LANDSCAPE CONNECTIVITY

Friends of South Shore | 2023

Photo: Michael Awad

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Photo: Michael Awad

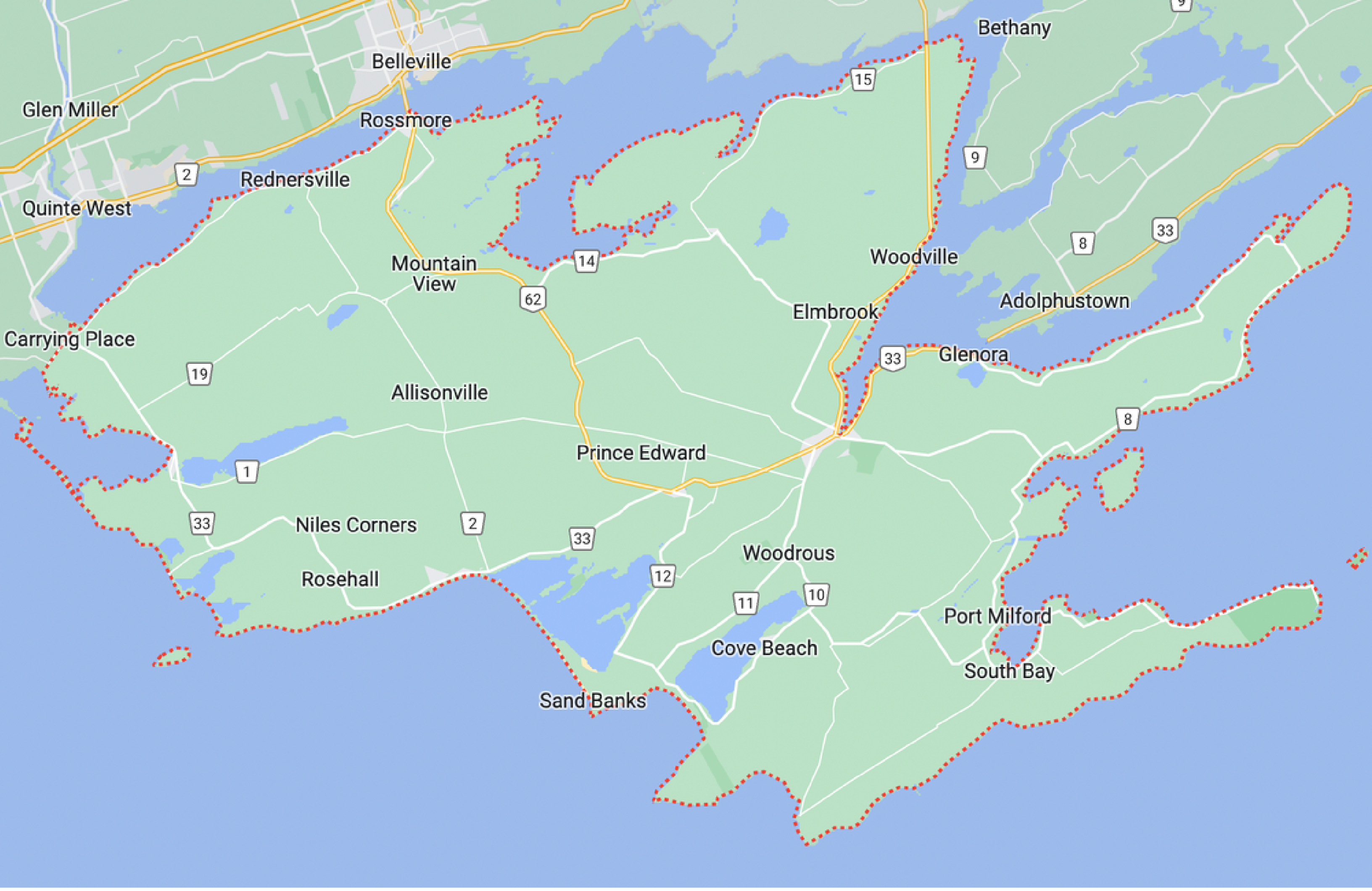

Figure 1: Map of Prince Edward County (PEC). Photo: Google Maps.

PRINCE EDWARD COUNTY

Prince Edward County's (PEC) expansive natural heritage resources: sprawling agricultural fields, limestone shores, and wetlands are critical to the County's identity, community spirit, economy, tourism, environment, and health and yet they are under threat of disappearing.

The South Shore is a significant natural heritage landscape, one that sustains farming and fishing as well as wetlands and wildlife, in a rare, incredible, and biodiverse natural ecosystem. It is one of the last remaining wild shores on Lake Ontario. More than the sum of its parts, the South Shore is a vital connection between two Provincially Significant Wetlands and home to endangered and threatened species. The South Shore is made up of core protected areas connected by natural and agricultural corridors linking Sandbanks Provincial Park to Soup Harbour to Point Petre and, ultimately, to Long Point.

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BIODIVERSITY

'**Biological diversity**' or '**Biodiversity**' is "the variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems." (The Convention on Biological Diversity, 2006).

We are seeing the effects of anthropogenic drivers like climate change, land degradation, and ocean acidification all over the natural world (Blake, 2022, Intergovernmental Panel on Climate Change, 2022, Portner, 2023). Biodiversity loss is also occurring at unprecedented rates. The IPBES (2019) estimated a projected loss of over 1 million species in the next decade. Biodiversity loss, climate change and ecosystems are all interconnected, with the resilience of ecosystems being eroded by land-use changes, habitat fragmentation, pollution, and species exploitation. We will experience severe climate change impacts, and the ecosystems and species within them will be vulnerable to this change if no actions are taken to protect them (Blake 2022, Portner 2023).

Figure 2: Common Wood-nymph found during the Friends of South Shore BioBlitz (2023). Photo: Paul Jones.

Figure 3: Coral Fungus found during FOSS BioBlitz, 2023. Photo: Jessica Daze.

WHAT ARE KEY BIODIVERSITY AREAS?

A KBA is a "site contributing significantly to the global persistence of biodiversity", in terrestrial, freshwater, and marine ecosystems. It is a designation that shows the importance of an area, biodiversity wise, but does not provide any actual protection. Its importance lies within recognizing, highlighting, and mapping an area that is significant, so that federal and provincial governments, organizations, and decision-makers are provided with information that can help to guide future land management, protection, and conservation decisions. KBA's can be used as a tool to identify areas vital to sustaining biodiversity with high ecological value.

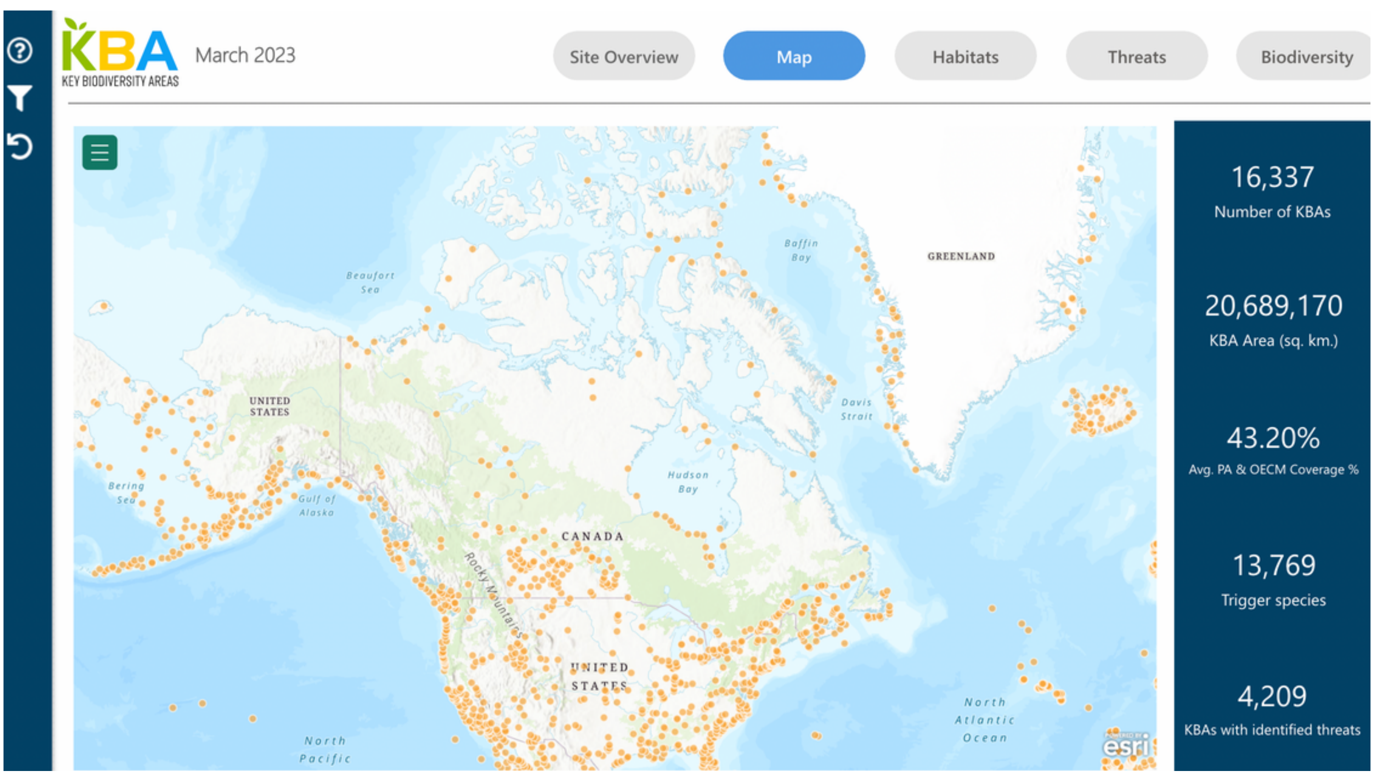


Figure 4: Map of current KBA's around the world. Photo: keybiodiversityareas.org

WHAT IS THE KEY BIODIVERSITY AREA (KBA) CRITERIA/ STANDARDS?

There is a Global Standard for the Identification of Key Biodiversity Areas. This is a standard that includes the definitions, criteria, thresholds, and delineation procedures for establishing new KBAs (IUCN, 2016). The purpose of this criteria is to highlight areas that contribute to the global persistence to biodiversity, and they are identified for their biodiversity elements (IUCN, 2016). The criterion in the standard is listed below.

A. Threatened Biodiversity Criteria

- Threatened Species: The site holds “a significant proportion of the global population size of a species facing a high risk of extinction and so contribute to the global persistence of biodiversity at genetic and species levels.”
    - This would include species that are considered threatened regionally/nationally, if they have not been assessed globally, as well as species listed on the IUCN Red List of Threatened Species. They can be observed through number of mature individuals, area of occupancy, extent of suitable habitat, range, number of localities, or distinct genetic diversity.
- Threatened Ecosystem Types: Site holding “a significant proportion of the global extent of an ecosystem type facing a high risk of collapse and so contribute to the global persistence of biodiversity at the ecosystem level.”
    - This would include ecosystem types that have been assessed and listed under the IUCN Red List of Ecosystems Categories and Criteria.

Figure 5: A Crescent Butterfly found at the Friends of South Shore BioBlitz 2023. Photo: Jessica Daze.

Figure 6: A Blanding’s Turtle found at Soup Harbour in 2023. Photo: Nina-Marie Lister.

KBA CRITERIA/ STANDARDS CONTINUED

B. Geographically Restricted Biodiversity

- Individual Geographically Restricted Species: Sites that “hold a significant proportion of the global population size of a geographically restricted species and so contribute significantly to the global persistence of biodiversity at the genetic and species level.”
- Co-occurring Geographically Restricted Species: Sites that “hold a significant proportion of the global population size of multiple restricted-range species, and so contribute significantly to the global persistence of biodiversity at the genetic and species level.”
- Geographically Restricted Assemblages: Sites that “hold assemblages of species within a taxonomic group that are globally restricted and so contribute significantly to the global persistence of biodiversity at the genetic, species and ecosystem levels.”
- Geographically Restricted Ecosystem Types: Sites that “hold a significant proportion of the global extent of a geographically restricted ecosystem type and so contribute significantly to the global persistence of biodiversity at the species and ecosystem level.”

C. Ecological Integrity

- “Sites qualifying as KBAs under criterion C hold wholly intact ecological communities with supporting large-scale ecological processes and so contribute significantly to the global persistence of biodiversity at the ecosystem level.”
- This identifies ecosystem types and components that maintain full function, because they are still natural, intact, and largely undisturbed by significant industrial human influence.
- This supports the ability of species to engage in natural movements and allows for the unimpeded functioning of ecological processes.
- This would be observed/inferred from species composition, abundance, biomass across taxonomic groups and absence or low levels of direct industrial human impact.

KBA CRITERIA/ STANDARDS CONTINUED

D. Biological Processes

- Demographic Aggregations: Sites that "hold a significant proportion of the global population size of a species during one or more life history stages or processes, and so contribute significantly to the global persistence of biodiversity at the species level."
- Ecological Refugia: Sites that "hold a significant proportion of the global population size of a species during periods of environmental stress, and so contribute significantly to the global persistence of biodiversity at the species level."
- Recruitment Sources: Sites "where a significant proportion of the global population size of a species is produced, and so contribute significantly to the global persistence of biodiversity at the species level."

E. Irreplaceability through a Quantitative Analysis

- Sites that "have very high irreplaceability for the global persistence of biodiversity as identified through a complementarity based quantitative analysis of irreplaceability." (IUCN, 2016)

Figure 7: A Least Skipper found at the Friends of South Shore BioBlitz 2023. Photo: Paul Jones.

WHY ARE KBAS IMPORTANT FOR PRINCE EDWARD COUNTY'S SOUTH SHORE?

Currently, the ecological value of the South Shore of Prince Edward County's landscape is under evaluation as a Key Biodiversity Area (KBA). There is little doubt that South Shore will be designated but the delineation of its boundaries is yet to be determined. Once the landscape is defined and designated, it will become a priority for protection by the government of Canada in its efforts to fulfill its commitment to protect 30% of the nation's land by 2030.

Numerous community organizations in PEC, landowners and conservation agencies have been working tirelessly to protect the unique and dynamic landscapes found there. Organizations such as Friends of South Shore (FOSS), South Shore Joint Initiative (SSJI), Prince Edward County Field Naturalists (PECFN) and Prince Edward Point Bird Observatory (PEPtBO), to name a few. We all have a role to play in the protection and conservation of the County's natural landscape.

When an area is being considered for the KBA designation, not only are the species found in an area important, but the ecosystem configuration and elements are important as well. Structural and functional connectivity in a landscape is a key aspect for protecting biodiversity and ecosystem health. The connecting habitat between natural areas need to be protected, conserved, and restored. When natural areas are fragmented and not connected to each other there can be many negative impacts on an ecosystem, its health and resilience, and the species that live there. The Ecological Integrity criteria for KBAs identifies an important site as having intact, still natural ecological communities, that support ecological processes, maintaining full function while being largely undisturbed by significant human industrial impacts. This applies to the connected, natural areas of PEC's South Shore.

Figure 8: Friends of South Shore BioBlitz 2023. Photo: Patricia Gale.

Figure 9: Friends of South Shore BioBlitz 2023. Photo: Jessica Daze.

WHAT IS A CONNECTED LANDSCAPE?

‘**Ecological connectivity**’ or **landscape connectivity** is the unimpeded movement of species and the flow of natural processes that sustain life on Earth (CMS, 2020, Hilty et al., 2020).

Figure 10: South Shore of PEC. Photo: Debra Marshall.

‘Ecological Connectivity is “the degree to which the landscape facilitates or impedes movement among resource patches” (Taylor et al., 1993, Blake, 2022). Disruption of this flow occurs because of fragmentation, mostly human induced, which is the breaking up of a habitat/ecosystem into smaller pieces of land (Hilty et al., 2020, Wilcox & Murphy, 1985). Natural fragmentation can include bodies of water, topography, land cover, and anthropogenic fragmentation includes barriers such as roads, settlements, walls, fences, and changes in land uses. The fragmentation can affect different species in different ways but some of the impacts may include reduction in resilience to respond to changing habitat conditions, disease, and less genetic diversity. This fragmentation leads to a decrease in the biodiversity of an ecosystem (Blake, 2022, Wilcox & Murphy, 1985). *Biodiversity has been shown to be important in the ecosystem* by being able to continue to support us and provide ecosystem services, as well as being foundational to long-term resilience of these services and the ecosystem as a whole (Blake, 2022, Watson et al., 2005).

WHY ARE CONNECTED LANDSCAPES IMPORTANT?

Landscape connectivity is an important aspect in a healthy and resilient ecosystem. A broad variety of research has explored the impacts of connected landscapes on the ability of a species to survive and do well, as well as the increase of ecosystem resilience when a landscape is connected. Connected landscapes are resilient because they can allow a species the space to adapt to change (Blake, 2022). Connectivity has been shown to increase the movement of individuals when they disperse or migrate and this promotes gene flow, population recolonization or establishment, and could contribute to the rescue of small, isolated populations of species (Zeller et al., 2020, Hilty et al., 2012).

The climate is changing and for species to be able to adapt and survive, landscapes must be connected to encourage the space and movement for these species and to not lose more biodiversity (Blake, 2022, Chen et al., 2011). Without that connectivity, ecosystems cannot function properly, and without well-functioning ecosystems, biodiversity is at risk as ecosystems are not able to adapt to changes as easily or when needed.

The IPBES Global Assessment Report on Biodiversity and Ecosystem Services (2019) states that **fragmentation and the loss of landscape/ecological connectivity is a driver of global biodiversity loss.** This has been formally recognized by governments around the world. Through the United Nations General Assembly, which states "the enhancement of connectivity between ecosystems and cooperation in order to maintain healthy and intact ecosystems and habitats, which are needed to conserve biodiversity…" and the first goal in the recently adopted UN Convention on Biological Diversity Post-2020 Global Biodiversity Framework states by 2050 the ""… integrity, connectivity and resilience off all ecosystems are maintained, enhanced, or restored,…" (Joly, 2023, IPBES, 2019, Pither et al., 2023). Around the world, countries will have to start looking more into ecological connectivity conservation and what can be done to improve habitat fragmentation (Pither et al., 2023).

Connected landscapes are important for humans as well. We are connected to ecosystems, in the sense that we need their support for clean air, water, food, shelter, spiritual fulfilment, and recreation, among many other services (Blake, 2022, Grunewald & Bastian, 2015). We rely on biodiverse ecosystems for these services and supports that they provide, but ecosystems need our support as well. **For ecosystems to continue to be resilient to change, diverse, well-functioning, and to continue to help support us, we must act to protect and restore them (Blake, 2022).**

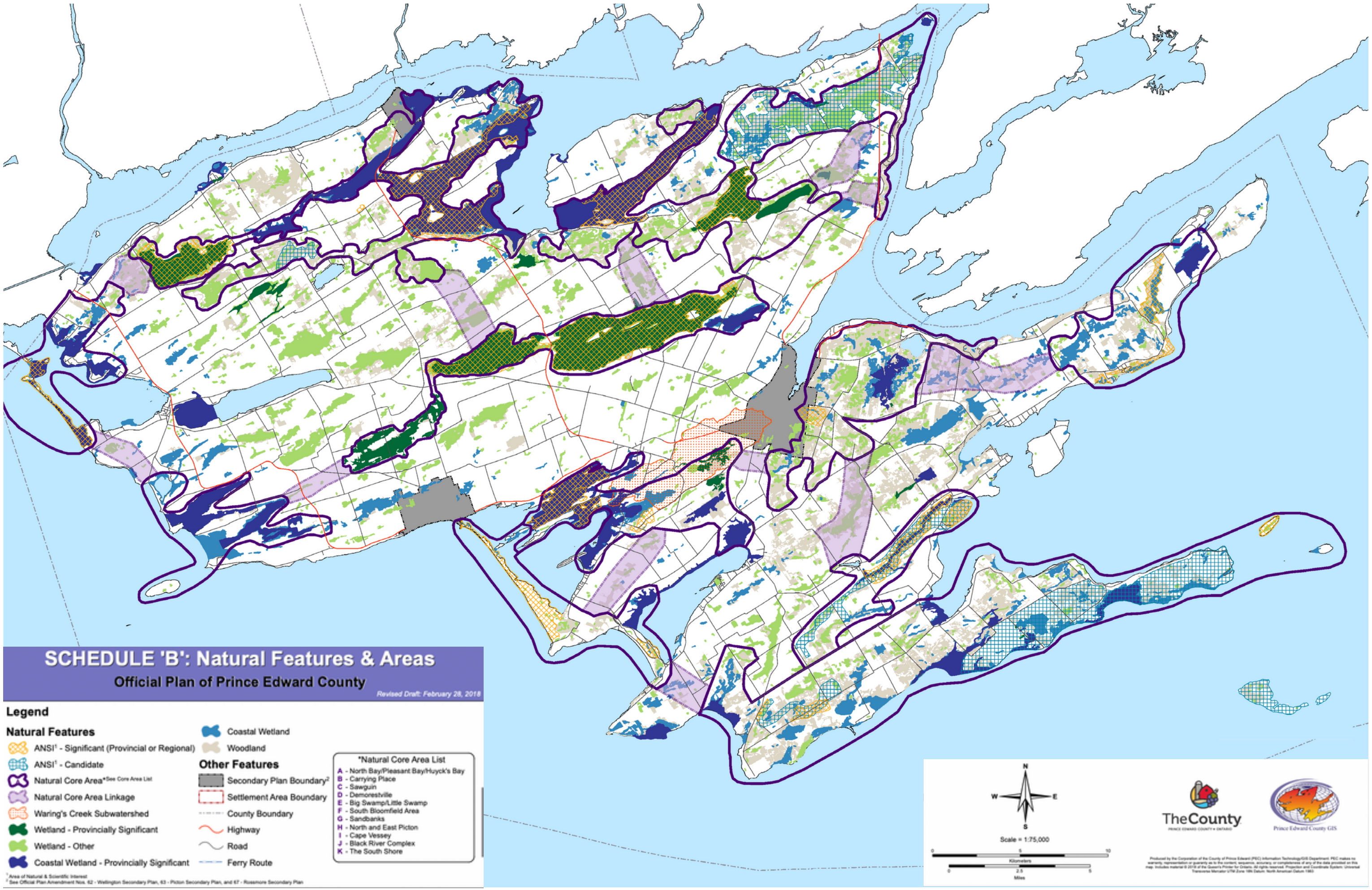


Figure 11: Schedule "B" of PEC's Official Plan. Photo: Prince Edward County Municipal Services.

CONNECTIVITY IN PRINCE EDWARD COUNTY

Prince Edward County's Official Plan recognizes the need for landscape connectivity. The Natural Heritage System included in the Prince Edward County Official Plan is meant to contribute to the conservation of biological diversity, and to the quality of air, land and water. Schedule 'B' identifies key components of the Natural Heritage System, including wetlands, areas of Natural and Scientific Interest, **Natural Core Areas, Natural Core Area Linkages**, Waring's Creek Sub-watershed, and woodlands. (See Figure ... for Schedule 'B'). This map outlines all of the bove-mentioned components, but most importantly the Natural Core Area Linkages and Natural ore Areas. The County recognizes that the area linking Sandbanks Provincial Park to Long Point is a Natural Core Area, and from Sandbanks Provincial Park to Soup Harbour is a Natural Core Area Linkage.

Prince Edward County's (PEC) South Shore has many important natural areas and ecosystems that are in need of protection, this includes the land that connects these ecosystems together. PEC's South Shore is host to a spectacular diversity of species, and ecosystems, and this is being shown through the data that is beginning to be collected on this land, through citizen science, dedicated volunteers and the efforts of different organizations.

CONNECTIVITY IN PRINCE EDWARD COUNTY

A first step in conservation efforts that anyone can contribute to, is collecting and recording data on the flora and fauna that uses the ecosystems we are surrounded by. Nature observations can show us exactly what, when, and where a species is and what habitat they are using in their different life cycles. These records contribute to species monitoring efforts, help to make conservation decisions now and into the future, as well as better our understanding of the natural world, not to mention further the evidence of why an area like the entire South Shore of PEC should be designated and delineated as a KBA. Participating in platforms and programs like iNaturalist and eBird (among others), as well as participating in BioBlitz's can help to collect extremely important data that has not been previously documented and can help to guide future conservation decisions. Records like these help in the protection of these diverse habitats, connections, and corridors within.

For example, in August 2023, the first annual Friends of South Shore BioBlitz was held at Soup Harbour to help gather more data and raise awareness of the importance of the ecosystems this land supports. A BioBlitz provides a snapshot of the diversity that an area contains at a certain location and time of year. A team of 10 citizen scientists, biologists and ecologists alike recorded a collective of 49 confirmed species, 26 unconfirmed species and 22 individuals that were only identified at a family or genus level on iNaturalist to date. There were 10 additional bird records added to the tally from eBird observations. There were over 100 observations on iNaturalist made from the day, along with 2 eBird lists. This is a total of 107 individuals observed, identified, and recorded throughout one day of searching at the end of the summer season. Some species at risk were observed, for example the Monarch, which is listed as Vulnerable in Canada, a Peregrine Falcon which is a species of special concern in Ontario. Blanding's Turtles (threatened in Ontario and endangered in Canada) are known to use and nest in the area as well.

Figure 12: A Pileated Woodpecker captured and banded during the 2023 MAPS season at the Soup Harbor station on the South Shore of PEC. Photo: Nina-Marie Lister.

CONNECTIVITY IN PRINCE EDWARD COUNTY

In the summer of 2023, Friends of South Shore (FOSS) in partnership with Prince Edward Point Bird Observatory (PEPtBO) created and operated a Monitoring Avian Productivity and Survivorship (MAPS) station on Soup Harbour. This MAPS station, under the guidance set out by the Institute for Bird Populations (IBP), can be used to show key demographic parameters on the birds that are breeding in the ecosystems on the South Shore. A MAPS station is a 5-year commitment of monitoring at the same site, it monitors bird populations, and creates a picture of bird trends at individual sites and across north America. MAPS data helps to answer questions such as: which factors are affecting a decline in bird species populations? Where are the problems most acute (breeding or non-breeding grounds)? What are the relationships between populations and weather, climate, and habitat loss and how can we help to reverse these declines if they are happening? It also helps to provide an idea of the types of species using an area that we might not otherwise see or hear but catch in the mist nets used during bird banding procedures. At the Soup Harbour MAPS station, during the 2023 breeding season, 258 new birds were caught and banded of 35 species, most notably the breeding Grasshopper Sparrows that were banded, as they are a species of Special Concern in Ontario. The team also caught Wood Thrush, which is considered a species of special concern in Ontario and a threatened species in Canada, and a third species of concern captured was the Eastern Wood-Pewee. There were also 6 individuals that were captured but not banded and 62 birds that were recaptured through the breeding season, one of which was a Common Grackle that was first caught in the fall of 2021 at the Prince Edward Point Bird Observatory and recaptured in the breeding season at the Soup Harbour MAPS Station. This is a direct example of the Common Grackle using the connected landscape to travel along the South Shore.

This preliminary data that has been collected is already showing connections to the KBA criteria, for example under the Threatened Biodiversity criteria (with threatened and endangered species being observed using the land), as well as Ecological Integrity (connected, intact, still natural landscape with little human, industrial influence).

CONNECTIVITY IN PRINCE EDWARD COUNTY

Protecting this habitat and these ecosystems is extremely important for the species and humans who call these areas home. By keeping this landscape connected and protected we can support the biodiversity that lives here. This is just the start into the data collection that can and will be continued in the future for this area. With the accumulation of data and evidence gathered by the dedicated individuals and organizations from the South Shore of PEC, we can corroborate that landscape as eligible to be designated and delineated as a Key Biodiversity Area. KBA status can help us to protect this land for years to come.

Through a literary review, this report will provide more insight on the importance of landscape connectivity on many levels, including at a species level, the ecosystem as a whole and how we interact and gain support from the ecosystems that surround us. We will highlight the importance of landscape connectivity and the effects that a connected landscape can have, both positive and negative, and best practices/case studies (real world examples) that have already proven landscape connectivity is a key tool that we can use for the conservation of an ecosystem that helps to reduce the effects of habitat loss and fragmentation (Zeller et al., 2020).

Figure 13: Shoreline near Soup Harbour on PEC's South Shore. Photo: Debra Marshall.

CONNECTED LANDSCAPES/HABITAT FRAGMENTATION

Connected landscapes, whether they were conserved or restored, are a tool we can use to combat biodiversity loss, and to improve or continue to support well-functioning ecosystems (Resasco, 2019). Three meta-analyses/literature reviews, one from 2009 by Gilbert-Norton et al., one from 2019 completed by Resasco, and one from Fletcher et al. (2016), investigated the effectiveness of corridors. Corridor is a clearly defined geographical space that is governed and managed over the long term to maintain or restore effective ecological connectivity. The following terms are often used similarly: 'linkages', 'safe passages', 'ecological connectivity areas', 'ecological connectivity zones', and 'permeability areas' (IPBES, 2019). They found that the conservation/ restoration of corridors (in other words connected landscapes) helped to promote movement and dispersal of species between habitat patches. Even minimal migration of a species from one area to another can mitigate the loss of genetic diversity for a species (Gilbert-Norton et al., 2009).

In the Gilbert-Norton study (2009), it was mentioned that corridors have an impact on species movement and dispersal to natural areas, but that natural corridors, not modified by humans, showed more movement of species between habitat patches or natural areas than corridors manipulated by humans. Fletcher et al. (2016) study, which looked at the effectiveness of landscape connectivity on species population/community levels found that the effects of connectivity are almost always positive and frequently observed. The Resasco (2019) meta-analysis reinforced that corridors/connected landscapes are important and effective at increasing movement between habitat patches as well, at a species, population, and community level. It seems that although they agree there are predominantly positive impacts on biodiversity and movement of species through connected landscapes, the gaps that these three literatures reviews/meta-analyses found was that there needs to be more long-term study of the effects of connected landscapes on a species, population and community level to better understand whether connected landscapes helped to increase or sustain biodiversity in an area (Gilbert-Norton et al., 2009, Resasco, 2019, Fletcher et al., 2016). Nevertheless, all three of these studies show that to best conserve biodiversity, we need to restore and protect the connectivity between habitat patches or fragments (Resasco, 2019)

Figure 14: Broadleaf Arrowhead found at the FOSS BioBlitz, 2023. Photo: Patricia Gale.

CONNECTED LANDSCAPES/HABITAT FRAGMENTATION

A study completed by Betts et al. (2019), mentions that habitat loss is generally accepted to be connected to declines in biodiversity, yet to which degree habitat fragmentation also has an impact on declining species has been debated over the years (Betts et al., 2019). This study looked at forest fragmentation sensitivity, and where conservation efforts should be put if any into limiting edges created by fragmentation. They concluded that this study somewhat helps to reconcile the great debate over habitat fragmentation, and its impacts on biodiversity. When studies found there were negative effects on species because of fragmentation, it was often in an area (like the tropics) where fragmentation and human disturbances aren't often around.

In cases when there wasn't a strong relationship with fragmentation of a habitat and a species decline or loss in biodiversity, it was in an area that was already disturbed or will be disturbed frequently, so the species that are sensitive to these disturbances have already moved on to areas that are not disturbed as much or have already declined because of these disturbances. There are always exceptions to this, but not many were found in this study. This is not to say that climate change may interact with habitat loss and fragmentation to reduce a species capacity to adapt in the future.

The results indicated that conservation actions to reduce edge-driven fragmentation effects does not have to be simple rules for the whole world but rather would be more effective when tailored to regions where forest fragmentation sensitive species are present (Betts et al., 2019). Shedding light on the debate, it also showed connected landscapes are once again an important tool to be used when conserving ecosystems.

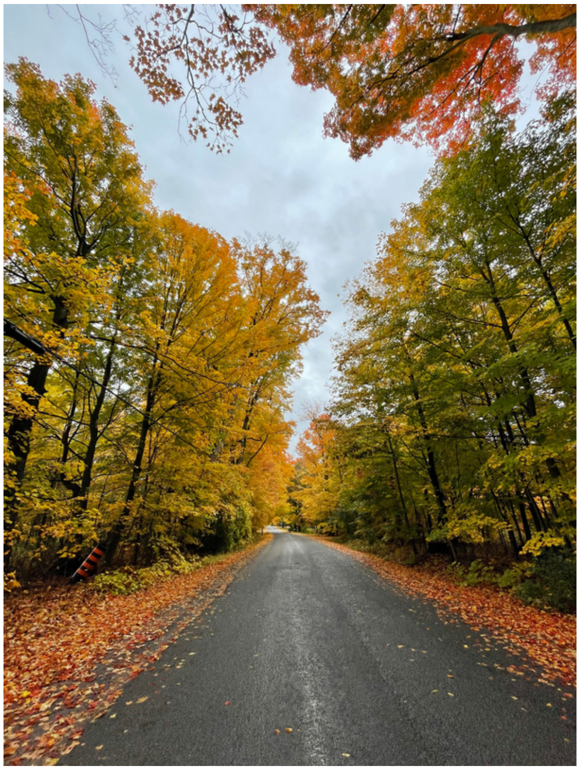


Figure 15: An example of a road on the South Shore of PEC fragmenting the connected land. Photo: Jessica Daze.

CONNECTED LANDSCAPES/HABITAT FRAGMENTATION

IIn much of the literature, one of the main concerns is how to measure whether connectivity can combat fragmentation for a species or community of species. There are a few studies that use modelling approaches that worked for measuring connectivity and fragmentation in the landscape, and they showed how these approaches can be used in many cases to inform decision makers on where best to focus conservation efforts.

A study completed by Allen et al. (2016) on a modeling approach to estimate landscape connectivity for bighorn sheep helps to answer this question. They used an individual-based model to estimate - exploring the simple land-use management tool to help identify and implement landscape connectivity. This study shows **landscape connectivity is a highly recommended strategy to reduce negative effects of climate change and land use development on a species.** By using the example of bighorn sheep, this study shows that this way of estimating landscape connectivity of an individual species and how a species uses a landscape, is a good way to show how conservation scenarios may increase functional connectivity for the species in the study area. *It also is an approach that can help provide support for decision makers seeking to incorporate wildlife conservation and connectivity into land-use planning (Allen et al., 2016).*

Two other studies used similar methods, one based in Prince Edward Island (PEI), Canada completed by Silver (2021), and a larger study looking at more species from all over Canada (Pither et al., 2023). They analyzed functional ecological connectivity to *better inform ecologists and planners where restoration and connectivity conservation efforts could occur, through wildlife crossings, selection/purchase of land for protection and restoration, or managing provincial and federal lands.* The studies used Circuitscape and Linkage Mapper to determine where the movement of all their study species would most likely occur between fragmented habitats.

As previously noted, **fragmentation and the loss of ecological connectivity is considered an important driver of global biodiversity loss,** according to the IPBES Global Assessment Report (2019) and this has been acknowledged by governments around the world. The Pither at al. (2023) study realized that countries will now have to accelerate efforts of increasing ecological connectivity and that federal governments would benefit from country-wide data to help objectively prioritize areas that need conservation. Pither et al. (2023) showed that functional connectivity for multiple species can be modelled across Canada using their approach and should be used in other large planning areas or countries as well to help reach time-bound initiatives and targets, including the ones from the UN Convention on Biological Diversity Post-2020 Global Biodiversity Framework (Pither et al., 2023).

BEST PRACTICES

One of the major pieces of literature that deserves a mention is **the Guidelines for Conserving Connectivity through Ecological Networks and Corridors** published by the IUCN (Hilty et al., 2020). Its purpose was to consolidate best-available practices and the wealth of information on combatting fragmentation and maintaining connectivity. This document states that habitat loss and fragmentation are a leading cause of biodiversity loss worldwide and that improving or sustaining connectivity between protected areas is key for conserving and managing biodiversity. Connectivity is important because it can allow species to respond to range shifts due to climate change or to migrate into protected areas. Gene flow, movement of individuals, metapopulation dynamics, migration, seasonal dispersal and flows of ecological processes are all affected by landscape connectivity (Hilty et al., 2020).

Ecosystems that are connected support migration, water and nutrient cycling, pollination, seed dispersal, food security, climate resilience and disease resistance. Landscape connectivity is important and plays a big role in healthy ecosystems as shown in these guidelines and many other studies. The Guidelines provide detailed instruction on how to plan/implement an ecological corridor by reviewing different aspects - such as basic information, selecting objectives, choosing a governance model, delineating boundaries, and implementing management/ monitoring plans to reach the set objectives. It covers the applications and benefits of ecological corridors in different environments and gives case studies as examples. It also reviews ecological connectivity in government through law and policy. The Guideline was produced to support the growing demand for connectivity conservation, by scientists, policy makers and practitioners.

Every situation is different, and this document provides direction on how to conserve ecological connectivity in all conservation situations in consistent and measurable fashions. Ecological connectivity conservation must be addressed to reach global, regional, and national targets for biodiversity conservation, climate change and environmental sustainability. These guidelines are a tool to help provide direction on how to implement ecological connectivity in different situations (Hilty et al., 2020).

Figure 16: Guidelines for conserving connectivity through ecological networks and corridors. Photo: IUCN.

BEST PRACTICES

Another useful resource that could be used by scientists, planners, land managers, conservation agencies, community groups, students or individuals who are trying to figure out how linkages can play a role in conservation of biodiversity and ecosystems is the book: *Linkages in the Landscape: The Role of Corridors and Connectivity in Wildlife Conservation*, written by Bennet (2003) and put out by the IUCN.

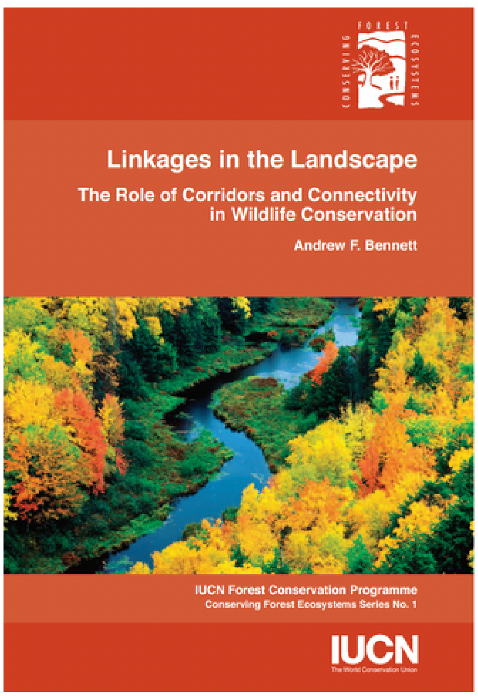
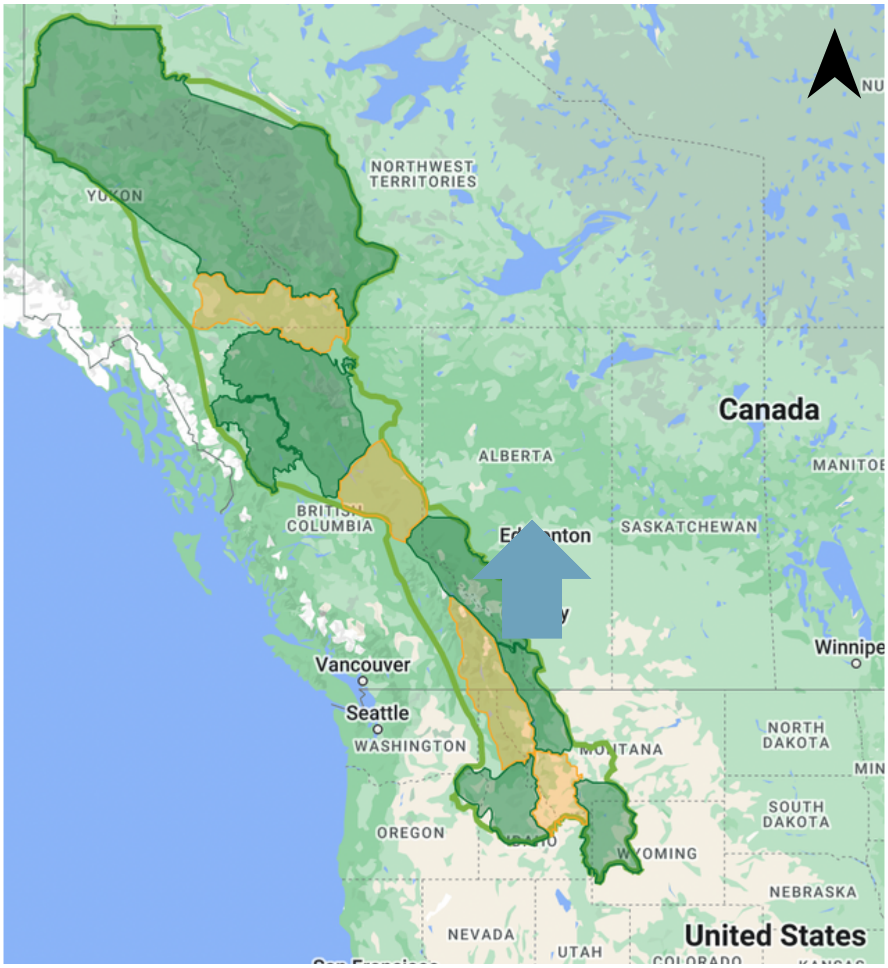


Figure 17: Linkages in the Landscape Resource. Photo: IUCN.

The goal of this resource was to provide an understanding of why landscape connectivity is important, and how conservation of wildlife is benefitted by connectivity, as well as the important issues that should be considered when implementing these concepts into conservation. Bennet uses many real-life examples and case studies from all over the world, showing the array of different circumstances and challenges that wildlife conservation is facing. This book defines the issues, assesses the values of linkages/corridors and evaluates the role of connectivity in conservation strategy. It states that the process of habitat loss and fragmentation has many implications for the conservation of flora and fauna throughout the world, the consequences being the loss of species, changes to composition of the community of species, and changes to ecological processes. It states that to minimize the effects of fragmentation, we must enhance landscape connectivity. Not only does this text give case studies and an assessment of why and when we should be using ecological connectivity as a conservation tool and its role in nature conservation, it also illustrates the diverse ways in which land managers are planning, implementing, or presently managing linkages for conservation as examples (Bennet, 2003).

Figure 18: Beautiful photo of the South Shore of PEC, showing an example of connectivity between habitat patches. The tree lines along the fields are great for connectivity. Photo: Michael Awad.



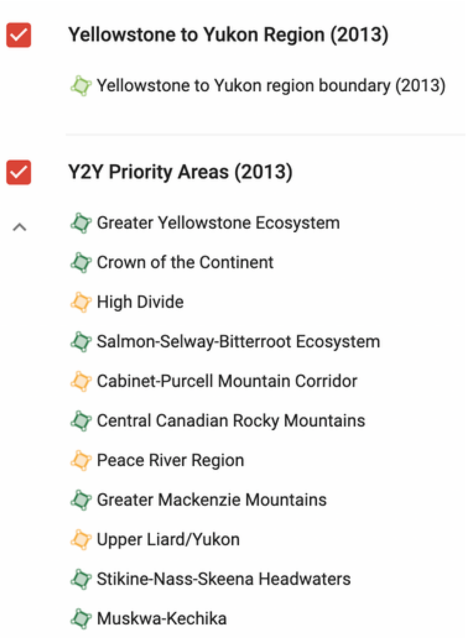


Figure 19: Map of the Yellowstone to Yukon area. "This region remains one of the few remaining intact mountain ecosystems on earth". Photo: Yellowstone to Yukon, Google MyMaps.

One of the biggest and longest-term examples of landscape connectivity is found in the Yellowstone to Yukon (Y2Y) initiative which is a large-landscape conservation strategy that included an interconnected system of wildlands going from Yellowstone to the Yukon. The Wildlands Project and large carnivore conservation was the inspiration for the Y2Y vision, motivated by the decreasing distribution of grizzly bears and gray wolves. Y2Y Conservation Initiative is a collaborative, non-governmental organization with the goal of promoting large-landscape conservation (Chester 2015, Hebblewhite et al., 2021). Hebblewhite et al. (2021) wanted to demonstrate the proof of impacts that this large-landscape conservation vision has produced and to test whether the Y2Y vision contributed to 5 major conservation outcomes in the region. However hard to quantify the impacts of large-scale landscape conservation, this study suggests that it can help enhance area-based biodiversity targets. It also suggests that large-landscape conservation strategies can promote growth of protected area networks globally and help achieve enhanced area-based conservation targets (Hebblewhite et al., 2021). The Y2Y region remains an important area for large mammal diversity in North America and the large-landscape scale conservation is one of the best strategies to continue it on this path (Hebblewhite et al., 2021).

CASE STUDIES: PLANT DIVERSITY

Another long-term study example is an 18-year experiment on plant diversity, through habitat connectivity completed by Damschen et al. (2019). The study showed there is an urgent need for conservation strategies to mitigate biodiversity losses due to habitat fragmentation. They tested long-term effects of habitat connectivity on plant colonization and extinction dynamics by manipulating connectivity through the creation of habitat corridors. Fragments of landscapes were created with some being connected and some not. It was found that when an experimental landscape was connected there were increased rates of colonization and decreased rates of extinction. These rates continue on this path of improving biodiversity and species richness in the experimental habitat patches every year where there is connectivity (Damschen et al., 2019). This long-term experiment continues to show that connected landscapes can help to create and protect biodiverse and healthy ecosystems in not only animal species but also plants. It is important to show that species who do not have a form of more visible movement are also impacted by landscape connectivity.

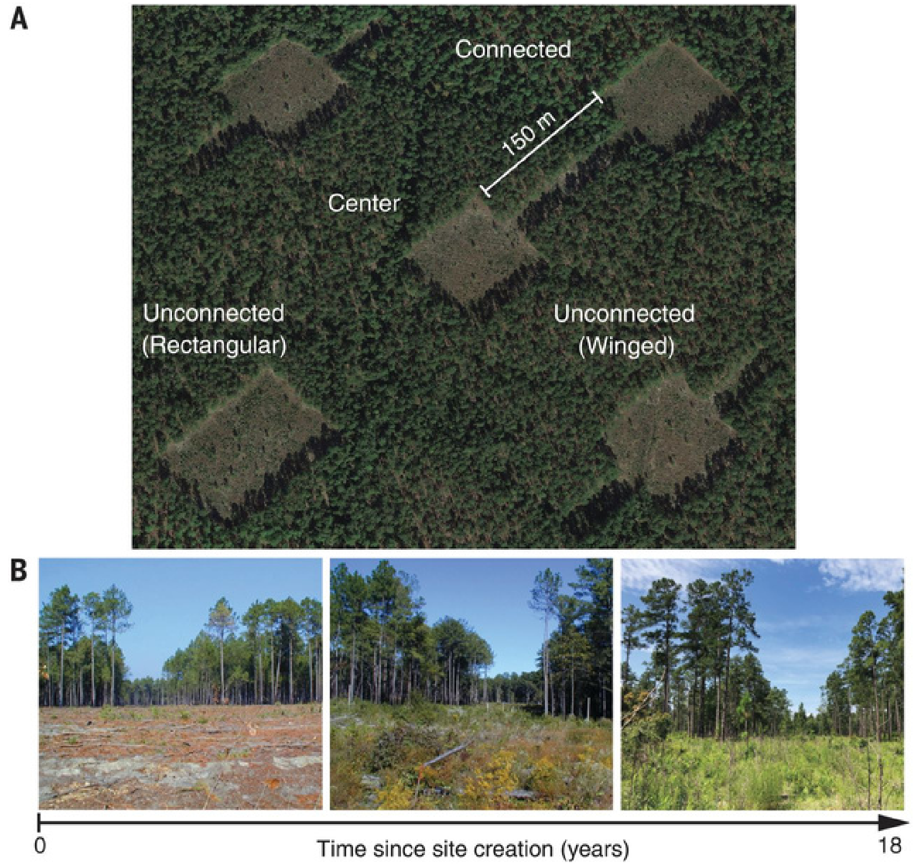


Figure 20: (A) Shows one of the experimental landscapes from the study with connected and unconnected landscapes. Photo: Google Earth 2019, (B) Plant communities within fragments have assembled over nearly two decades and are being restored to native longleaf pine savanna using frequent, low-intensity fires that mimic the historic fire regime. Photo: (left to right): M. A. Burt, N. M. Haddad, and E. I. Damschen. (Damschen et al., 2019)

CASE STUDIES: CANADA

Planning for Long, Wide Conservation Corridors on Private lands in the Oak Ridges Moraine, Ontario, Canada, completed by Whitelaw & Eagles (2007). The Oak Ridges Moraine (ORM) supports many native plant and animal species and is a groundwater recharge and discharge area for some 65 watercourses. It is a glacial landscape feature created by the glacier's advancement and retreats during the Pleistocene. The Oak Ridges Moraine Conservation Act and Plan was passed by the government to protect this important area, in part influenced by advocacy by citizens and the environmental movement, media engagement, political timing and acceptance of conservation biology principles. This was precedent setting in the use of conservation biology as a basis for the legal protection of extensive core areas consisting of environmentally sensitive lands and long, wide conservation corridors that link core areas creating a natural heritage system.

Figure 21: Map of the Oak Ridges Moraine area. Photo: Ontario Government, 2022 https://geohub.lio.gov.on.ca/datasets/oak-ridges-moraine-orm-planning-area/explore

The Toronto and Region Conservation Authority (TRCA) produced a document on the "**Crossing Guideline for Valley and Stream Corridors"** in 2015, which was a document meant to support TRCA partners in the management of natural hazards and natural heritage issues associated with crossings. It supports the infrastructure and transportation infrastructure sections of the Living City Policies for Planning and Development in the Watersheds of the TRCA (TRCA, 2015). The guideline mentions that when designed wisely and appropriately crossings can avoid expensive repairs, channel realignment, or early replacement caused by migrating channels. The guideline takes landscape connectivity into account. It states "Natural heritage functions include existing and potential high-quality aquatic and terrestrial habitat and connectivity for fish and wildlife passage. These functions have become increasingly important in the location and design of valley and stream corridor crossings in recent years." (TRCA, 2015). It is mentioned that the crossings can impact habitat and connectivity, and that is considered when guiding design decisions for the crossings (TRCA, 2015).

CASE STUDIES: CANADA

The Toronto Ravine Strategy takes landscape connectivity into account. One of the largest networks for ravines in the world can be found in Toronto, connecting Oak Ridges Moraine to Lake Ontario, carrying water, wildlife, and people with it. Ravines are vital for biodiversity and ecological health, they are home to forests, wetlands, and savannahs and provide critical habitat for wildlife, are important flyways for migrating birds and they filter/convey stormwater and connect into larger watershed systems. Population growth, new development and climate change asserts pressure on Toronto's ravine networks and a strategy was critical to balance the fine line between protection and use, as well as to identify and prioritize actions and investments needed to ensure that these areas are protected long into the future. This strategy is meant to help support the ravine network around Toronto to continue to be natural and connected for the health and well-being of the city. The strategy is guided by 5 principles, **Protect, Invest, Connect, Partner, and Celebrate**. Protect; for long-term sustainability, ecological function, connectivity, and resilience is the key for the ravines and watersheds. Invest; Managing the pressure on the ravine network, for example population growth and increased recreational use to climate change, weather events and invasive species. Connect: Connect people to nature and history of the city through the ravines, to ensure people appreciate and understand the importance of the ravine systems in Toronto. Partner: Partner up with organizations like the TRCA, municipalities, government, property owners, utility providers, the community, and other stakeholders to create more opportunities for individuals and organizations to contribute to these spaces in meaningful ways. Celebrate; Celebrate and encourage recognition of this amazing ravine system. Ravines are fundamentally natural spaces and need ecological function/resilience in the foundation of long-term sustainability (City of Toronto, nd).

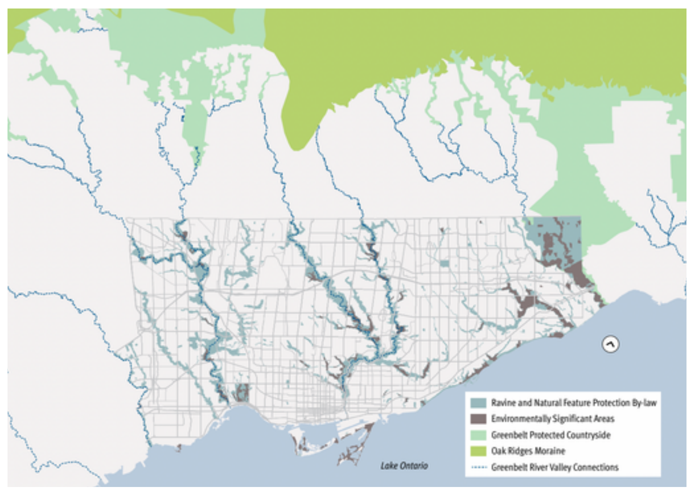


Figure 22: Map of Toronto's Ravine. Photo: City of Toronto.

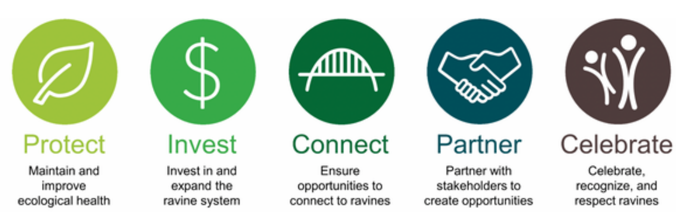


Figure 23: The 5 guiding principles of the Toronto Ravine Strategy. Photo: City of Toronto.

CASE STUDIES: NATURAL HERITAGE PLANS

Some Natural Heritage Plans from municipalities, cities and towns even include or recognize the importance of landscape connectivity.

In the **Region of Waterloo's Natural Heritage Strategy**, in Objectives it states, "General objectives for ecological enhancement and restoration opportunities, some of which have been mentioned in preceding sections, are as follows: improved linkage / connectivity between natural areas" and goes on to speak about more specifics of where connectivity and linkages will be restored or worked on and why they are needed in certain areas (Region of Waterloo, 2018).

The **City of Guelph's Natural Heritage Action Plan** states "To implement a systems approach that ensures that the diversity and connectivity of natural features in the city, and the long-term ecological function and biodiversity of the natural heritage system is managed with recognition of linkages between and among natural heritage features, surface water features and groundwater features." (City of Guelph, 2018).

An example from here in Prince Edward County, is PEC's Official Plan, the Natural Heritage System, Schedule 'B', where the County recognizes the need for landscape connectivity, and goes as far as creating the map (See Figure 1) that shows Natural Core Areas and Natural Core Area Linkages, including the south shore area of Sandbanks Provincial Park through Soup Harbour, Point Petre to Long Point as Natural Core Area and Natural Core Area Linkage. **Even Prince Edward County recognizes this extremely important habitat all the way from Sandbanks PP to Long Point as Ecologically Significant.**



Figure 24: (Photos left to right) Lake Ontario from South Shore. The second photo is Marsh Milkweed. The third is a photo of participants in the FOSS BioBLitz 2023. Photo: Nina-Marie Lister.

CONCLUSIONS

TThis literary review shows us that landscape connectivity is an important tool to be used in conservation, and connectivity should be protected and restored when possible. Connectivity is a widely accepted and essential method of conserving biodiversity in ecosystems, recognized by governments, municipalities, and other organizations all over the world today. It must be addressed to reach global, regional, and national targets for biodiversity conservation, climate change and environmental sustainability (Hilty et al., 2020).

Every connectivity situation is different and using the many conservation tools provided in this literature review, among others, will be an extremely important step in combating the loss of ecological connectivity due to fragmentation, which is a vital driver of global biodiversity loss worldwide (IPBES, 2019).

Ecosystems that are connected support migration, water and nutrient cycling, pollination, seed dispersal, food security, climate resilience and disease resistance, as well as allowing species to respond to range shifts due to climate change or to migrate into protected areas. Gene flow, movement of individuals, metapopulation dynamics, seasonal dispersal and flows of ecological processes are all affected by landscape connectivity (Hilty et al., 2020). As shown in the studies above, landscape connectivity is important and plays a big role in the health and resilience of the ecosystems that surround and support us.

Figure 25: A pair of White-breasted Nuthatches caught at the new Soup Harbour MAPS station (MAPS = Monitoring Avian Productivity and Survivorship), in partnership with FOSS and PEPtBO. Photo: Nina-Marie Lister.

Looking at the preliminary data that has been collected, we can see that the South Shore of PEC matches criteria set out by the IUCN on the Global Standard for Identification of Key Biodiversity Areas, the ecological integrity and threatened species criteria being two of the biggest. With more research and observation of the landscape, there is a high possibility of finding more threatened, natural species, and more information to match the criteria set out for a site to be designated and delineated as a KBA. Currently we can see that the South Shore of PEC is an intact ecological community, which supports large-scale ecological processes and contributes to the global persistence of biodiversity (the ecological integrity criteria). It is an ecosystem that maintains full function, that is natural, intact, and currently largely undisturbed by industrial human influence, allowing species to engage in natural

CONCLUSIONS

movements and allowing for the unimpeded functioning of ecological processes. We see this through the diversity of species that use this area for different parts, or all their life cycles, in the data being collected on the landscape. As for threatened species, Grasshopper Sparrows, Wood Thrush, and Eastern Wood-Pewees are using this area to breed, as they were captured during the breeding season and banded. Other species at risk have been observed using this landscape, for example the Peregrine Falcon, Monarchs, and Blanding's Turtles. Many species of birds fly through and use this area as a stopover site. This is why it is extremely important for the dedicated volunteers, citizen scientists, researchers, and organizations who are already gathering data on the entirety of the South Shore of PEC (from Sandbanks Provincial Park to Long Point) to continue to do so, it creates a better understanding of the flora, fauna and abiotic elements of the area, and furthers the evidence that this biodiverse and connected landscape is extremely important and should be designated and delineated as a Key Biodiversity Area.

There is an urgency worldwide for protecting, conserving, and restoring natural lands and the landscapes that connect them. In Canada, a KBA designation for an area will become a priority for protection in the future as Canada reaches its goal of protecting 30% of its land by 2030.

Figure 26: Photo looking out onto Lake Ontario from Soup Harbour on the South Shore of Prince Edward County. Photo: Nina-Marie Lister.

There is little doubt the South Shore will be designated as a KBA, as mentioned before, but the delineation of the boundaries is yet to be determined. Considering the importance of landscape connectivity as shown in this research and the fact our municipality has recognized the entirety of the South Shore from Sandbanks Provincial Park to Long Point as Natural Core Areas and Natural Core Area Linkages (See Figure 1), we must continue our efforts to show that these ecosystems, habitat patches and corridors are essential to protect.

Figure 27: The group of citizen scientists who participated in the First Annual Friends of the South Shore BioBlitz 2023.

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DEFINITIONS OF TERMS

Landscape Connectivity/Ecological Connectivity: The unimpeded movement of species and the flow of natural processes that sustain life on Earth (CMS, 2020).

Ecological connectivity for species (scientific-detailed definition): The movement of populations, individuals, genes, gametes and propagules between populations, communities and ecosystems, as well as that of non-living material from one location to another (IPBES, 2019).

Functional connectivity for species: A description of how well genes, gametes, propagules or individuals move through land, freshwater and seascape (IPBES, 2019).

Structural connectivity for species: A measure of habitat permeability based on the physical features and arrangements of habitat patches, disturbances, and other land, freshwater or seascape elements presumed to be important for organisms to move through their environment. Structural connectivity is used in efforts to restore or estimate functional connectivity where measures of it are lacking (IPBES, 2019).

Corridor: A clearly defined geographical space that is governed and managed over the long term to maintain or restore effective ecological connectivity. The following terms are often used similarly: ‘linkages’, ‘safe passages’, ‘ecological connectivity areas’, ‘ecological connectivity zones’, and ‘permeability areas’ (IPBES, 2019).

Network (for conservation): A system of core habitats (protected areas and other intact natural areas), connected by ecological corridors, which is established, restored as needed and maintained to conserve biological diversity in systems that have been fragmented (IPBES, 2019).

Biodiversity Loss: The reduction of any aspect of biological diversity (i.e. diversity at the genetic, species and ecosystem levels) is lost in a particular area through death (including extinction), destruction or manual removal; it can refer to many scales, from global extinctions to population extinctions, resulting in decreased total diversity at the same scale (IPBES, 2018).

Resilience: The level of disturbance that an ecosystem can undergo without crossing a threshold to a situation with different structure or outputs. Resilience depends on factors such as ecological dynamics as well as the organizational and institutional capacity to understand, manage and respond to these dynamics (IPBES, 2019).

DEFINITIONS OF TERMS

Restoration: Any intentional activity that initiates or accelerates the recovery of an ecosystem from a degraded state. Active restoration includes a range of human interventions aimed at influencing and accelerating natural successional processes to recover biodiversity ecosystem service provision. Passive restoration includes reliance primarily on natural process of ecological succession to restore degraded ecosystems, but may include measures to protect a site from processes that currently prevent natural recovery (e.g. protection of degraded forests from overgrazing by livestock or unintentional human-induced fire) (IPBES, 2019).

Migration: Seasonal movement of animals from one region to another for food, breeding, etc (IPBES, 2018)

Genetic Diversity: The variation at the level of individual genes, which provides a mechanism for populations to adapt to their ever-changing environment. The more variation, the better the chance that at least some of the individuals will have an allelic variant that is suited for the new environment and will produce offspring with the variant that will in turn reproduce and continue the population into subsequent generations (IPBES, 2019).

APPENDIX A

Table 1: Bird species caught and banded at the Soup Harbour Monitoring Avian Productivity and Survivorship Station in 2023.

Bird	4-letter Alpha Code	Number of Banded Individuals
American Bittern	AMBI	1
Downy Woodpecker	DOWO	6
Hairy Woodpecker	HAWO	2
Pileated Woodpecker	PIWO	1
Eastern Wood-Pewee (Special Concern – Ontario, Canada)	EAWP	3
Trails Flycatcher	TRFL	4
Least Flycatcher	LEFL	2
Eastern Phoebe	EAPH	1

APPENDIX A

Table 1: Bird species caught and banded at the Soup Harbour Monitoring Avian Productivity and Survivorship Station in 2023.

Bird	4-letter Alpha Code	Number of Banded Individuals
Trails Flycatcher	TRFL	4
Least Flycatcher	LEFL	2
Eastern Phoebe	EAPH	1
Great-crested Flycatcher	GCFL	1
Warbling Vireo	WAVI	5
Red-eyed Vireo	REVI	7
Blue Jay	BLJA	1
Black-capped Chickadee	BCCH	7

APPENDIX A

Table 1: Bird species caught and banded at the Soup Harbour Monitoring Avian Productivity and Survivorship Station in 2023.

Bird	4-letter Alpha Code	Number of Banded Individuals
White-breasted Nuthatch	WBNU	2
House Wren	HOWR	1
Wood Thrush (Special Concern – Ontario, Threatened – Canada)	WOTH	5
American Robin	AMRO	9
Gray Catbird	GRCA	14
Cedar Waxwing	CEDW	2
Nashville Warbler	NAWA	1
Yellow Warbler	YEWA	41

APPENDIX A

Table 1: Bird species caught and banded at the Soup Harbour Monitoring Avian Productivity and Survivorship Station in 2023.

Bird	4-letter Alpha Code	Number of Banded Individuals
Chestnut-sided Warbler	CSWA	1
American Redstart	AMRE	3
Ovenbird	OVEN	3
Northern Waterthrush	NOWA	2
Common Yellowthroat	COYE	13
Grasshopper Sparrow (Special Concern – Ontario)	GRSP	4
Field Sparrow	FISP	1
Song Sparrow	SOSP	79

APPENDIX A

Table 1: Bird species caught and banded at the Soup Harbour Monitoring Avian Productivity and Survivorship Station in 2023.

Bird	4-letter Alpha Code	Number of Banded Individuals
Swamp Sparrow	SWSP	17
Northern Cardinal	NOCA	1
Rose-breasted Grosbeak	RBGR	3
Indigo Bunting	INBU	8
Red-winged Blackbird	RWBL	8
Baltimore Oriole	BAOR	2
American Goldfinch	AMGO	1

APPENDIX A

Table 1: Bird species caught and banded at the Soup Harbour Monitoring Avian Productivity and Survivorship Station in 2023.

Totals	**Individual Total**	**258**
	Species Total	**35**

APPENDIX B

First Annual, Friends of South Shore, Soup Harbour BioBlitz Results

Table 1: Confirmed Observations from iNat, or observations from eBird. Pink writing means that the species observed is Introduced to Prince Edward County, Ontario. Red writing means that the species is of concern in Ontario or Canada.

Number of Species Observed	Species: Common Name	Species: Scientific Name	SAR? Rare?	Research Grade?
1	Eastern Giant Swallowtail	Heraclides cresphontes		Yes
2	Swamp Milkweed	Asclepias incarnata		Yes
3	Dekay's Brownsnake	Storeria dekayi		Yes
4	Virginia Tiger Moth	Spilosoma virginica		Yes
5	Western Chorus Frog	Pseudacris triseriata		Yes
6	Common Boneset	Eupatorium perfoliatum		Yes
7	Summer Azure	Celatrina neglecta		Yes

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Table 1: Confirmed Observations from iNat, or observations from eBird. Pink writing means that the species observed is Introduced to Prince Edward County, Ontario. Red writing means that the species is of concern in Ontario or Canada.

Number of Species Observed	Species: Common Name	Species: Scientific Name	SAR? Rare?	Research Grade?
8	Blue-spotted Salamander	Ambystoma lateral		Yes
9	Common Wood-Nymph	Cercyonis pegala		Yes
10	Cabbage White	Pieris rapae	Introduced	Yes
11	Widow Skimmer	Libellula luctuosa		Yes
12	Grey Treefrog	Hyla versicolor		Yes
13	Least Skipper	Ancyloxypha numitor		Yes
14	Red Admiral	Vanessa atalanta		Yes

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First Annual, Friends of South Shore, Soup Harbour BioBlitz Results

Table 1: Confirmed Observations from iNat, or observations from eBird. Pink writing means that the species observed is Introduced to Prince Edward County, Ontario. Red writing means that the species is of concern in Ontario or Canada.

Number of Species Observed	**Species: Common Name**	**Species: Scientific Name**	**SAR? Rare?**	**Research Grade?**
15	White-faced Meadowhawk	Sympetrum obtrusum		Yes
16	Common Ringlet	Coenonympha california		Yes
17	Clouded Sulphur	Colias philodice		Yes
18	Northern Leopard Frog	Lithobates pipiens		Yes
19	Eastern Forktail	Ischnura verticalis		Yes
20	Turkey Vulture	Cathartes aura		Yes
21	Viceroy	Limenitis archippus		Yes

APPENDIX B

First Annual, Friends of South Shore, Soup Harbour BioBlitz Results

Table 1: Confirmed Observations from iNat, or observations from eBird. Pink writing means that the species observed is Introduced to Prince Edward County, Ontario. Red writing means that the species is of concern in Ontario or Canada.

Number of Species Observed	Species: Common Name	Species: Scientific Name	SAR? Rare?	Research Grade?
22	Mute Swan	Cygnus olor	Introduced	Yes
23	Monarch	Danaus plexippus	Vulnerable in Canada	Yes
24	False Solomon's Seal	Maianthemum racemosum		Yes
25	Bird's-foot Trefoil	Lotus corniculatus	Introduced	Yes
26	Broadleaf Arrowhead	Sagittaria latifolia		Yes
27	Bittersweet Nightshade	Solanum dulcamara	Introduced	Yes
28	Riverbank Grape	Vitis riparia		Yes

APPENDIX B

First Annual, Friends of South Shore, Soup Harbour BioBlitz Results

Table 1: Confirmed Observations from iNat, or observations from eBird. Pink writing means that the species observed is Introduced to Prince Edward County, Ontario. Red writing means that the species is of concern in Ontario or Canada.

Number of Species Observed	Species: Common Name	Species: Scientific Name	SAR? Rare?	Research Grade?
29	Buttonbush	Cephalanthus occidentalis		Yes
30	Marsh Cinquefoil	Comarum palustre		Yes
31	Yellow Salsify	Tragopogon dubius	Introduced	Yes
32	Quagga Mussel	Dreissena bugensis	Introduced	Yes
33	Yellow Sweetclover	Melilotus officinalis	Introduced	Yes
34	Asian Lady Beetle	Harmonia axyridis	Introduced	Yes
35	Canadian Beaver	Castor canadensis		Yes
36	Butter-and-Eggs	Linaria vulgaris	Introduced	Yes

APPENDIX B

First Annual, Friends of South Shore, Soup Harbour BioBlitz Results

Table 1: Confirmed Observations from iNat, or observations from eBird. Pink writing means that the species observed is Introduced to Prince Edward County, Ontario. Red writing means that the species is of concern in Ontario or Canada.

Number of Species Observed	Species: Common Name	Species: Scientific Name	SAR? Rare?	Research Grade?
37	White Sweet-Clover	Melilotus albus	Introduced	Yes
38	Fragrant Sumac	Rhus aromatica		Yes
39	Yellow-collared Scape Moth	Cisseps fulvicollis		Yes
40	Ditch Stonecrop	Penthorum sedoides		Yes
41	Sugar Maple	Acer saccharum		Yes
42	Mayapple	Podophyllum peltatum		Yes
43	Shield Lichen	Parmelia sulcata		Yes
44	Bitternut Hickory	Carya cordiformis		Yes

APPENDIX B

First Annual, Friends of South Shore, Soup Harbour BioBlitz Results

Table 1: Confirmed Observations from iNat, or observations from eBird. Pink writing means that the species observed is Introduced to Prince Edward County, Ontario. Red writing means that the species is of concern in Ontario or Canada.

Number of Species Observed	Species: Common Name	Species: Scientific Name	SAR? Rare?	Research Grade?
45	Rough Cocklebur	Xanthium strumarium		Yes
46	Great Mullein	Verbascum thapsus L.	Introduced	Yes.
47	Spotted Cucumber Beetle	Diabrotica undecimpunctata		Yes
48	Red Clover	Trifolium pratense	Introduced	Yes
49	Spotted Jewelweed	Impatiens capensis		Yes

APPENDIX B

Table 2: Other observations from iNaturalist that have yet to be determined as Research Grade, but have the potential to be when Naturalists who are confident with the Identifications confirm that is what the species is. Pink writing means that the species observed is Introduced to Prince Edward County, Ontario. Red writing means that the species is of concern in Ontario or Canada.

Number of Species Observed	Species: Common Name	Species: Scientific Name	SAR? Rare?	Research Grade?
1	Orange Mycena	Mycena leaiana		Not Yet
2	Common Eyelash	Scutellinia scutellata		Not Yet
3	White-spotted Sable	Anania funebris		Not Yet
4	Eastern Cicada-killer Wasp	Sphecius speciosus		Not Yet
5	Buffalo Treehopper	Stictocephala bisonia		Not Yet
6	Green Burgundy Stink Bug	Banasa dimidiata		Not Yet
7	Carolina Grasshopper	Dissosteira carolina		Not Yet

APPENDIX B

Table 2: Other observations from iNaturalist that have yet to be determined as Research Grade, but have the potential to be when Naturalists who are confident with the Identifications confirm that is what the species is. Pink writing means that the species observed is Introduced to Prince Edward County, Ontario. Red writing means that the species is of concern in Ontario or Canada.

Number of Species Observed	Species: Common Name	Species: Scientific Name	SAR? Rare?	Research Grade?
8	Candy Apple Waxy Cap	Hygrocybe cuspidata		Not Yet
9	Sulphur Cinquefoil	Potentilla recta		Not Yet
10	Bitter Lettuce	Lactuca virosa	Introduced	Not Yet
11	Common Evening-Primrose	Oenothera biennis		Not Yet
12	White Coral Jelly Fungus	Sebacina sparassoidea		Not Yet
13	Pale Smartweed	Persicaria lapathifolia		Not Yet
14	Floating Marsh-Marigold	Caltha natans		Not Yet

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Number of Species Observed	Species: Common Name	Species: Scientific Name	SAR? Rare?	Research Grade?
15	Blistered Cup	Peziza vesiculosa		Not Yet
16	Water Parsnip	Sium suave		Not Yet
17	Wild Carrot	Daucus carota	Introduced	Not Yet
18	Water Smartweed	Persicaria amphibia		Not Yet
19	Herb Robert	Geranium robertianum		Not Yet
20	American Searocket	Cakile edentula		Not Yet
21	Early Meadow-Rue	Thalictrum dioicum		Not Yet
22	Eastern Redcedar	Juniperus virginiana		Not Yet

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Number of Species Observed	Species: Common Name	Species: Scientific Name	SAR? Rare?	Research Grade?
23	Canada Wild Rye	Elymus canadensis		Not Yet
24	Perennial Sow Thistle	Sonchus arvensis		Not Yet
25	Red Osier Dogwood	Cornus sericea		Not Yet
26	Fox Sedge	Carex vulpinoidea		Not Yet

APPENDIX B

Table 3: Observations from iNaturalist where the observer could only get the identification down to Family or Genus. Needs further identification, but they are different species. Pink writing means that the species observed is Introduced to Prince Edward County, Ontario. Red writing means that the species is of concern in Ontario or Canada.

Number of Species Observed	Species: Common Name	Species: Scientific Name	SAR? Rare?	Research Grade?
1	Crescent sp.	Genus Phyciodes		Needs ID
2	Wolf Spiders sp.	Family Lycosidae		Needs ID
3	North American Spur-throated Grasshoppers	Genus Melanoplus		Needs ID
4	Clavulinopsis aurantiocinnabarina (a member of Antler and Spindle Fungi)	Family Clavariaceae		Needs ID
5	Viper's-Buglosses	Genus Echium		Needs ID
6	Fleabanes and Horseweeds sp.	Genus Erigeron		Needs ID
7	St. John's-Worts	Genus Hypericum		Needs ID

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Number of Species Observed	Species: Common Name	Species: Scientific Name	SAR? Rare?	Research Grade?
8	Cattails	Genus Typha		Needs ID
9	False Bindweeds	Genus Calystegia		Needs ID
10	Ashes sp.	Genus Fraxinus		Needs ID
11	Burdocks sp.	Genus Arctium	Introduced	Needs ID
12	Water Horehounds	Genus Lycopus		Needs ID
13	Plume Thistles	Genus Cirsium		Needs ID
14	Dogwoods	Genus Cornus		Needs ID
15	American Asters	Genus Symphyotrichum		Needs ID
16	Wild Lettuces	Genus Lactuca		Needs ID

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Number of Species Observed	**Species: Common Name**	**Species: Scientific Name**	**SAR? Rare?**	**Research Grade?**
17	Blue Cohoshes	Genus Caulophyllum		Needs ID
18	Mint Family	Family Lamiaceae		Needs ID
19	Raspberry	Genus Rubus		Needs ID
20	Goldenrods	Genus Solidago		Needs ID
21	Bur-Reeds	Genus Sparganium		Not Yet
22	Willows	Genus Salix		Not Yet

APPENDIX B

Table 4: The results from the two eBird Lists from the BioBlitz. Red writing means that the species is of concern in either Ontario or Canada.

Number of Observations	Common Name (number observed)	Scientific Name	SAR?
1	Mallard (3)	Anas platyrhynchos	
2	Herring Gull (2)	Larus argentatus	
3	Sharp-shinned Hawk (1)	Accipiter striatus	
4	Peregrine Falcon (1)	Falco peregrinus	Special Concern (Ontario)
5	Least Flycatcher (1)	Empidonax minimus	
6	Blue Jay (1)	Cyanocitta cristata	
7	Common Raven (1)	Corvus corax	
8	Cliff Swallow (2)	Petrochelidon pyrrhonota	

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Table 4: The results from the two eBird Lists from the BioBlitz. Red writing means that the species is of concern in either Ontario or Canada.

Number of Observations	**Common Name (number observed)**	**Scientific Name**	**SAR?**
9	Cedar Waxwing (1)	Bombycilla cedrorum	
10	Song Sparrow (2)	Melospiza melodia	