticillata</i>	Vascular Plants	Endangered	Endangered	Endangered	Forests and Treed Swamps
Laura's Clubtail	<i>Stylurus laurae</i>	Arthropods	Endangered	No Status	Endangered	Watercourses and Riparian Areas
Least Bittern	<i>Ixobrychus exilis</i>	Birds	Threatened	Threatened	Threatened	Coastal Wetlands and Inner Bay Watercourses and Riparian Areas
Little Brown Myotis	<i>Myotis lucifugus</i>	Mammals	Endangered	Endangered	Endangered	Artificial Habitat Structures Forests and Treed Swamps Watercourses and Riparian Areas
Louisiana Waterthrush	<i>Parkesia motacilla</i>	Birds	Threatened	Threatened	Threatened	Coastal Wetlands and Inner Bay Forests and Treed Swamps Watercourses and Riparian Areas
Midland Painted Turtle	<i>Chrysemys picta marginata</i>	Reptiles	Special concern	No Status	No Status	Amphibians and Reptiles Coastal Wetlands and Inner Bay Watercourses and Riparian Areas
Monarch	<i>Danaus plexippus</i>	Arthropods	Endangered	Special Concern	Special Concern	Open Country
Mottled Duskywing (Great Lakes Plains population)	<i>Erynnis martialis</i>	Arthropods	Endangered	No Status	Endangered	Open Country
Nine-spotted Lady Beetle	<i>Coccinella novemnotata</i>	Arthropods	Endangered	No Status	Endangered	Forests and Treed Swamps Open Country

Common Name	Scientific Name	Taxon	COSEWIC	SARA	ESA	Conservation Targets
						Watercourses and Riparian Areas
Northern Map Turtle	<i>Graptemys geographica</i>	Reptiles	Special Concern	Special Concern	Special Concern	Amphibians and Reptiles Coastal Wetlands and Inner Bay Watercourses and Riparian Areas
Northern Myotis	<i>Myotis septentrionalis</i>	Mammals	Endangered	Endangered	Endangered	Forests and Treed Swamps Watercourses and Riparian Areas
Olive-sided Flycatcher	<i>Contopus cooperi</i>	Birds	Special Concern	Threatened	Special Concern	Forests and Treed Swamps Watercourses and Riparian Areas
Piping Plover circumcinctus subspecies	<i>Charadrius melodus circumcinctus</i>	Birds	Endangered	Endangered	Endangered	Beaches and Coastal Dunes
Prothonotary Warbler	<i>Protonotaria citrea</i>	Birds	Endangered	Endangered	Endangered	Coastal Wetlands and Inner Bay Forests and Treed Swamps Watercourses and Riparian Areas
Queensnake	<i>Regina septemvittata</i>	Reptiles	Endangered	Endangered	Endangered	Amphibians and Reptiles Artificial Habitat Structures Coastal Wetlands and Inner Bay Watercourses and Riparian Areas
Red-headed Woodpecker	<i>Melanerpes erythrocephalus</i>	Birds	Endangered	Threatened	Special Concern	Forests and Treed Swamps Open Country
Riverine Clubtail (Great Lakes Plains population)	<i>Stylurus amnicola</i>	Arthropods	Endangered	Endangered	Endangered	Watercourses and Riparian Areas
Round-leaved Greenbrier (Great Lakes population)	<i>Smilax rotundifolia</i>	Vascular Plants	Threatened	Threatened	Threatened	Forests and Treed Swamps
Rusty Blackbird	<i>Euphagus carolinus</i>	Birds	Special Concern	Special Concern	Special Concern	Forests and Treed Swamps
Rusty-patched Bumble Bee	<i>Bombus affinis</i>	Arthropods	Endangered	Endangered	Endangered	Open Country
Short-eared Owl	<i>Asio flammeus</i>	Birds	Special Concern	Special Concern	Special Concern	Open Country
Small White Lady's-slipper	<i>Cypripedium candidum</i>	Vascular Plants	Threatened	Threatened	Endangered	Open Country
Smooth Yellow False Foxglove	<i>Aureolaria flava</i>	Vascular Plants	Threatened	No Status	No Status	Forests and Treed Swamps Open Country
Snapping Turtle	<i>Chelydra serpentina</i>	Reptiles	Special Concern	Special Concern	Special Concern	Amphibians and Reptiles Coastal Wetlands and Inner Bay

Common Name	Scientific Name	Taxon	COSEWIC	SARA	ESA	Conservation Targets
						Watercourses and Riparian Areas
Spiny Softshell	<i>Apalone spinifera</i>	Reptiles	Endangered	Endangered	Endangered	Amphibians and Reptiles Coastal Wetlands and Inner Bay Watercourses and Riparian Areas
Spotted Turtle	<i>Clemmys guttata</i>	Reptiles	Endangered	Endangered	Endangered	Amphibians and Reptiles Coastal Wetlands and Inner Bay Forest and Treed Swamps Watercourses and Riparian Areas
Spotted Wintergreen	<i>Chimaphila maculata</i>	Vascular Plants	Threatened	Threatened	Endangered	Forests and Treed Swamps
Swamp Rose-mallow	<i>Hibiscus moscheutos</i>	Vascular Plants	Special Concern	Special Concern	Special Concern	Coastal Wetlands and Inner Bay
Transverse Lady Beetle	<i>Coccinella transversoguttata</i>	Arthropods	Special Concern	No Status	Endangered	Forests and Treed Swamps Open Country Watercourses and Riparian Areas
Tri-colored Bat	<i>Perimyotis subflavus</i>	Mammals	Endangered	Endangered	Endangered	Forests and Treed Swamps Watercourses and Riparian Areas
Unisexual Ambystoma Jefferson Salamander dependent population	<i>Ambystoma laterale</i> – (2) <i>jeffersonianum</i>	Amphibians	Endangered	Endangered	Endangered	Amphibians and Reptiles Forests and Treed Swamps
Virginia Goat's-rue	<i>Tephrosia virginiana</i>	Vascular Plants	Endangered	Endangered	Endangered	Open Country
Wood Thrush	<i>Hylocichla mustelina</i>	Birds	Threatened	Threatened	Special Concern	Forests and Treed Swamps
Woodland Vole	<i>Microtus pinetorum</i>	Mammals	Special Concern	Special Concern	Special Concern	Forests and Treed Swamps
Yellow-banded Bumble Bee	<i>Bombus terricola</i>	Arthropods	Special Concern	Special Concern	Special Concern	Forests and Treed Swamps Open Country
Yellow-breasted Chat virens subspecies	<i>Icteria virens virens</i>	Birds	Endangered	Endangered	Endangered	Open Country Watercourses and Riparian Areas

APPENDIX B: VIABILITY ASSESSMENT

FORESTS AND TREED SWAMPS

Overall Rating: Fair

SIZE

Key Ecological Attribute: Interior forest habitat

Indicator: Number of large forest patches

Viability Rating: Good

Poor	Fair	Good	Very Good
No large patches	At least one large patch	Several large patches	

Source of rating: External research

Measurement value: There is 1 patch 200 m from the edge AND >200 ha in size and 3 patches 200 m from the edge AND 100-200 ha in size

Source of measurement: Intensive Assessment

Large forest patches may support a greater diversity of plant and wildlife species and are important for the persistence of area-sensitive species and habitat specialists. For example, both Acadian Flycatcher and Cerulean Warbler require large contiguous blocks of relatively undisturbed mature deciduous or mixed forests (Environment Canada, 2012). Environment Canada's (2013) *How much habitat is enough?* (HMHE) guideline was used as a reference for developing the rating criteria. According to the guidelines, "a watershed or other land unit should have at least one, and preferably several, 200-hectare forest patches (measured as forest area that is more than 100 metres from an edge)" (Environment Canada, 2013). A spatial analysis in ArcGIS was completed to identify interior forest patches using the ECCC's BCR13 composite land cover layer.

Interior forest habitat patches in Long Point Walsingham Forest.

Size	Number of Patches	Total Area
200 m AND >200 ha	1	228 ha
200 m AND 100-200 ha	3	328 ha
100 m AND >200 ha	2	304 ha
100 m AND 100-200 ha	13	1,678 ha

Key Ecological Attribute: Ecosystem extent

Indicator: Percent forest cover

Viability rating: Fair

Poor	Fair	Good	Very Good
<20%	20-30%	31-49%	>=50%

Source of rating: External research

Measurement value: 17.5%

Source of measurement: Intensive assessment

The total forest cover on a landscape is important for the persistence of forest-dependent wildlife species (Trzcinski et al, 1999). According to HMHE, “30% forest cover at the watershed scale is the minimum forest cover threshold, 40% equates to a medium-risk approach and 50% a low-risk approach that is likely to support most of the potential species” (Environment Canada, 2013). These guidelines were used to develop the viability rating criteria as the Priority Place is a similar planning unit to a watershed. Percent forest cover was assessed in ArcGIS using the ECCC BCR13 Composite land cover layer. In this assessment “forest” includes all treed communities (upland forest, treed swamps, plantations, treed cultivated and hedge rows). It does not include woodlands and savannahs which are encompassed under the Open Country (non-agriculture) conservation target. While forest cover in LPWF is high compared to other areas in southwestern Ontario, it still falls short of the minimum forest cover threshold of 30% forest cover.

CONDITION

Key Ecological Attribute: Presence/abundance of forest interior bird communities

Indicator: Number of individuals of Cerulean Warblers and Acadian Flycatchers

Viability rating: Fair

Poor	Fair	Good	Very Good
0	1-10	11-20	>20

Source of rating: Rough guess

Measurement value: 15 Acadian Flycatcher and 10 Cerulean Warbler individuals

Source of measurement: Intensive assessment

Forest bird communities are important components of the forest ecosystem and have long been used as ecological indicators due to their sensitivity to environmental change and relative ease of observation (Carignan & Villard, 2002). Forest interior birds in particular are used as umbrella species as many of their habitat needs overlap with those of other wildlife and plants (Carignan & Villard, 2002). At the 2018 CIP workshops, the presence and abundance of forest interior bird communities was identified as a key ecological attribute for forest condition. The Acadian Flycatcher and Cerulean Warbler are indicators of overall forest condition. Both species require large tracts of mature forest to breed and are more likely to be detected in landscapes with higher overall forest cover. Based on data collected by the Birds Canada Forest Birds at Risk Program, there are approximately 15 Acadian Flycatcher males and 10 Cerulean Warbler males in LPWF with an unknown number of pairs (Fife, I. R. *pers. comm.* 2020). Individuals will be monitored over pairs for a couple reasons. First, Cerulean Warbler females are very hard to detect. They are well camouflaged and spend the majority of the time in the upper canopy (>18 m) of the interior forest. Second, we will assume there will be a 1:1 male to female ratio of Acadian Flycatchers and Cerulean Warblers and that presumably, if a male has occupied a territory, a female will also be present.

LANDSCAPE CONTEXT

Key Ecological Attribute: Connectivity of forest patches

Indicator: Amount of resistance to movement

Viability Rating: Good

Poor	Fair	Good	Very Good
Very high resistance to movement	High resistance to movement	Medium resistance to movement	Low resistance to movement

Source of rating: External research

Measurement value: Medium resistance to movement

Source of measurement: Intensive assessment

Maintaining connectivity on a landscape is important for ecological processes such as seasonal migrations, colonization of habitat, and gene flow (McRae et al., 2016). Forest connectivity in LPWF was analyzed using the connectivity software package Circuitscape, which models connectivity in heterogeneous landscapes (McRae et al., 2016). The Circuitscape analysis found the current density in the Priority Place to be medium (the majority of hexagons contain a score of 5). This indicates medium resistance to movement.

COASTAL WETLANDS AND INNER BAY

Overall Rating: Good

SIZE

Key Ecological Attribute: Ecosystem extent

Indicator: Percent coastal wetland cover

Viability rating: Very Good

Poor	Fair	Good	Very Good
0	<6%	6%	>6%

Source of rating: External research

Measurement value: 9%

Source of measurement: Intensive assessment

Approximately 9% of the Priority Place is covered by coastal wetland (7,838 ha). ECCC's HMHE guidelines indicate that a minimum of 6% of each subwatershed should be protected and restored as wetland habitat (Environment Canada, 2013). Coastal wetlands alone represent more than 6% of the Priority Place and when combined with inland wetlands, wetlands as a whole comprise well over the 6% reference point.

CONDITION

Key Ecological Attribute: Species composition/dominance

Indicator: Obligate marsh-nesting bird species richness

Viability rating: Good

Poor	Fair	Good	Very Good
<3.5	3.5-4.0	4.1-5.0	>5.0

Source of rating: Expert knowledge

Measurement value: 5.0

Source of measurement: Intensive assessment

Obligate marsh nesting birds (ex. grebes, bitterns and rails) require marsh habitat to complete their life cycle. They are also less tolerant to human disturbance which means their presence can provide valuable information on the ecological integrity of a wetland (Shear et al., 2003). Using the Marsh Monitoring Program data, the mean total species richness was calculated from approximately 17 routes (with no less than 5 stations per route) distributed across the Priority Place. The mean total species richness for marsh-nesting obligates in the Long Point coastal wetlands surveyed is 5.

Key Ecological Attribute: Plant community integrity

Indicator: Percent Phragmites (*Phragmites australis*) cover

Viability rating:

Poor	Fair	Good	Very Good
>50%	50-20	<20-5	<5

Source of rating: Expert knowledge

Measurement value: 9% (+ 33% error = 12%)

Source of measurement: GIS analysis and survey from on-the-ground treatment

Non-native Phragmites (*Phragmites australis*) is an invasive plant species commonly found in wetlands, beaches and ditches in southern Ontario. The invasive perennial grass out-competes and displaces native wetland vegetation, forming dense monocultures. As an indicator it provides an important picture of wetland biological integrity because its presence in a wetland can lead to reduced floral diversity and changes to hydrology and nutrient cycling. Phragmites is a major threat in the Long Point coastal wetlands and a significant management effort, led by the OMNRF and NCC, has been ongoing since 2016 to control its spread. The current 2018 extent of un-treated Phragmites in the Long Point Coastal Wetland Complex is approximately 711.3 ha and is located on the Big Creek and Long Point National Wildlife Areas. NCC has found through the on the ground treatment work conducted that existing mapping technology underestimates coverage by approximately 33%. With the 33% margin of error existing Phragmites coverage could be upwards of 946 ha or 12% of the coastal wetland complex. In 2015 before treatment began, Phragmites covered approximately 26% of the coastal wetland complex. The viability rating criteria used for Phragmites cover comes from the Lake Erie Biodiversity Conservation Strategy (Pearsall et al., 2012).

LANDSCAPE CONTEXT

Key Ecological Attribute: Sediment stability and movement

Indicator: Percent shoreline hardening

Viability rating: Very Good

Poor	Fair	Good	Very Good
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Majority of shoreline is hardened >75%	Large proportion of shoreline is hardened 51-75%	Some hardening 25-50%	Very little hardening <25%
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Source of rating: External research

Measurement value: <25%

Source of measurement: Intensive assessment

Lake Erie as a whole has a significant amount of shoreline hardening, however the shoreline within Norfolk County has minimal hardening <25% (GLEAM, 2012).

Key Ecological Attribute: Adjacent natural systems

Indicator: Percent non-impervious cover within 120 m

Viability rating: Very Good

Poor	Fair	Good	Very Good
<20%	20-49%	50-75%	>75%

Source of rating: External research

Measurement value: 97%

Source of measurement: Intensive assessment

Adjacent land cover is an important indicator of wetland function and quality (Smith & Chow-Fraser, 2010), and of the presence and persistence of wetland dependent species that require a variety of habitat types to complete their life cycle (Houlahan et al., 2006). Urban land use next to wetlands has been shown to negatively affect the overall integrity of the avian community present (Smith & Chow-Fraser 2010). The total percent non-impervious cover within 120m of coastal wetlands is 97%. Adjacent cover was assessed in ArcGIS by buffering the coastal wetlands by 120 m and calculating the percent of natural cover within the buffer. Natural cover consists of all natural habitats, which includes water. The 120 m criterion was selected based on the Natural Heritage Reference Manual as “a reasonable probability exists that developments within 120 metres of wetlands will affect the ecological functions of the wetlands that they surround” (OMNRF, 2010). The assessment criteria are similar to what was used in the Landscape Conservation Assessment for the Mixedwood Plains (Nature Conservancy of Canada and Canadian Wildlife Service, 2015) but have been adjusted to align with the 4 categories (poor to very good).

BEACHES AND COASTAL DUNES

Overall rating: Very Good

SIZE

Key Ecological Attribute: Adjacent vegetation

Indicator: Percent non-impervious surface within 1 km of beach

Viability rating: Good

Poor	Fair	Good	Very Good
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<80%	80-94%	95-99%	100%
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Source of rating: Rough guess

Measurement value: 95%

Source of measurement: Intensive assessment

Structures built close to the shoreline can inhibit coastal processes and the natural movement of beach and coastal dune ecosystems. The presence of adjacent vegetation is also important for wildlife habitat. The percent non-impervious surface within 1 km of beach is 95%.

CONDITION

Key Ecological Attribute: Presence and status of rare plant communities

Indicator: Element Occurrence (EO) ranks of rare vegetation communities

Viability rating: Very Good

Poor	Fair	Good	Very Good
Rare vegetation communities not present or in poor estimated viability	Rare vegetation communities present with majority fair estimated viability	Rare vegetation communities present with majority good estimated viability	Rare vegetation communities present with majority excellent estimated viability

Source of rating: External research

Measurement value: SDO1-1 and SDT1-1 present and ranked as excellent viability

Source of measurement: Intensive assessment

Using the Ecological Land Classification (ELC) schema, the Natural Heritage Information Centre (NHIC) has mapped vegetation types that are rare in Ontario. A plant community occurrence is an area of land and/or water on/in which a plant community is or was present. An EO has practical conservation value for the plant community; it is a location important to the conservation of the vegetation type. *Little Bluestem - Switchgrass - Beachgrass Dune Grassland Type* (SDO1-1; SRank S2 [imperiled]) vegetation type is identified as a rare plant community in Ontario. Based on available mapping (NHIC, 2015), more than 75% of the provincial total of this vegetation type is found within LPWF. Further, it is ranked as being in excellent estimated viability (the EO rank describes the probability of persistence of the element at a particular location and considered the condition, size and landscape context). Additionally, *Cottonwood Dune Savannah Type* (SDT1-1) has a SRank of S1 (critically imperiled). There is more than 25 % of the provincial total of this vegetation type found within the Priority Place. The majority of the area within Priority Place has a rank of excellent estimated viability.

See www.ontario.ca/document/guide-significant-wildlife-habitat-for-rankings.

LANDSCAPE CONTEXT

Key Ecological Attribute: Sediment stability and movement

Indicator: Percent shoreline hardening

Viability rating: Very Good

Poor	Fair	Good	Very Good
Majority of shoreline is hardened >75%	Large proportion of shoreline is hardened 51-75%	Some hardening 25-50%	Very little hardening <25%

Source of rating: External research

Measurement value: <25%

Source of measurement: Intensive assessment

Lake Erie has a significant amount of shoreline hardening, however in this location there is minimal hardening, <25% (GLEAM, 2012).

OPEN COUNTRY

Overall rating: Fair

SIZE

Key Ecological Attribute: Ecosystem extent

Indicator: Number of hectares of Open Country (meadow, prairie, savannah, thicket, and tallgrass woodland) in LPWF.

Viability rating: Poor

Poor	Fair	Good	Very Good
current extent at least 15% of historical tallgrass habitat in LPWF (>1,476 ha)	current extent at least 25% of historical tallgrass habitat in LPWF (>2,460ha)	current extent at least 50% of historical tallgrass habitat in LPWF (>4,920 ha)	current extent at least 75% of historical tallgrass habitat in LPWF (>7,380 ha)

Source of rating: Intensive assessment completed by Linton (2019)

Measurement value: At present day, there are estimated to be 1,520 ha of Open Country habitat in the LPWF area.

Source of measurement: This data is based on an estimate of best available data. It requires ground-truthing and does not include recently restored sites (data sources include the CWS Service ELC mapping and an Agriculture & Agri-food Canada data layer).

Based on mapping compiled in Rodger (1998), a rough estimate of historic tallgrass prairie and savannah in southern Ontario was calculated by Wasyl Bakowsky (Natural Heritage Information Centre). In LPWF it is estimated that there was historically a minimum of 9,841 ha of tallgrass habitat which included some significantly large patches. This represented approximately 11% of the total land cover in LPWF. At present day, there are estimated to be 1,520 ha of Open Country habitats in the LPWF area. Of this, approximately 842 ha is re-planted native tallgrass prairie, 67 ha is tallgrass savannah, and 424 ha is tallgrass woodland. Although a higher proportion of tallgrass savannah and woodland in the LPWF area is naturally occurring, the majority of it is degraded (A. Heagy pers. comm. 2019). An additional 185.5 ha are other Open

Country habitats including 8.5 ha graminoid meadow and 177 ha thicket shrubland. In consideration of the overall ecosystem extent for all Open Country Habitats, native tallgrass habitats represent approximately 88% of communities. However, verifying current existing data sources and ground-truthing is required to accurately rate the status of this Key Ecological Attribute. Native tallgrass communities are threatened by invasive and exotic species which can quickly dominate the landscape and out-compete native species. Open Country habitats now represent only (approximately) 1.8% of the total land cover in LPWF, a reduction by almost 85% of its former extent. Based on the proposed rating system in the viability assessment this is considered Poor. Given present day land uses, it is unlikely that the full minimum extent of tallgrass habitat can be restored on the landscape. Therefore the rating system of “Good” and desired future status are based on increasing Open Country habitat cover by 35% to achieve at least 50% of its former extent.

Key Ecological Attribute: Habitat patch size

Indicator: Number of patches >5 ha

Viability rating: Poor

Poor	Fair	Good	Very Good
>95% of patches <5 ha	25 % of patches >5 ha	50% of patches >5 ha	75% of patches 5-10 ha

Source of rating: Intensive assessment by Linton (2019)

Measurement value: There are 2,274 Open Country habitat patches mapped in the LPWF area (based on Canadian Wildlife Service ELC mapping and an Agriculture & Agri-food Canada data layer). Of these, 88.5% (n=2,012) are less than 1 ha in area and 98% are less than 5 ha in area. Less than 1% are greater than 10 ha and only one habitat patch is greater than 100 ha in area.

Based on available mapping:

- there are no habitat patches greater than 5 ha in the St. Williams Nursery Tract and surrounding area identified on Figure 2;
- almost 73% of habitat patches greater than 5 ha are on Long Point ;
- there are 5 habitat patches greater than 5 ha around the Turkey Point area and 7 in the Big Creek/Port Rowan Shoreline area.

Source of measurement: This data is based on an estimate of best available data. It requires ground-truthing and does not include recently restored sites (data sources include the CWS ELC mapping and an Agriculture & Agri-food Canada data layer). Note: Information related to St. Williams Nursery Tract requires confirmation given the extent of recent and ongoing oak savannah habitat restoration going on at the forestry reserve which includes tree removal, canopy thinning, and prescribed fire.

Many Open Country species require a certain acreage of habitat for survival and minimum habitat patch sizes greater than what is available in LPWF to support viable populations. Of the 49 open country breeding birds known to occur in LPWF, 33 (67%) of them require habitat patches 5 ha or larger and 20 (41%) of them require habitat patches greater than 10 ha in area.

Vickery et al. 1998 suggests that Open Country grassland sites need to be more than 50 ha, preferably about 200 ha, if they are to be likely to support a diverse grassland bird fauna.

Looking at another taxonomic group, the Karner Blue butterfly is considered a keystone species in conservation planning because it requires a large amount of open native habitat which is also beneficial to numerous other species that rely on Open Country habitats. The Ohio Nature Conservancy has noted that oak savannah restoration targeted at Karner Blue recovery and reintroduction has also helped increase populations of American Badgers, Red-headed Woodpeckers, Lark Sparrows, and the state-endangered Frosted Elfin and Persius Duskywing butterflies (butterflies also native to LPWF but now extirpated) (The Nature Conservancy 2008). It is also an effective species for engaging public support for conservation due to its aesthetic appeal and connection to an imperiled ecosystem (Guiney and Oberhauser 2008). The area identified to maintain a minimum viable population of Karner Blue is just over 150 ha, distributed among 7-9 well-connected sub-sites (USFWS 2003; Fuller 2008).

CONDITION

Key Ecological Attribute: Species composition

Indicator: Open Country bird species richness

Viability rating: Good

Poor	Fair	Good	Very Good
<15 Open Country bird species native to the area are present and found breeding	16-25 Open Country bird species native to the area are present and found breeding	>25 Open Country bird species native to the area are present and found breeding	Majority of Open Country bird species requiring >10 ha of habitat present and found breeding

Source of rating: Intensive assessment completed by Linton (2019)

Measurement value: 50 Open Country species

Source of measurement: Expert knowledge

Open country bird species are defined as species which breed in the defined Open Country habitats (cultural meadow, native grasslands, native or cultural savannahs, native or cultural woodlands). In the LPWF area this includes 50 species, 36 (72%) of which will only breed in meadow and native grasslands with a canopy cover of <25% (Attachment 1). Thirteen Open Country bird species that have been documented in the LPWF area are species at risk, while another two are provincially tracked species of conservation concern. The majority of species at risk are considered declining or restricted in the LPWF area, only barn swallow is present throughout the area. In total, 27 (54%) Open Country bird species are considered common and geographically widespread in the LPWF area, making overall species richness fairly good in this area. However, the majority of species requiring minimum patch sizes of 10 ha or more (almost 60% of which are at some level of risk) are rare or extremely localized. Furthermore, the documented presence of breeding individuals does not necessarily represent a viable population of the species.

LANDSCAPE CONTEXT

Key Ecological Attribute: Disturbance regime

Indicator: Percentage of tallgrass habitats actively managed to maintain the vegetation community structure of prairie (<10% canopy), savannah (10-35% canopy) or woodland (35-60% canopy) habitats.

Viability rating: Unknown. Number of tallgrass sites managed within their respective disturbance frequency cycles not known at this time. Baseline information required to confirm number of ha of tallgrass habitat and management activities associated with each site.

Poor	Fair	Good	Very Good
	<40% of tallgrass sites managed within their respective disturbance frequency cycles	41-60% of tallgrass sites managed within their respective disturbance frequency cycles	>61% of tallgrass sites managed within their respective disturbance frequency cycles

Source of rating: Intensive assessment completed by Linton (2019)

Measurement value: Unknown

Source of measurement: Expert knowledge

Regular disturbance is necessary to maintain tallgrass vegetation communities and is a good indicator of the overall condition of these habitats. Most literature (e.g. Reichman 1987, Rodger 1998) suggests that prairie sites must be subject to a high intensity fire every 1 to 5 years (to as many as 10 years) in order to maintain the open structure and dense cover of grasses and forbs. Savannah habitats are maintained through medium to high intensity fires occurring every 1 to 5 years or moderate intensity fires every 5-20 years. Woodland habitats may be subject to fire every 1-20 years but at a low intensity as a result of limited graminoid fuel load, typically Pennsylvania Sedge. It is generally accepted that a fire interval of greater than 20 years results in the closing of canopy and establishment of mesic hardwoods (maple and ash) which suppress the available fuel load of grasses, sedges and oak leaves. As the woodland canopy closes in and understorey develops, leaf litter retains more moisture and fire becomes less feasible and less effective at reversing the trend.

WATERCOURSES AND RIPARIAN AREAS

Overall rating: Fair

SIZE

Key Ecological Attribute: Habitat integrity

Indicator: Percent of 30 m buffer (adjacent to watercourses) naturally vegetated

Viability rating: Fair

Poor	Fair	Good	Very Good
<50%	50-74%	75-90%	>90%

Source of rating: Rough guess

Measurement value: 64%

Source of measurement: Intensive assessment

Indicator: Percent of 5 m buffer (adjacent to drains) naturally vegetated

Viability rating: Poor

Poor	Fair	Good	Very Good
<50%	50-74%	75-90%	>90%

Source of rating: Rough guess

Measurement value: 32%

Source of measurement: Intensive assessment

The percent of the 30m buffer surrounding watercourses that is naturally vegetated is 64% (does not include agricultural areas or open water, total area of 30m buffers is 5,170.79 ha). The total area of 5 m buffers is 304.28 ha, and 32% of this area is naturally vegetated. Based on literature, a finer resolution assessment may be the % of 30 m buffer that is forested (37%) or % of Priority Place that is forested (~19%) or impervious (% impervious that doesn't include ag- 3%; % impervious that includes ag- 50% however somehow measuring intensity is more appropriate).

Most contributions to aquatic habitat are realized in the first 5 to 30 m of vegetated riparian zone- 30 m riparian adjacent vegetation reflects general threshold distances for aquatic health and riparian functions; meant to capture a variety of protection and habitat functions as well as support variation in fish assemblages. Lands adjacent to drains with established vegetation are more efficient at removing excess nutrients from runoff (e.g., widths as narrow as 4.6 m shown to be 90% effective in removing nitrogen and phosphorus).

Other potential KEA/Indicator to be incorporated: Watershed landcover – specifically ratio of natural cover (forest) to impervious – shown to change effectiveness of riparian buffers (work [i.e. Wang et al 2003] also suggests that watershed-scale land cover conditions better predictors of fish assemblages compared with local riparian conditions); what about effects of agriculture – impervious? Agricultural intensity may be better measure than percent cover of agriculture, if considering wider watershed landcover. Relationship between biotic community and land use/cover typically linear at low levels of disturbance: see *How Proximity of Land use Affects Stream Fish and Habitat* (Stanfield and Kilgour 2012). Percent of impervious is key indicator: levels of imperviousness produced by land covers of >80% agricultural or >40% urban within a catchment.

See: www.trca.on.ca/dotAsset/37039.pdf

CONDITION

Key Ecological Attribute: Surface water quality

Indicator: Total phosphorus (mg/L)

Viability rating: Fair

Poor	Fair	Good	Very Good
0.061-0.180	0.031-0.060	0.020-0.030	<0.020

Source of rating: Onsite research

Measurement value: 0.048 mg/L

Source of measurement: Intensive assessment

Surface water quality is monitored at 5 sites in LPWF under the Provincial Water Quality Monitoring Network. Three of the sites have not been sampled recently. The following 2 sites were monitored in 2016:

- Site: 16012401402, Trout Creek, last sampled: 19/04/2016, result: 0.048 mg/L
- Site: 16012401102, Big Creek, last sampled: 19/04/2016, result: 0.048 mg/L

The viability rating criteria was derived from the 2018 Long Point Region Conservation Authority watershed report card (LPRCA, 2018) and the data is from the Provincial Water Quality Monitoring Network (OMECC, 2018).

LANDSCAPE CONTEXT**Key Ecological Attribute: Hydrologic regime**

Indicator: Natural flow regime

Viability rating: Fair

Poor	Fair	Good	Very Good
Significantly altered flow regime, hydrograph does not represent historical	Moderately altered flow regime	Minimally altered flow regime	No alteration of flow regime, natural hydrograph

Source of rating: Rough guess

Measurement value: Moderately altered flow regime

Source of measurement: Expert knowledge

Flow regime (magnitude, frequency, duration, timing and rate of change) influences the ecological integrity of water systems (water quality, physical habitat, biotic interactions and energy sources) (Poff et al., 1997). “Base flow volume has been impacted by the draining of wetlands in LPWF, but not to a point that would justify a poor (probably a good or fair). That said, during dry periods or drought conditions, irrigation pressure can have serious impacts on stream flows in the study area, and can change the rating to a poor” (Gagnon, pers. comm.).

AMPHIBIANS AND REPTILES

Overall rating: Fair

SIZE

Key Ecological Attribute: Habitat availability

Indicator: Extent of habitat identified as having potential to contain biophysical attributes required by nested targets to support one or more life stages (measured as percent of LPWF)

Viability rating: Good

Poor	Fair	Good	Very Good
<25%	25-49%	50-75%	>75%

Source of rating: Rough guess

Measurement value: 56,928 ha or 65% of LPWF

Source of measurement: Intensive assessment

There are 56,928 ha of habitat that have the potential to contain the biophysical attributes required by nested targets to support one or more life stages. This is measured as the total area of critical habitat polygons that have been identified for nested target reptiles and amphibians within the Priority Place (Blanding's Turtle, Eastern Foxsnake, Fowler's Toad, Gray Ratsnake, Jefferson Salamander, Queensnake, Spiny Softshell and Spotted Turtle). This does not mean that the entire 56,928 ha are comprised of suitable habitat, but it is the area within which suitable habitat may exist. There is likely additional suitable habitat that was not identified as critical habitat due to distance buffers used. The rating criteria are a rough guess and may need adjustment.

CONDITION

Key Ecological Attribute: Presence and persistence

Indicator: Proportion of species assessed by COSEWIC as at-risk

Viability rating: Poor

Poor	Fair	Good	Very Good
More than 10 species (reptile or amphibian) are assessed as at-risk by COSEWIC	5 to 10 species (reptile or amphibian) are assessed as at-risk by COSEWIC	Fewer than 5 species (reptile or amphibian) are assessed as at-risk by COSEWIC	No species (reptile or amphibian) are assessed as at-risk by COSEWIC

Source of rating: Rough guess

Measurement value: 16

Source of measurement: Intensive assessment

At present, COSEWIC has assessed 16 reptile and amphibian species as special concern, threatened or endangered that occur (or have been observed in the past 20 years) in the Priority Place. Of these 16, 9 have been assessed as endangered by COSEWIC (based on the most

recently available assessment). One is threatened and 6 are of special concern. In addition to these 16 species, there are 20 species that are not presently identified as at risk. The rating criteria needs discussion to confirm.

Notes:

- If we reassess this criteria in 5 years and some are extirpated, then what?; how many will have new assessment reports in the next 5 years. How many species will be assessed and potentially have a status (e.g., Mudpuppy)
- There are ~36 species of reptiles/amphibians in the Priority Place that have been reported in the last 20 years [any other sensitive sp missing that wouldn't be shown in the herp atlas?]. Do we consider all herps in the assessment (and not just those currently assessed as at risk at some level)?
- Currently 25% of all herp sp are endangered. Is that fair? Is that poor? [>10 of 36 would be ~30% of all herps are endangered]
- Not at risk (and occur in Priority Place in past 20 years): American Toad, American Bullfrog, Blue-spotted Salamander, Dekay's Brownsnake, Eastern Gartersnake, Eastern Newt, Eastern Red-backed Salamander, Gray Treefrog, Green Frog, Mudpuppy, Northern Leopard Frog, Northern Watersnake, Pickerel Frog, Red-bellied Snake, Ring-necked Snake, Smooth Greensnake, Spotted Salamander, Spring Peeper, Western Chorus Frog (Carolinian population), Wood Frog= 20 species not at risk

LANDSCAPE CONTEXT

Key Ecological Attribute: Ability to move across the landscape

Indicator: Road mortality risk - Percent of total suitable habitat (habitat within which biophysical attributes likely to be found) intersecting high risk roads

Rating: Poor

Poor	Fair	Good	Very Good
High risk	Medium-High risk	Medium risk	Medium-Low risk

Source of rating: Rough guess

Measurement value: High or 62% of total suitable habitat intersects with high risk roads

Source of measurement: Intensive assessment

Within the Priority Place, amphibians and reptiles are susceptible to road mortality. Paved roads with a high speed limit and multiple lanes are assumed to pose the highest risk of mortality to amphibians and reptiles. Road mortality risk was determined based on speed limit, paved status and number of lanes (as listed in the National Road Network dataset) to create a weighted sum (total score) for each road segment. This was then intersected with 2 ha hexagons that contain critical habitat for at least one nested target. The total area of 2 ha hexagon that contains suitable habitat AND intersects an at risk road: 2,265 ha. Table C-2 summarizes the results of the assessment.

Amount of hexagon that intersects each weighted sum score.

Road Mortality Risk	Weighted Sum Score	Total Area Intersect w/ hab	% of total area intersecting roads	Viability
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High	17, 15, 14	1,418 ha	62%	Poor
Medium-High	13, 12, 11	719 ha	31%	
Medium	10, 9	102 ha	4%	
Medium-Low	8, 7	25 ha	1%	

APPENDIX C: THREAT RATING

Threat Terminology

Table C-1. IUCN Threat Classification Categories V.2.0 Crosswalked to the Direct Threat Name Used in the Situation Analysis.

IUCN Threat Classification Categories		Direct Threats in the Situation Analysis
		Conventional Threats
1.0 Residential & Commercial Development	1.1 Housing & Urban Areas	Housing & Urban Areas
	1.2 Commercial & Industrial Areas	Commercial & Industrial Areas
	1.3 Tourism & Recreation Areas	Tourism & Recreation Areas
2.0 Agriculture & Aquaculture	2.1 Annual & Perennial Non-timber Crops	Annual & Perennial Non-timber Crops
	2.3 Livestock Farming & Ranching	Livestock Farming & Ranching
4.0 Transportation & Service Corridors	4.1 Roads & Railroads	Roads
	4.2 Utility & Service Lines	Utility & Service Lines
5.0 Biological Resource Use	5.1 Hunting & Collecting Terrestrial Animals	Hunting & Collecting Terrestrial Animals
	5.2 Gathering Terrestrial Plants	Gathering Terrestrial Plants
	5.3 Logging & Wood Harvesting	Logging & Wood Harvesting
	5.4 Fishing & Harvesting Aquatic Resources	Fishing & Harvesting Aquatic Resources
6.0 Human Intrusions & Disturbance	6.1 Recreational Activities	Recreational Activities
7.0 Natural System Modifications	7.1 Fire & Fire Suppression	Fire Suppression
	7.2 Dams & Water Management/Use	Dams & Water Management/Use
	7.3 Other Ecosystem Modifications	Shoreline Hardening& Beach Modifications
8.0 Invasive & Problematic Species, Pathogens & Genes	8.1 Invasive Non-native/Alien Plants & Animals	Invasive Species
	8.2 Problematic Native Plants & Animals	Problematic Native Plants & Animals
	8.4 Pathogens & Microbes	Pathogens & Microbes
9.0 Pollution	9.1 Household Sewage & Urban Waste Water	Household Sewage & Urban Waste Water
	9.3 Agricultural & Forestry Effluents	Agricultural Runoff (point and non-point source)
	9.4 Garbage & Solid Waste	Garbage & Solid Waste
	9.5 Air-borne Pollutants	Air-borne Pollutants
	9.6 Excess Energy	Light & Noise Pollution
IUCN Threat Classification Categories		Climate Threats
11. Climate Change	11.1 Ecosystem Encroachment, 11.3 Changes in Temperature Regimes, 11.4 Changes in Precipitation & Hydrological Regimes, 11.5 Severe / Extreme Weather Events	Climate Change and Severe Weather

Forests and Treed Swamps Threat Rating Detail

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Summary Notes
Housing & Urban Areas	Low	Very High	Very High	Medium	<ul style="list-style-type: none">Impact from existing housing and settlement and potential for increased residential development outside towns and villages (1.4% population increase between 2011 and 2016 for Norfolk County).Unlike in coastal wetlands and on beaches, new residential development is allowed in forested areas.
Commercial & Industrial Areas	Not Specified	Not Specified	Not Specified	Low	<ul style="list-style-type: none">The current municipal government is also reassessing the tree-cutting by-law in Norfolk County and looking to reduce measures afforded to commercial and agricultural practices.<ul style="list-style-type: none">The suggested amendments would remove the requirement for landowners to create a forest management plan as well as allowing landowners to remove trees if the landowner feels it is impeding on agricultural or commercial activities.If the suggested amendments of the by-law are passed this could negatively affect the amount of forest cover as well as increase resistance for wildlife corridors across the LPWF Priority Place and potentially increase the threat ranking determined in the threat assessment.
Roads	Medium	Low	High	Medium	<ul style="list-style-type: none">Edge effects, invasive species, nest parasites, road mortality, road avoidance, road vegetation maintenance, noise.Climate change will alter habitat conditions resulting in species migration which will be inhibited by roads and may result in increased road mortalityIncreased rainfall due to climate change will increase the runoff of contaminants from roads into surrounding environments and may also cause road washout which would be detrimental to amphibians and reptiles<ul style="list-style-type: none">Increased temperatures may support the establishment of invasive species by roads
Logging & Wood Harvesting	High	Medium	Medium	Medium	<ul style="list-style-type: none">Current management practices are resulting in significantly greater extent of younger forests (less diversity, more open canopy, modified structural diversity) than would historically have been present.<ul style="list-style-type: none">Unsustainable harvesting activities often target old-growth trees reducing the forest canopy and does not provide for good forest regeneration practices.There is also a growing market for live edge rough sawn lumber in Norfolk County and the surrounding areas for commercial purposes which hinders sustainability practices of old-growth forestsNorfolk County enforces a strong tree cutting by-law which reduced logging and wood harvesting in the Priority Place.<ul style="list-style-type: none">The current municipal government is also reassessing the tree-cutting by-law in Norfolk County and looking to reduce measures afforded to commercial and agricultural practices.The suggested amendments would remove the requirement for landowners to create a forest management plan as well as allowing landowners to remove trees if the landowner feels it is impeding on agricultural or commercial activities.If the suggested amendments of the by-law are passed this could negatively affect the amount of forest cover as well as increase resistance for wildlife corridors across the LPWF Priority Place and potentially increase the threat ranking determined in the threat assessmentDecline of species dependent on older growth conditions, such as Acadian Flycatcher.Norfolk County has the highest forest cover in southwestern Ontario at 25%. As a result, there is room for the County to provide an economically sustainable timber market.<ul style="list-style-type: none">With regards to economic value in Norfolk County, wood harvesting in the form of timber operations is second only to agriculture (Norfolk County 2019a).With a warming climate, the forest floor does not contain a suitable frost layer and no longer suitable for harvesting.As a result, winter forestry operations are slowly being reduced and in some cases a project that should take three months ends up taking three years to complete (D. Thain <i>pers. comm.</i> 2020).
Recreational Activities	High	High	High	Medium	<ul style="list-style-type: none">Many private and public wooded areas are used for active recreation.Damage to habitat and species from off-road vehicles and ATVs, mountain bikes, and hikers.Active recreation also take advantage of waterways either for travelling along or for mudding.

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Summary Notes
					<ul style="list-style-type: none"> For species such as Acadian Flycatcher that nest relatively low over the water this could have negative effects on their productivity. In one instance, an Acadian Flycatcher nest was located over the water in a very active ATV and dirt bike area. The nest was abandoned, presumably to the activity (Fife and Stewart 2019). In another instance, ATV activity through Louisiana Waterthrush (Threatened in Canada) habitat resulted in abandonment of the site altogether (Fife and Purves 2020). ATV use depending on area/forest can compact soil and/or cause erosion. Scope based on widespread occurrence of active recreation in the LPWF Priority Place. Severity was credited a high threat rating score given that two occurrences of nest abandonment as a result of active recreation in two separate sights suggests that active recreation affecting the nests and eggs of SAR and other migratory birds may be more common than anticipated and over 3 generations this could seriously reduce SAR populations. This is further compounded by an already low Acadian Flycatcher productivity (Fife and Purves 2020, Fife and Stewart 2019). Irreversibility was scored as high criteria as it would take well within 21-100 years to alter people’s behavior and restore the compacted and destroyed land back to normal.
Fire Suppression	High	Low	Low	Low	<ul style="list-style-type: none"> Very little oak regeneration occurring. Some of the Forest (i.e., the pine/oak-dominated stands) would historically have been maintained by fire as savannah or open woodland. Red Maple filling the natural canopy gaps that would normally be kept open by periodic fire is having a negative impact on Eastern Flowering Dogwood (Draper pers. comm. 2018), and undoubtedly many other edge/open canopy taxa. This threat does not apply to mesic and wet forest types. Forest fires will increase in intensity and length with increased temperatures caused by climate change and this will be exacerbated by fire suppression having caused fuel loaded areas with woody vegetation Fire suppressed areas will be more susceptible to forest fires in summer, fall and spring with drier conditions caused by climate change
Dams & Water Management/Use	Low	Medium	Medium	Low	<ul style="list-style-type: none"> Agricultural fields throughout the Priority Place are tiled for drainage purposes. Tile drains are affecting swamp forest hydrology. The Nature Conservancy of Canada is closing tiles, and LPRCA is creating retention wetlands at drain outlets.
Invasive Non-native/Alien Plants & Animals	High	Medium	Medium	High	<ul style="list-style-type: none"> Presence of invasive species throughout many of the ecosystems in the Priority Place Invasive Plants <ul style="list-style-type: none"> Phragmites (<i>Phragmites australis</i>) found in treed tamarack swamps and along ditches; it is very difficult to remove from this habitat and spreads rapidly without control. Invasive shrubs and trees are found throughout many of the forests, they include: Autumn Olive (<i>Elaeagnus umbellata</i>), European Buckthorn (<i>Rhamnus cathartica</i>), Japanese Barberry (<i>Berberis thunbergii</i>) and Multiflora Rose (<i>Rosa multiflora</i>). Invasive woodland plants include Garlic Mustard (<i>Alliaria petiolata</i>), Periwinkle (<i>Vinca minor</i>), and Greater Celandine (<i>Chelidonium majus</i>). Garlic Mustard is present in most forests. Other invasive species include: Bittersweet Nightshade (<i>Solanum dulcamara</i>), European Frog-bit (<i>Hydrocharis morsus-ranae</i>), European Alder (<i>Alnus glutinosa</i>), Honey Locust (<i>Gleditsia triacanthos</i>), Hybrid Cattail (<i>Typha x glauca</i>), Flowering Rush (<i>Butomus umbellatus</i>), Lady’s-thumb (<i>Polygonum persicaria</i>), non-native Willow complex (<i>Salix alba</i>, <i>S. fragilis</i>, and <i>S. x rubens</i>), Pale Yellow Iris (<i>Iris pseudacorus</i>), Purple Loosestrife (<i>Lythrum salicaria</i>), Reed-canary Grass (<i>Phalaris arundinacea</i>), and White Sweet Clover (<i>Melilotus alba</i>). Invasive Wildlife <ul style="list-style-type: none"> Emerald Ash Borer (<i>Agrilus planipennis</i>), Fall Cankerworm (<i>Alsophila pometari</i>), Gypsy Moth (<i>Lymantria dispar</i>), and Feral Cats (<i>Felis catus</i>). Specifically, EAB and gypsy moth are the two most realized invasive threats to their woodlots as they affect not only forest structure but forest cover through defoliation. <ul style="list-style-type: none"> However, firewood transportation has increased the spread of detrimental invasive species such as Emerald Ash Borer (<i>Agrilus planipennis</i>, EAB) and Asian long-horned beetle (<i>Anoplophora glabripennis</i>) (Gagné et al. 2017).

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Summary Notes
					<ul style="list-style-type: none"> ▪ The prevalence of EAB has also increased the number of dead trees in the LPWF Priority Place. ○ Similarly, gypsy moth affects trees through defoliation and causes serious growth loss and, in some cases, tree senescence (OMNRF 2019a). ○ Feral cats have significant impacts on wildlife in forest habitats via predation. Likely a greater threat closer to urban areas and farms with outdoor cats. There is a general lack of support for managing this issue from the public and it is difficult to catch these animals to address the issue. • Populations can be reduced with control, but will continue to spread without intervention • Climate change will increase temperatures creating more favourable conditions for invasive species resulting in the spread of invasives <ul style="list-style-type: none"> ○ Increased temperatures will also support longer growing and reproductive seasons which can be detrimental to native species
Problematic Native Plants & Animals	High	Medium	Low	Low	<ul style="list-style-type: none"> • White-tailed deer browse removes native herbaceous understory and prevents woody species regeneration. <ul style="list-style-type: none"> ○ Impact on nested targets (wildlife species) may be very high. ○ Culling to control deer populations. • Impacts from mesofauna include Northern Raccoon, Striped Skunk, Virginia Opossum, and Wild Turkey. <ul style="list-style-type: none"> ○ Mid-size predators of birds, small mammals, amphibians and reptiles. ○ Subsidized through agriculture or urbanization. • Impacts from pest insects on various tree species <ul style="list-style-type: none"> ○ Elm Casebearer (<i>Coleophora ulmifoliella</i>) for elm trees and Cherry Casebearer (<i>Coleophora pruniella</i>) and Cherry Scallopshell Moth (<i>Hydria prunivorata</i>) for cherry trees (Scarr, 2012).
Pathogens & Microbes	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none"> • Important to note that Dogwood Anthracnose Fungus, Beech Scale, and Hornbeam Anthracnose Fungus cause dramatic population declines for Eastern Flowering Dogwood, American Beech, and Ironwood (Scarr, 2012) • Oak Wilt (<i>Bretziella fagacearum</i>) is responsible for killing thousands of oak tree in North America each year. The disease is currently 500 m at the border near Windsor, ON and is a rapidly spreading disease that can kill oak trees within a year (OFAH 2020). Oak trees are a highly economic wood resource for southern Ontario and not only will oak wilt affect the forest composition but the economy as well (OMNRF 2019b).
Agricultural Runoff (point & non-point source)	Very High	High	High	Medium	<ul style="list-style-type: none"> • Neonicotinoids and other pollutants are polluting water supplies and SAR habitat. • Seeds and insects treated with neonicotinoids and other pesticides are increasingly being found to be consumed by migratory birds and in some cases have detrimental effects on migratory behavior (Addy-Orduna et al. 2019, Eng et al. 2019, Humann-Guillemot et al. 2019). <ul style="list-style-type: none"> ○ As of 2016, insecticide use such as neonicotinoids in Norfolk County has increased by 31% (Norfolk County 2019b). ○ An amphibian's permeable skin allows them to take oxygen from the water, these pollutants could have detrimental effects on the genera and effect ephemeral wetlands. ○ Additionally, many wildlife species use water resources for subsistence including birds such as Acadian Flycatcher, Louisiana Waterthrush and Prothonotary Warbler; species-at-risk that depend on aquatic invertebrates to feed themselves and their young. ○ The effects of neonicotinoids are largely unknown. ○ Agricultural run-off has the potential for serious cause for decline among forest birds and wildlife by way of food resources. • Given the extent of agricultural land in the LPWF Priority Place and the increased use of insecticides, insecticide is making its way to the waterway and affecting food resources (i.e., invertebrates) for SAR. <ul style="list-style-type: none"> ○ If agricultural run-off is affecting food resources then the severity is quite high for SAR over 3 generations. ○ Between getting farmers to change their behavior about using insecticides or being presented with a better alternative, a 21-100 year environmental recovery seems reasonable to award irreversibility with a high threat level • The scope is very high. Given the extent of agricultural land in the LPWF Priority Place and the increased use of insecticides, it only seems reasonable an insecticide is making its way to the waterway and affecting food resources (i.e., invertebrates) for SAR. • The severity was determined to be a high level threat. If agricultural run-off is affecting food resources, then the severity is quite high for SAR over 3 generations. • Climate change may result in increased rainfall which will increase agricultural runoff, resulting in the pollution of surrounding environments

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Summary Notes
					<ul style="list-style-type: none"> ○ Climate change will also increase temperatures resulting in drier and impermeable soils that will not be able to absorb rainfall during high rainfall events which will also increase agricultural runoff ○ Also, these increased temperatures in winter may result in rapid snowmelt which will result in increased runoff over frozen grounds. • Between getting farmers to change their behavior about using insecticides or being presented with a better alternative, a 21-100 year environmental recovery seems reasonable to award irreversibility with a high threat level.
Garbage & Solid Waste	Medium	Low	Low	Low	<ul style="list-style-type: none"> • By-laws prohibit dumping of waste in forests • There are two Norfolk County run transfer stations open year round
Air-borne Pollutants	Very High	Low	Medium	Low	<ul style="list-style-type: none"> • Impacts from pollutants from fossil fuel emissions; nitrogen oxides, sulfur dioxide, sulfate, heavy metals, VOCs.
Light & Noise Pollution	Low	Medium	Medium	Low	<ul style="list-style-type: none"> • Light pollution causing migrating songbirds to collide with buildings and infrastructure.
Climate Change	Very High	Medium	High	Low	<ul style="list-style-type: none"> • Drier and hotter weather may increase the speed at which ephemeral wetlands are drying out (compounded by tile and municipal drainage), impeding on amphibian breeding cycle and reptile life cycle. • Climate change may be causing aquatic insects to decline and/or is developing a mismatch with insect hatch dates and breeding cycles with other species that are relying on invertebrates for raising young. • Bird species affected are aerial insectivores (the fastest declining group of birds in North America) like Acadian Flycatcher. • Other species-at-risk include all amphibians and reptiles and some plant species (see nested species list in the Situation Analysis) • Even if efforts are taken up quickly (e.g., tree planting) and severity of climate change improves, the amount of time it will take for the environment to return to previous levels will take numerous years • The scope is very high as it encompasses and affects the entire LPWF Priority Place. • The severity was given a medium threat rating as it is likely to reduce and degrade the overall conservation target but at a much slower interval. It will also depend on the overall public response to climate change if efforts are made to reduce the effects of climate change. • Irreversibility was given a high threat rating. Even if efforts are taken up quickly (e.g., tree planting) and severity of climate change improves, the amount of time it will take for the environment to return to previous levels will take numerous years. • Overall, the climate change threat is relatively unknown.

Coastal Wetlands and Inner Bay Threat Rating Detail

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Summary Notes
Housing & Urban Areas	Low	High	High	Low	<ul style="list-style-type: none"> • New residential development is not expected within the target, so the ratings are based on the current residential footprint. • This threat directly reduces the extent of available habitat for all species and alters wind action effects on the target. Additional threat of existing housing on the point and near Port Rowan. • Another impact of increased residential development on migratory waterfowl is the increase of Feral Cats, Northern Raccoons, etc.
Tourism & Recreation Areas	Medium	Medium	Low	Low	<ul style="list-style-type: none"> • Various campgrounds, seasonal cottages and beach resorts on Long Point encourage touristic activity.
Roads & Railroads	Low	Medium	High	Low	<ul style="list-style-type: none"> • Many of the roads on Long Point are sand, and could be a larger problem in the future if they are paved. • Climate change will alter habitat conditions resulting in species migration which will be inhibited by roads and may result in increased road mortality

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Summary Notes
					<ul style="list-style-type: none"> Increased rainfall due to climate change will increase the runoff of contaminants from roads into surrounding environments and may also cause road washout which would be detrimental to amphibians and reptiles <ul style="list-style-type: none"> Increased temperatures may support the establishment of invasive species by roads
Recreational Activities	Medium	Low	Low	Low	<ul style="list-style-type: none"> Most of the recreational disturbance from boating is in the Crown Marsh, boating removes vegetation and injures/kills species at risk. Boating increases turbidity, stressing wildlife & plant species.
Dams & Water Management/Use	High	Medium	High	Medium	<ul style="list-style-type: none"> This threat related to dykes that have been constructed within coastal wetlands such as the Big Creek National Wildlife Area. The LPRCA also operates several small dams and water control structures for fishing and water level management. Some members of the local community perceive dyked wetlands as a good thing, whereas others do not. Science team input requested.
Shoreline Hardening & Beach Modifications	Low	High	Medium	Low	<ul style="list-style-type: none"> The presence of built structures and shoreline hardening directly along the water's edge affects wave action on the target, removes vegetation, and decreases ease of animals' access to the water.
Invasive Species	Very High	Very High	Medium	Very High	<ul style="list-style-type: none"> Eurasian Watermilfoil (<i>Myriophyllum spicatum</i>), Phragmites (<i>Phragmites australis</i>), Common Carp (<i>Cyprinus carpio</i>), Mute Swan (<i>Cygnus olor</i>), Quagga Mussel (<i>Dreissena bugensis</i>), Round Goby (<i>Neogobius melanostomus</i>), Rusty Crayfish (<i>Orconectes rusticus</i>), Sea Lamprey (<i>Petromyzon marinus</i>), and Zebra Mussel (<i>Dreissena polymorpha</i>) The Mute Swan population continues to increase (Petrie & Francis, 2003) <ul style="list-style-type: none"> Lack native predators and aggressively compete with native waterfowl that have overlapping habitats (Petrie & Francis, 2003; Barney & Badzinski 2015) Discouraged from nesting and are removed by permit under the Migratory Birds Convention Act, 1994 (MBCA) Phragmites is ubiquitous within this target, easily out-competes native vegetation and rapidly reduces the extent of available habitat. Science Team input requested on how Phragmites directly affects waterfowl and waterbirds. Climate change will increase temperatures creating more favourable conditions for invasive species resulting in the spread of invasives <ul style="list-style-type: none"> Increased temperatures will also support longer growing and reproductive seasons which can be detrimental to native species Phragmites can thrive in warmer temperatures and drier conditions which can result in them overtaking habitats of native plant species in wetlands and near shore environments
Problematic Native Plants & Animals	Medium	Medium	Medium	Medium	<ul style="list-style-type: none"> White-tailed Deer browse removes native herbaceous understory and prevents woody species regeneration; culling used for population control (Bowles & Bradstreet, 2016). Double-crested Cormorants form large colonies and impact their nesting trees by producing large amounts of guano (Weseloh & Collier, 1995). Subsidized generalist mesofauna (e.g., Raccoons, Striped Skunks, American Crows, etc.) prey on waterbird/waterfowl nests
Agricultural Runoff (point & non-point source)	High	Medium	High	Medium	<ul style="list-style-type: none"> The target is located downstream of all agricultural lands increasing vulnerability to nutrient loading from pesticides, fertilizers and manure, and resulting in a high scope rating. Severity rating is based on negative impacts of agricultural effluent primarily on water quality, amphibians and mussels. Climate change may result in increased rainfall which will increase agricultural runoff, resulting in the pollution of surrounding environments <ul style="list-style-type: none"> This will increase nutrient loads in wetlands and near shore environments resulting in alterations to the plant community composition and affecting wetlands functions
Garbage & Solid Waste	Low	Medium	Low	Low	<ul style="list-style-type: none"> Residential garbage dumping can negatively affect water quality and amphibians.
Climate Change	Very High	Low	High	Low	<ul style="list-style-type: none"> Climate change is expected to decrease Lake Erie water levels, therefore affecting the hydrology, extent and location of coastal wetland plants. Other changes may include increased leeching, sedimentation rates and erosion of the near shore habitat due to higher precipitation rates and more extreme precipitation events (Verma, 2015). Climate change will likely also increase water temperatures and pollutant toxicity, and decrease dissolved oxygen levels (Ficke et al., 2007). Severity is low because rating is assessed for the next 10 years.

Watercourses and Riparian Areas Threat Rating Detail

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Summary Notes
Housing & Urban Areas	Not Specified	Not Specified	Not Specified	Not Specified	
Annual & Perennial Non-timber Crops	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none">Threats from agriculture in the Priority Place include hedgerow removal, fertilizer and pesticide runoff, soil erosion, and lack of vegetated buffers along ravines and waterways.Overall, agricultural practices within the Priority Place are relatively good compared to other parts of southwestern Ontario.
Roads	Low	Low	High	Low	<ul style="list-style-type: none">Scope based on a rapid visual assessment of the map.Science Team input is requested on Severity: how do roads degrade the target?Roads running directly along waterways & riparian areas reduce tree cover and restrict wildlife movement.Climate change will alter habitat conditions resulting in species migration which will be inhibited by roads and may result in increased road mortalityIncreased rainfall due to climate change will increase the runoff of contaminants from roads into surrounding environments and may also cause road washout which would be detrimental to amphibians and reptiles<ul style="list-style-type: none">Increased temperatures may support the establishment of invasive species by roads
Logging & Wood Harvesting	Low	Low	Low	Low	<ul style="list-style-type: none">Removes vegetation cover from the riparian area.Tree tops are discarded into waterways.
Fishing & Harvesting Aquatic Resources	Low	Medium	Medium	Low	<ul style="list-style-type: none">Science Team input requested to rate the extent of fish removal, risk of introducing non-native species, wildlife entanglements in fishing lines, and bank erosion.Regulations minimize this threat by legally binding fishermen to live-release by-catch, which supports the survival and recovery of species at risk (Gislason, 2010).
Recreational Activities	Low	Medium	Medium	Low	<ul style="list-style-type: none">ATVs are known to cross waterways or run along their edges, leading to increased erosion which affects water quality and riparian vegetation cover.
Dams & Water Management/Use	Medium	High	High	Medium	<ul style="list-style-type: none">Changing water flow patterns through culverts, surface water diversions, channelization, ditching etc. alters habitats and resource availability for wildlife.
Shoreline Hardening & Beach Modifications	Medium	Very High	Medium	Medium	<ul style="list-style-type: none">The presence of built structures directly along the water's edge affects wave action and water flow, removes vegetation, and decreases ease of animals' access to the water.
Invasive Species	Medium	Very High	Medium	Medium	<ul style="list-style-type: none">Phragmites does occur in some areas within the target and easily out-competes native vegetation. Science Team input is requested to confirm/ refine ratings.Climate change will increase temperatures creating more favourable conditions for invasive species resulting in the spread of invasives<ul style="list-style-type: none">Increased temperatures will also support longer growing and reproductive seasons which can be detrimental to native speciesPhragmites can thrive in warmer temperatures and drier conditions which can result in them overtaking habitats of native plant species in wetlands and near shore environments
Problematic Native Plants & Animals	Not Specified	Not Specified	Not Specified	Not Specified	

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Summary Notes
Household Sewage & Urban Waste Water	Low	High	Low	Low	<ul style="list-style-type: none">This threat is due to faulty and unmaintained residential septic tanks.Local by-laws and water treatment systems were installed minimize this threat.
Agricultural Runoff (point & non-point source)	High	Medium	High	Medium	<ul style="list-style-type: none">The target receives all agricultural effluent that does not drain directly into Lake Erie. Severity rating is based on negative impacts of agricultural effluent primarily on water quality, amphibians and mussels.Runoff from agricultural fields (either surface or sub-surface) carries with it nutrients applied as fertilizer, pesticides, and eroded soil.Nitrogen more heavily used on corn (nitrogen retention benefit).Livestock accessing waterways negatively impact water quality (increased nutrients, turbidity, and bank erosion).Dredging drains also release significant amounts of sediment in watercourses.Climate change may result in increased rainfall which will increase agricultural runoff, resulting in the pollution of near shore environments
Garbage & Solid Waste	Low	Medium	Low	Low	<ul style="list-style-type: none">Residential garbage dumping can negatively affect water quality and amphibians.Countermeasures include implementing by-laws prohibiting dumping and opening two transfer stations for garbage and recycling.
Climate Change	Very High	Low	High	Low	<ul style="list-style-type: none">Water levels are expected to decrease with climate change, therefore affecting waterways' water volume and flow speed, leading to increased erosion of vegetation. Other changes may include increased leeching, sedimentation rates and erosion of the near shore habitat due to higher precipitation rates and more extreme precipitation events (Verma, 2015).Climate change will likely also increase water temperatures and pollutant toxicity, and decrease dissolved oxygen levels (Ficke et al., 2007).Severity is low because rating is assessed for the next 10 years.

Beaches and Coastal Dunes Threat Rating Detail

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Summary Notes
Housing & Urban Areas	Medium	High	High	Medium	<ul style="list-style-type: none">This threat directly reduces the extent of available habitat for all species. It also alters the effects of wind action on the target.New residential development is not expected within the target, so the ratings are based on the current residential footprint. New residential development is difficult to get approved in the Beaches and Dunes target, in part because there are flooding risks and safe access limitations (only road in and out, so if it floods, no way for emergency vehicles to get in).<ul style="list-style-type: none">Additional pressure resulting from rebuilds with bigger footprints.For example, Turkey Point was a traditionally summer town but has become more of a year round location with large, two-story houses; now about 1300 residential units there. Boathouses are also used illegally as housing (fitted with bedrooms).No one is legally allowed to live year round, but people are using homes more regularly in the shoulder season and causing more pressure on the environment (illegally grading the beach, launching sail boats from the beach using tractors and trailers).<ul style="list-style-type: none">Increased residential use leads to more people on the beach, and greater risks related to infrastructure (e.g., septic system failure).It also includes beach raking, which removes and damages vegetation, lowering native plant abundance and diversity and removing micro-habitat for beach-nesting animals such as Fowler's Toad.Big sense of ownership on the beach. There is little acceptance of the natural features and their aesthetic (which leads owners to rake the beach to get rid of sticks).Portion of owners who want full municipal services year-round.

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Summary Notes
Tourism & Recreation Areas	Medium	Low	Low	Low	<ul style="list-style-type: none"> Various campgrounds, seasonal cottages, and beach resorts on Long Point.
Roads	Low	Low	High	Low	<ul style="list-style-type: none"> Scope based on a rapid visual assessment of the map. Roads cause edge effects fragmenting the target, altering plant communities and restricting wildlife movement. Roads and vehicles facilitate the spread of invasive species by accidental transportation and the removal of roadside vegetation. Climate change will alter habitat conditions resulting in species migration which will be inhibited by roads and may result in increased road mortality <ul style="list-style-type: none"> Increased rainfall due to climate change will increase the runoff of contaminants from roads into surrounding environments and may also cause road washout which would be detrimental to amphibians and reptiles Increased temperatures may support the establishment of invasive species by roads
Recreational Activities	High	High	Low	Medium	<ul style="list-style-type: none"> ATV use within this target crushes vegetation and amphibians, and affects sand placement and compaction. Free parking on Erie Blvd significantly increases the number of people using the provincially managed Crown Lands beach, and the duration of their stay. <ul style="list-style-type: none"> The parking lot and the Crown Lands access point are on municipal land.
Dams & Water Management/Use	Not Specified	Not Specified	Not Specified	Not Specified	
Shoreline Hardening & Beach Modifications	Medium	Medium	Medium	Medium	<ul style="list-style-type: none"> Raking of beaches by residents for cosmetic purposes and bulldozing the dunes in the spring removes vegetation and destroys amphibian terrestrial refugia and habitat. Examples of affected species include the Fowler's Toad, Snapping Turtle, Killdeer, and Kingfisher.
Invasive Species	High	Very High	Medium	High	<ul style="list-style-type: none"> Phragmites easily out-competes native vegetation and can rapidly reduce the extent of available habitat. Climate change will increase temperatures creating more favourable conditions for invasive species resulting in the spread of invasives <ul style="list-style-type: none"> Increased temperatures will also support longer growing and reproductive seasons which can be detrimental to native species Phragmites can thrive in warmer temperatures and drier conditions which can result in them overtaking habitats of native plant species in near shore environments
Problematic Native Plants & Animals	Not Specified	Not Specified	Not Specified	Not Specified	
Household Sewage & Urban Waste Water	Low	High	Low	Low	<ul style="list-style-type: none"> This threat is due to faulty and unmaintained residential septic tanks. Local by-laws and water treatment systems were installed minimize this threat.
Agricultural Runoff (point & non-point source)	Not Specified	Not Specified	Not Specified	Not Specified	
Garbage & Solid Waste	Medium	Low	Low	Low	<ul style="list-style-type: none"> Residential littering and garbage dumping on beaches can negatively affect water quality and amphibians. Countermeasures include implementing by-laws prohibiting dumping and opening two transfer stations for garbage and recycling.
Climate Change	Very High	Low	High	Low	<ul style="list-style-type: none"> Lake Erie levels are expected to decrease with climate change potentially changing the extent and location of beaches and dunes. Depending on current placement of barriers, this may affect species dispersal. Severity is low because rating is assessed for the next 10 years.

Open Country Threat Rating Detail

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Summary Notes
Roads	Low	Low	Low	Low	<ul style="list-style-type: none">Many prairie species are found along roadside and rail lines (in degraded and non-prairie situations)<ul style="list-style-type: none">Provides opportunities for restoration.In Delhi area (outside the project scope) there are ATV impacts along decommissioned a rail trail that has a naturally-occurring prairie remnant.Climate change will alter habitat conditions resulting in species migration which will be inhibited by roads and may result in increased road mortality<ul style="list-style-type: none">Increased rainfall due to climate change will increase the runoff of contaminants from roads into surrounding environments and may also cause road washout which would be detrimental to amphibians and reptilesIncreased temperatures may support the establishment of invasive species by roads
Gathering Terrestrial Plants	Medium	Low	Low	Low	<ul style="list-style-type: none">Collecting wildflowers at prairie remnants degrades those areas.
Recreational Activities	Medium	Medium	Low	Low	<ul style="list-style-type: none">Extensive trail systems with ATVs and mountain bikes have impacts such as direct trampling of vegetation, introduction of invasive plants, and running over snakes.
Fire Suppression	Very High	Very High	Medium	Very High	<ul style="list-style-type: none">Prescribed burns are occurring at a localized scale; mowing can sometimes be an effective substitute.Due to fire suppression, the current Forests target includes areas that were historically Open Country areas.Contributing factors for fire suppression relate to public safety concerns, funding, and political will.Weather and climate could affect the conditions of the plants and soil of the open country through excess moisture or drought. This would either challenge the ability to undertake such prescribed burns (e.g. in the event of excess moisture through precipitation) or by increasing the safety concerns (eg. in the event that fire spread under drought conditions). These non-ideal conditions for burning are driven by seasonal weather.
Invasive Species	High	Medium	Medium	Medium	<ul style="list-style-type: none">Scot’s pine (<i>Pinus sylvestris</i>), Black Locust (<i>Robinia pseudoacacia</i>), Honeysuckles (<i>Lonicera</i> spp.), European Buckthorn (<i>Rhamnus cathartica</i>), Autumn Olive (<i>Elaeagnus umbellata</i>), Russian Olive (<i>Elaeagnus angustifolia</i>), Spotted Knapweed (<i>Centaurea maculosa</i>), Canada Thistle (<i>Cirsium arvense</i>), Swallowworts (<i>Chelidonium</i> spp.), Sweet Clovers (<i>Melilotus alba</i>), Smooth Brome (<i>Bromus inermis</i>).Feral cat (<i>Felis catus</i>) predation on birds, small mammals amphibians and reptiles.<ul style="list-style-type: none">Large populations are difficult to control and management strategies such as spaying, neutering, and euthanasia are costly.Climate change will increase temperatures creating more favourable conditions for invasive species resulting in the spread of invasives<ul style="list-style-type: none">Increased temperatures will also support longer growing and reproductive seasons which can be detrimental to native species
Problematic Native Plants & Animals	Medium	Medium	Low	Low	<ul style="list-style-type: none">White-tailed Deer browsing impacts native herbaceous species.Populations are probably slightly above carrying capacity and impacting on native ground flora.

Amphibians and Reptiles Threat Rating Detail

Threat	Scope	Severity	Irreversibility	Summary Threat Rating	Summary Notes
Housing & Urban Areas	Low	Medium	Very High	Medium	<ul style="list-style-type: none">Low footprint of built up area results in low scope.Medium severity captures new development. Development in aquatic wetlands not in “prime” suitable habitat and less likely than forests and agricultural lands due to policies and official plans.Irreversibility is very high because the impact of paving over wetlands and forests is difficult to reverse.Level of Concern:

					<ul style="list-style-type: none"> ○ High: Blanding’s Turtle, Eastern Hog-nosed Snake, Eastern Milksnake, Eastern Musk Turtle, Eastern Ribbonsnake, Northern Map Turtle, Snapping Turtle, and Spiny Softshell ○ Low: Spotted Turtle. • Related to <i>Commercial & Industrial Areas and Tourism & Recreation Areas</i>
Commercial & Industrial Areas	Low	Medium	Very High	Medium	<ul style="list-style-type: none"> • Similar to <i>Housing & Urban Areas</i>
Tourism & Recreation Areas	Low	Low	High	Low	<ul style="list-style-type: none"> • Low scope because Long Point and Turkey Point campgrounds have a low ecological footprint. • High irreversibility because removal of some of the campgrounds in the area is unlikely.
Annual & Perennial Non-timber Crops	High	Low	Medium	Low	<ul style="list-style-type: none"> • Croplands are the dominant form of agriculture in the Priority Place (row crops). <ul style="list-style-type: none"> ○ Conservation actions that will address agricultural threats may benefit highly threatened species such as the Eastern Foxsnake, however restoring wetlands from agricultural lands is difficult and costly. • Level of concern <ul style="list-style-type: none"> ○ High: Blanding’s Turtle, Eastern Musk Turtle, Eastern Ribbonsnake, and Snapping Turtle ○ Low: Spotted Turtle ○ Multiple categories: Eastern Milksnake (high because of agricultural land impacts, medium because of old farm building removal and low because of mortality from agricultural equipment)
Livestock Farming & Ranching	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none"> • Threat recognized but not assessed • Level of Concern <ul style="list-style-type: none"> ○ Medium: Spiny Softshell ○ Low: Spotted Turtle
Roads	Very High	High	High	High	<ul style="list-style-type: none"> • Norfolk County manages approximately 4,100 lane-km (or 2,030 centreline-km) of roads and segments of provincial highways across the County’s landscape (Provincial Highways 3, 6, and 24) (Norfolk County, 2014) <ul style="list-style-type: none"> ○ Traffic volume on these roads has steadily increased over time (MTO, 2016) ○ Roads and traffic negatively affect wildlife populations in four main ways: 1) habitat loss 2) traffic mortality 3) resource inaccessibility, and 4) population subdivision (Jaeger et al., 2005) • Road construction and the expansion of a road network (OREG, 2018) <ul style="list-style-type: none"> ○ Destroys habitat quantity and quality by introducing pollution, vibrations, thermal effects, altered hydrological processes and storm water discharge, soil compaction, dust, sedimentation, spread of invasive species, and litter (Forman & Alexander, 1998; Trombulack & Frissell, 2000; Jochimsen et al, 2014; Daigle, 2010). ○ Deters anurans from using suitable breeding habitat near roads due to noise (Eigenbrod et al., 2009) ○ May create barriers, limiting seasonal movements, making resources inaccessible (road width, traffic volume, and road surface all determine the magnitude of the barrier effect) (Forman & Alexander, 1998; Jaeger et al., 2005), and subdividing/isolating populations (Jackson, 2000) ○ Facilitate human access to habitat, might allow illegal activities such as persecution and cruelty to wildlife, intentional vehicle collisions, poaching, and littering/dumping (Ashley et al, 2007; Environment and Climate Change Canada, 2016; Crawford & Andrews, 2016). May also facilitate discarding of unwanted pet turtles into native wild turtle habitats (e.g., Red-eared sliders, Ontario Nature, 2018). ○ Effects may extend a few kilometers from the road itself (Seiler, 2003) ○ Roads, road management activity and transportation corridors are the primary conduits that facilitate the spread of Phragmites ○ Blasting practices and heavy construction equipment cause direct mortality (OPWG, 2015) • Roads and roadside features may inadvertently create attractive but perilous habitat for wildlife (OREG, 2018) <ul style="list-style-type: none"> ○ Turtles nest on gravel shoulders beside roads (Langen et al., 2015) ○ Roadside nesting could be a mortality sink due to many hazards (nest predation, direct mortality of adults and hatchlings from vehicle collisions, road maintenance practices, etc.) (Aresco, 2003) • Road runoff (OREG, 2018) <ul style="list-style-type: none"> ○ Insecticides and herbicides used for gardens and golf courses may all be transported from their point sources through surface road runoff and enter wildlife habitat and waterbodies (Ovaska et al., 2004) ○ Road de-icing contaminants (i.e. NaCl) are toxic to amphibian larvae (Mahaney, 1994; Sanzo & Hecnar, 2006)

					<ul style="list-style-type: none"> Vehicle collisions (OREG, 2018) <ul style="list-style-type: none"> Vehicles cause direct mortality of individuals and threaten population sustainability Some reptiles and amphibians respond with immobility to approaching vehicles (Mazerolle et al., 2005) Road maintenance practices (OREG, 2018) <ul style="list-style-type: none"> Grading roadside shoulders threatens especially nesting females and buried turtle nests (Langen et al., 2015; MTO, 2017a) Nests may be sealed, nest incubation temperatures may change, and a hatchling's ability to emerge by deeply burying the nest (Turtle Guardians, 2017; MTO 2017a) Vegetation management within the road right-of-way threatens herpetofauna (e.g., mowing, weed control, brush control and tree and shrub maintenance, tree removal, and ground cover) (MTO, 2017) Heavy machinery and blade height may crush or harm reptiles and amphibians in roadside habitats (MTO, 2017; Danby et al., 2016) Under reported data (OREG, 2018) <ul style="list-style-type: none"> Many motor vehicle collisions involving smaller fauna go unreported, however road mortality studies of smaller species report high numbers of vertebrate mortalities on relatively short road segments that have been observed over limited field seasons Road kill may not be accurately quantified due to variable carcass persistence time and carcass detectability (Santos et al., 2016). Also, animals struck on the road may move off the road and die from their injuries or be flung into roadside habitat (Dodd et al, 1989; Choquette & Valliant, 2016) Some studies may miss data collection during mass amphibian migration and/or dispersal events (Puky, 2005; Glista et al., 2008) Very high scope because amphibians and reptiles occur across most of the Priority Place and many snakes are wide-ranging. Severity rated as high as a precaution, however may be closer to medium. Long term studies (10 years or 3 generations) will be needed to confirm this rating. Climate change will alter habitat conditions resulting in species migration which will be inhibited by roads and may result in increased road mortality <ul style="list-style-type: none"> Increased rainfall due to climate change will increase the runoff of contaminants from roads into surrounding environments and may also cause road washout which would be detrimental to amphibians and reptiles Increased temperatures may support the establishment of invasive species by roads
Hunting & Collecting Terrestrial Animals	Medium	High	Medium	Medium	<ul style="list-style-type: none"> Wildlife at risk of being collected. <ul style="list-style-type: none"> Snakes potentially being collected at prairie remnants. Level of Concern <ul style="list-style-type: none"> High: Spiny Softshell and Spotted Turtle Medium: Blanding's Turtle, Eastern Hog-nosed Snake, Eastern Musk Turtle, Northern Map Turtle and Snapping Turtle Low: Eastern Milksnake Wildlife at risk of being persecuted. <ul style="list-style-type: none"> Level of Concern <ul style="list-style-type: none"> High: Eastern Milksnake Medium: Eastern Hog-nosed Snake and Snapping Turtle Medium/Low: Eastern Ribbonsnake
Logging & Wood Harvesting	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none"> Threat recognized but not assessed Potential (unknown) impact on the Gray Ratsnake, the Jefferson Salamander, and Blanding's Turtle.
Fishing & Harvesting Aquatic Resources	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none"> Threat recognized but not assessed This threat refers to fishing by-catch for all species except Blanding's Turtle, for which it refers to accidental mortality as a result of commercial fisheries (i.e. motor boat propellers). Level of Concern <ul style="list-style-type: none"> High: Eastern Musk Turtle and Northern Map Turtle Medium: Spiny Softshell and Snapping Turtle.
Recreational Activities	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none"> Threats include boating, hiking, biking and ATVing. Level of Concern (with specified threats)

					<ul style="list-style-type: none"> ○ High: Spiny Softshell (boating mortality), Northern Map Turtle (boating mortality) and Spotted Turtle (off-road vehicles) ○ Medium: Spiny Softshell (human activity disturbance), Northern Map Turtle (human activity disturbance) ○ Unspecified: Eastern Musk Turtle (several threats)
Fire Suppression	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none"> • Threat recognized but not assessed • The Level of Concern is low for the Spotted Turtle. • Fires will increase in intensity and length with increased temperatures caused by climate change and this will be exacerbated by fire suppression having caused fuel loaded areas with woody vegetation <ul style="list-style-type: none"> ○ Fire suppressed areas will be more susceptible to fires in summer, fall and spring with drier conditions caused by climate change
Dams & Water Management/Use	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none"> • Threat recognized but not assessed • Level of Concern <ul style="list-style-type: none"> ○ High/Medium: Eastern Musk Turtle and the Northern Map Turtle ○ Medium: Spiny Softshell ○ Medium/Low: Blanding's Turtle ○ Low: Jefferson Salamander
Shoreline Hardening & Beach Modifications	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none"> • Threats include heavy machinery, maintenance and restoration activities, and maintenance of overwintering sites. • This threat refers to reduced prey for the Eastern Ribbonsnake. • The Level of Concern <ul style="list-style-type: none"> ○ Medium: Eastern Ribbonsnake and low for ○ Low: Blanding's Turtle.
Invasive Species	Medium	High	Medium	Medium	<ul style="list-style-type: none"> • Japanese Hop (<i>Humulus japonicus</i>), Purple Loosestrife (<i>Lythrum salicaria</i>), exotic Turtles, Common Carp (<i>Cyprinus carpio</i>), Rough Mannagrass (<i>Glyceria maxima</i>), Zebra Mussels (<i>Dreissena polymorpha</i>), Round Goby (<i>Neogobius melanostomus</i>), Rusty Crayfish (<i>Orconectes rusticus</i>), Silver Poplar (<i>Populus alba</i>), Crown Vetch (<i>Securigera varia</i>) and Kentucky Bluegrass (<i>Poa pratensis</i>). • Phragmites acts as a barrier for wildlife movement and modifies wetland structure, which alters breeding and foraging habitat. <ul style="list-style-type: none"> ○ Roads, road management activity and transportation corridors are the primary conduits that facilitate the spread of Phragmites (OREG, 2018). • Level of Concern <ul style="list-style-type: none"> ○ High: Spotted Turtle ○ High/Low: Spiny Softshell ○ Medium: Northern Map Turtle ○ Medium/Low: Eastern Musk Turtle and Blanding's Turtle. • Climate change will increase temperatures creating more favourable conditions for invasive species resulting in the spread of invasives <ul style="list-style-type: none"> ○ Increased temperatures will also support longer growing and reproductive seasons which can be detrimental to native species ○ Phragmites can thrive in warmer temperatures and drier conditions which can result in them overtaking habitats of native plant species in wetlands and near shore environments
Problematic Native Plants & Animals	Very High	Medium	High	Medium	<ul style="list-style-type: none"> • This threat refers to human-subsidized predators for all species except the Eastern Ribbonsnake, for which it refers to the introduction of predatory fish that reduce prey populations. • Subsidized generalist mesofauna (e.g., Northern Raccoons, Striped Skunks, Wild Turkeys, American Crows) feed on reptiles and amphibians. <ul style="list-style-type: none"> ○ Most amphibians and reptiles will be preyed upon by raccoons at some stage in their life. ○ Raccoon predation on turtle nests is a well-documented example, however they also prey on young and adults. ○ Wild turkey potentially eating SAR amphibians and reptiles. ○ Losing a nest for spatially restricted species (e.g., Spiny Softshell) can inhibit population growth. • Level of Concern <ul style="list-style-type: none"> ○ High/Medium: Spiny Softshell, Blanding's Turtle, Eastern Musk Turtle, Northern Map Turtle and Snapping Turtle ○ Medium/Low: Eastern Milksnake ○ Low: Eastern Ribbonsnake

Pathogens & Microbes	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none"> • Possible Pathogens and Microbes in the Priority Place: Snake Fungal Disease (SFD), Chytridiomycosis (Chytrid Fungus; Bd), Salamander Chytridiomycosis (Salamander Chytrid Fungus; Bsal) and Ranavirus. <ul style="list-style-type: none"> ○ For snakes, the threat considered was SFD which may be exacerbated by climate change and is mentioned in the recovery documents for the Gray Ratsnake, the Queensnake and the Eastern Foxsnake. <ul style="list-style-type: none"> ▪ Though SFD is not confirmed in the Priority Place, it has been found at Rondeau Park and in Brant County, just north of Norfolk County (Stephen et al., 2017). ○ For the Eastern Musk Turtle, the threat considered was a necrotic shell disease. ○ The Carolinian Eastern Foxsnake population may be highly vulnerable due to habitat fragmentation. • General lack of information for this threat. Bsal not yet found in the Priority Place, therefore not considered. • Low Level of Concern: Eastern Milksnake
Household Sewage & Urban Wastewater	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none"> • Threat recognized but not assessed • Level of Concern <ul style="list-style-type: none"> ○ Medium/Low: Eastern Musk Turtle and Spiny Softshell ○ Low: Northern Map Turtle.
Agricultural Runoff (point & non-point source)	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none"> • Threat recognized but not assessed • Level of Concern <ul style="list-style-type: none"> ○ Medium/Low: Eastern Musk Turtle, Snapping Turtle and Spiny Softshell ○ Low: Eastern Hog-nosed Snake and the Northern Map Turtle • Climate change may result in increased rainfall which will increase agricultural runoff, resulting in the pollution of surrounding environments <ul style="list-style-type: none"> ○ This will increase nutrient loads in wetlands and near shore environments resulting in alterations to the plant community composition and affecting wetlands functions
Garbage & Solid Waste	Medium	Medium	Low	Low	<ul style="list-style-type: none"> • Impact of garbage dumping plastic waste on turtles (e.g., ingestion, tangling)
Light & Noise Pollution	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none"> • Threat recognized but not assessed • Unknown impact on the Jefferson Salamander.
Ecosystem Encroachment	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none"> • Threat recognized but not assessed • Unknown impact on the Fowler's Toad.
Climate Change	Not Specified	Not Specified	Not Specified	Not Specified	<ul style="list-style-type: none"> • Threat recognized but not assessed • Level of Concern <ul style="list-style-type: none"> ○ Low: Blanding's Turtle and Spiny Softshell • This threat is related to <i>Pathogens and Microbes</i> because of how climate change may exacerbate SFD for the Eastern Foxsnake, the Gray Ratsnake and the Queensnake.