Park Watch Guide

Citizen Science in Public Green Spaces

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EcoSpark
Park Watch Guide:
Citizen Science in Public Green Spaces

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Design by comet art + design

Visitors to the Annual Spring Bird Festival at Colonel Sam Smith Park in Etobicoke, ON (Toronto and Region Conservation Authority 2018)

CONTENTS

Introduction

WHAT IS THE PARK WATCH GUIDE?

This Park Watch Guide helps volunteers lead outdoor citizen science activities in public green spaces. It was developed by EcoSpark, in consultation with Park People and the City of Toronto, as part of the Park Watch project to animate Toronto's public green spaces through citizen science. This project enables volunteers to support the health and maintenance of public parks and ravines, foster a stronger connection to our public green spaces and contribute scientifically meaningful data at municipal, provincial and national scales.

This Park Watch Guide is available for free at **www.ecospark.ca**. It includes:

1. an overview of **Citizen Science**, a participatory approach to environmental research where participants learn about local green space by contributing to real studies;

2. a volunteer's **Step-by-Step Guide** to conducting citizen science research with other park volunteers and the general public;

3. recommended **Citizen Science Projects** and everything you need to know to implement them outside with participants of all ages. Find pollinators, measure tree canopy, map habitat and more! Projects are listed below with the links you need to get started. The Resources section of each project listing highlights any associated activity plans, project-based education resources and stewardship extension ideas; and

4. **Additional Resources**, including links to educational resources about environmental topics, funding sources for outdoor activities and more about citizen science.

The Humber River near Lake Ontario at Sir Casimir Gzowski Park in Toronto, ON (EcoSpark, ON)

WHO IS THIS GUIDE FOR?

This Park Watch Guide was developed for park volunteers interested in facilitating real environmental monitoring projects in public green spaces. The focus of this guide is Toronto, Ontario. However, park groups everywhere may find the Park Watch Guide resources helpful for implementing citizen science activities with volunteers and the general public.

WHAT IS ECOSPARK?

EcoSpark empowers people to take an active role in protecting and sustaining nature. We do this by giving people the tools for education, monitoring and influencing positive change. Together, we create a healthy environment for all.

EcoSpark was founded in 1996 by prominent scientists, including Dr. Ursula Franklin, in response to provincial budget cuts in environmental monitoring. Since then, EcoSpark has connected youth and their communities with scientific ideas and skills for environmental monitoring. We have a strong reputation in the areas of education, citizen science, community engagement and collaboration. To date, we have directly worked with over 76,000 youth and adults from across southern Ontario in over 20 watersheds.

EcoSpark is a registered charity (Charitable Registration Number 86505 8721 RR0001).

Citizen scientists from Student School (TDSB) participating in EcoSpark's Changing Currents program in Étienne Brûlé Park, Toronto, ON (EcoSpark 2018)

Citizen Science

Citizen science is real scientific research conducted by volunteers. It is public participation in science, often in collaboration with professional scientists. A citizen refers to a citizen of the world, and there are citizen scientists of all ages and experience levels. A citizen science project could be local or international, large or small, developed by professionals or created by anyone interested in answering any type of scientific question.

While you can conduct citizen science activities as a park group or individual, you can also weave them into nature walks or events for the general public. Leading visitors will allow you to experience the park with new eyes and can provide concentrated person power for monitoring projects. For additional resources about citizen science, see Appendix.

PREVENTING DISTURBANCE WHILE MONITORING

It is important to acknowledge and minimize impacts on the natural environment while participating in citizen science. For example, consider the difference between observing a tree along an official trail or mown area versus a tree in a forested area. By stepping off a trail into the woods, alone or with a group, you risk trampling vegetation, compacting the soil and creating new informal trails that result in significant damage to

Native vegetation and other habitat features of pollinator gardens, mapped by citizen scientists from across North America using the Habitat Network website (Habitat Network 2018)

natural areas. Going off trails also risks introducing or spreading invasive species. Volunteers should stay on maintained parkland and official trails. Citizen scientists can prevent harm by practicing Leave No Trace principles (dispose of waste properly, respect wildlife, leave what you find, be considerate of others, etc., available at **www.leavenotrace.ca/principles**).

According to the City of Toronto Parks Bylaw (*Toronto Municipal Code, Chapter 608*), it is prohibited to injure, destroy or remove any plant material (trees, shrubs, flowers, fungus, etc.); move or remove any woody material, rocks or soil; or enter into restricted areas. In a city of nearly three million people, every footprint has an impact. Citizen science activities on City of Toronto parkland are limited to passive data collection, which can be done on mown grass parkland or official trails. Any other types of activities would require a special permit. For more information, contact your Park Supervisor (find contacts by emailing **311@toronto.ca** or calling 311) and email **greentoronto@toronto.ca**.

CITIZEN SCIENCE TO PROMOTE HUMAN AND ENVIRONMENTAL HEALTH

Citizen science is a way for people to "give back" to the ecosystems that support life by paying attention to their closest patch of nature — right in their local park. Volunteers contribute valuable environmental monitoring

data to inform conservation efforts while acquiring new skills, building community connections with other participants, and enjoying active time spent outdoors.

Restored urban green space is critical for ecosystem functions and human health (Zupancic, Tara et al., *Green City: Why Nature Matters to Health*. Toronto Public Health, 2013). Urban parks and ravines face multiple threats, from invasive species to climate change. The environmental monitoring activities featured in this guide show steps groups can take to contribute baseline data about park ecosystems and chart trends over time. This information can be used to inform stewardship actions and policies that promote ecological health of public spaces.

By taking part in environmental monitoring activities like regular wildlife surveys, citizen science participants can engage in outdoor exercise and gain new opportunities to connect with nature. This Park Watch Guide features several projects that also provide tools to help build naturalist communities with other volunteers. People can work together on projects, share results with others on online maps (for example, explore reptile and amphibian maps at **www.ontarionature.org/atlas**), and even connect virtually with expert naturalists on community forums like iNaturalist's (**www.iNaturalist.org**). Citizen scientists are a global network of volunteers!

Eastern red-backed salamander
© Joe Crowley (Ontario Nature 2018)

WORKING WITH CHILDREN

Park groups express concerns that children aren't engaged in nature. Citizen science is an excellent way to involve kids in nature activities. Many citizen science projects have developed fun activities for children and youth that introduce environmental topics and get them involved as real scientists — an empowering role!

Studying nature means spending time outside. It builds a sense of awe for the natural world and promotes outdoor inquiry. Citizen science children's author Loree Griffin Burns points out, "Living close to the earth, being observant, and staying focused are excellent traits for a scientist to have," and these are traits kids come by naturally (see Further Reading).

Children are important contributors in citizen science. Many projects produce findings of publishable quality using observation data collected by people of all ages (see, for example, **NatureWatch** and **eBird** publications).

Can you remember inspiring experiences as a child outdoors? How can you draw from your own motivations as a lover of nature to help other people — including young people — get involved? Citizen science projects can provide a jumping off point to help you lead an activity where everyone learns together.

Explore multiple perspectives on environmental education to help any young people you work with connect with green space. The Further Reading section includes informal education resources for the outdoors. EcoSpark's School Watch Guide, available at **www.ecospark.ca/school-watch**, has additional resources for using citizen science in environmental education. The School Watch Guide also provides safety tips, group management strategies, age-appropriate activities and other practical suggestions for leading citizen science projects with children.

Children participating in Bird Studies Canada projects at Dell Park in Toronto, ON. EcoSpark facilitated citizen science with students from Our Lady of the Assumption Catholic School and their teacher, Vincent Sgambelluri (EcoSpark 2018)

SAFETY CONSIDERATIONS

Citizen science encourages people to explore green space in new ways. Use common sense for the outdoors during citizen science activities. Check your park group's guidelines and policies regarding activities you facilitate with the public, including first aid procedures and insurance coverage. In addition, there are municipal regulations that pre-determine the types of activities allowed in public green space (see Learn about your study area, below).

Read each project's protocols and cautions in advance which may alert you to any particular issues like outdoor allergen triggers (stinging insects, for example). Use caution with specialized equipment (sharp edges, for example).

Particularly when working with children, be aware of hazards including adverse weather, poison ivy, and extra risks when monitoring near traffic or water. Set clear site boundaries and meeting points in advance. Ensure everyone has adequate water and sun protection in hot weather and layered clothing with boots in the cold.

Be mindful of digital privacy. Note that some citizen science projects ask for personal identifying information (name) or contact information (e-mail address) to set up an account. Some projects have age restrictions for account holders. Don't include photos of participants without permission when collecting citizen science data. Read each project's data policies on its website to learn what information will be shared with other project participants, researchers, or the public. Park volunteers can submit data collected with a group without including personal identifying information by creating and managing a group account for the project.

Step-by-Step Guide

This guide will help you plan and lead a citizen science project start to finish. You will start by exploring your park (or other green space) and learning about the local context for potential research ideas. Next, you'll plan a project by developing a study question with project participants, choosing a site, and reviewing protocols. Then, gather materials and head outside for data collection! Data entry starts right in the field, followed by analysis. Finally, your group can share results with others and use citizen science research to inform stewardship and spark positive action for the environment.

EXPLORE THE PARK

Visit natural features of your park to begin brainstorming citizen science ideas. What type of green spaces does your park have? Gardens, forests and wetlands all have an important role in ecosystem health. For example, these natural areas provide food and shelter for wildlife, improve water quality and may contribute to green space corridors by connecting to other natural areas in the landscape. The projects in this guide were selected to suit a wide range of public green spaces.

If you feel your park is lacking in natural elements, remember that citizen science data is just as valuable in impaired ecosystems as in healthy ones. Your activity could spark a campaign for improving green space at your park. Even mown areas and street trees have ecological value in urban environments, so consider any unpaved area for its potential to be part of a citizen science study.

Dandelions observed in a PlantWatch project at Wychwood Barns Park in Toronto, ON (EcoSpark 2018)

Don Valley ravine in the Parkway Forest neighbourhood of Toronto, ON (EcoSpark, 2018)

Learn about your study area

Before starting any citizen science programs or activities in an area, make sure you know who owns the land, who manages it and whether there are any regulations or restrictions that may affect your project. Each level of government manages public parklands, from federally controlled national parks down to neighbourhood parks run by local municipalities. Government websites for your municipality should have contact information for the Park Supervisor or management office.

Also, take the time to understand the sensitivities of the parkland you are looking to study. Is it a natural area? A meadow? A manicured park? These questions will have bearing on what type of project activities are appropriate and will affect how you proceed with approvals.

Consider the green space history and ties to existing projects to learn about local context for your project. What watershed are you in? Is the green space part of a larger wildlife corridor? Check the Resources sections in the Citizen Science Projects, for maps showing nearby wildlife activity (for example, see The Ontario Butterfly Atlas Online at **www.ontarioinsects.org/atlas**). You can also visit other nearby parks if they have undertaken citizen science (find other park volunteer groups by contacting your municipality or Park People at **www.parkpeople.ca**).

Conduct a social scan in addition to an environmental scan. Consider how your park's users and the broader community relate to the park. What nearby populations use the park currently or could potentially be partners in outdoor activities? Community centres, schools, religious organizations and other neighbours may be potential partners and participants in park citizen science activities. See if there are any naturalists or local experts in the park community who can provide support or expertise to the project. You can scan Ontario Nature's Nature Network to see if there is a naturalist group near you (**https://ontarionature.org/about/nature-network**).

PARKLAND IN TORONTO

Parkland in Toronto is usually owned by the City of Toronto or the Toronto and Region Conservation Authority in the case of most ravine land, and managed by the City's Parks, Forestry and Recreation Division. The City's Parks Bylaw (*Toronto Municipal Code, Chapter 608*) governs acceptable uses of public parkland and will help guide citizen science activities. Your immediate contact for your park will be the local Park Supervisor. If you haven't already connected with your Park Supervisor, call 311 to get their name and contact information. They may be able to provide information and support for your project. To see a map of your park in relation to the Natural Heritage System and other designations, visit **http://map.toronto.ca/maps/map.jsp?app=TorontoMaps_v2**. If you are planning any activities that involve natural spaces in your park (forests, wetlands, meadows, streams/rivers), you are encouraged to contact Urban Forestry's Natural Environment and Community Programs office at **greentoronto@toronto.ca** to ensure your activities are appropriate for sensitive ecosystems.

Measuring pollinator habitat (EcoSpark 2018)

PLAN A PROJECT

Develop a study question

Citizen science in public space should be organized around a motivating study question. What are you interested in learning about the environment at your park? This Park Watch Guide has citizen science projects for every season and every type of green space. Start by exploring the Citizen Science Projects.

Decide in advance what your group will do with the information you collect. Some projects have guidance on using citizen science contributed data to inform stewardship actions, for example. Are you interested in answering a specific question about the ecological health of your park? Bear in mind that it can take many years of repeated monitoring to get a large enough sample size for answering a question, but many small datasets contributed by large numbers of citizen scientists may offer a more complete picture than any individual researcher could achieve.

When choosing a study question, you will also need to decide how a citizen science project fits your group's planning needs. Is your volunteer base most active in summer or winter? Use the Timing section in project listings to plan engaging monitoring activities accordingly. If you are interested in a certain topic, monitoring might ideally occur in a particular season or seasons. For example, plants are easier to identify and monitor with the PlantWatch project from spring till fall.

EXAMPLES OF CITIZEN SCIENCE STUDY QUESTIONS

» How many bird species will our group observe in a 1 kilometre walking survey along a park trail?
» When do we observe the first spring buds of native plants blooming at a site in our park?
» How many pollinators are counted before and after a pollinator garden is planted?
» Which amphibian species are heard during weekly evening surveys of wetlands throughout the breeding season?
» How much precipitation falls on our park in one week, one month, and one year?

Select activities

Once you select a project or projects, use the How to Participate and Resources sections of each project listing to find or create activities that can be conducted with other park volunteers or with members of the general public. All of the citizen science projects in the Park Watch Guide have easy-to-follow protocols to help you conduct specific monitoring activities. Some projects also include ready-made educational materials for introducing topics to children. PlantWatch, TD Tree Bee, or Bird Studies Canada projects are good projects to start with if you are interested in accessing lots of educational material for programs with the public. Other projects have resources that show how your citizen science data contributes to conservation and stewardship. This material is listed in each project's Resources section. For example, Ontario Nature's website (**www.ontarionature.org**) includes a wealth of information about conservation efforts, including initiatives related to the Ontario Reptile and Amphibian Atlas citizen science project. For ideas on additional resources to explore environmental topics for any project, see Appendix.

The type of project you select will depend on your group's current capacity and your goals for monitoring. Look for opportunities to monitor changes, such as before and after nearby construction occurs. A citizen science project is a good fit if you can complete it start to finish. Not only will the data be more valuable, participants will benefit from seeing projects that have a "before and after" component or from creating solid baseline data which can spark an impetus to improve and take action. In the Citizen Science Project listings, use the How to Participate and Resources sections to find activities of different lengths to match your needs.

In deciding when to monitor, note that project lengths can grow according to your interests from 15 minutes to multi-year monitoring.

Many projects allow you to register your location and keep track of data so you can revisit the same project in later seasons or years, building a more complete dataset as you go. You can schedule repeat monitoring days by spreading the work across several volunteers using a group calendar. Communicate monitoring activities with a virtual field notebook or by using shared accounts on project websites.

Diagram for educating PlantWatch participants about botanical features (NatureWatch Canada 2018)
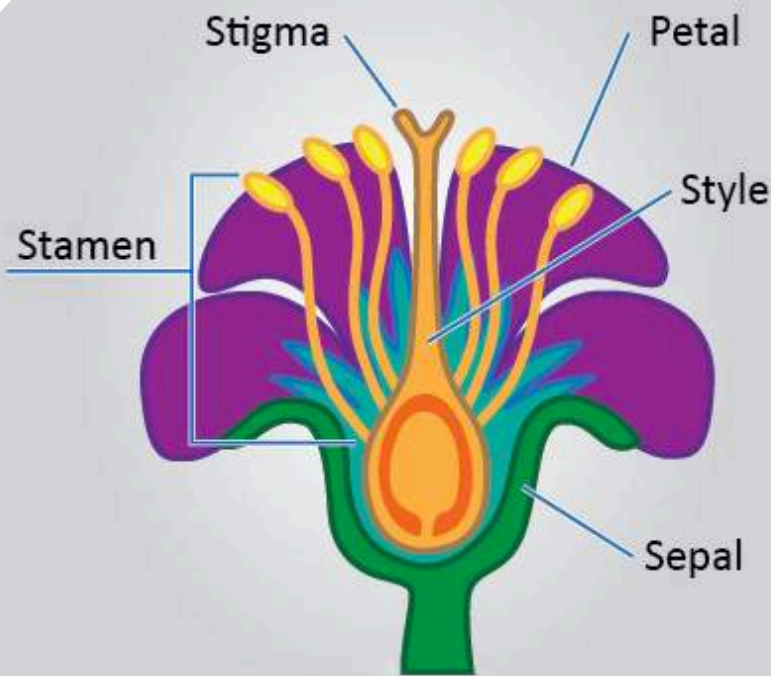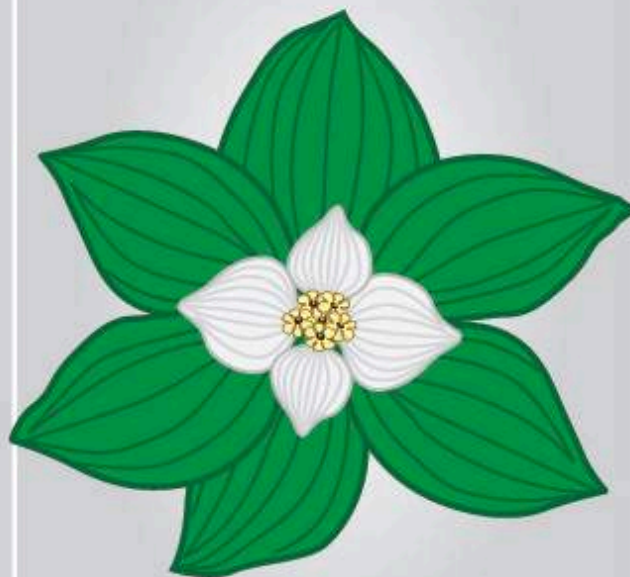
Prepare equipment

Determine what materials are needed and how any necessary equipment can be purchased or borrowed. The Citizen Science Project listings include information about costs and fees or specialized equipment that may be needed for specific activities. However, the majority of citizen science projects in this guide can be done with very simple household materials. The most common type of activity is monitoring, which can often be achieved with nothing more than a pencil and paper.

You may want to print project-specific data collection forms and then transcribe data to the project's website. Alternately, some projects allow for field data entry via smartphone app (if so, this is noted in the project listing).

Select sites

For site selection, you can use the citizen science project's website for guidance to find ideal habitat for species of interest in your park. For example, for Monarch Watch observations you can start by identifying areas where milkweed, the monarch's host plant, grows. Safety, park regulations (see above) and accessibility for all participants are additional considerations in site selection. Your group can seek recommendations from experts or community members for selecting monitoring sites. For example, the Park Supervisor might be able to point out sensitive areas of the green space where it would be particularly useful to report citizen science observations of any invasive species through the EDDMapS project. Consider selecting multiple sites at the park to compare and contrast data and learn more about the biodiversity of your green space.

Plan outdoor activities

Plan for the unexpected. Check with park management to see if any park events are scheduled during your monitoring time. Be prepared to answer questions about your study as other park users might be curious. You might postpone for rain or decide to proceed: with proper clothing and gear (such as a water-tight bag in which to store data sheets), outdoor monitoring can still be successful. Decide any modifications in advance.

EQUIPMENT THAT MAY BE USEFUL FOR CITIZEN SCIENCE ACTIVITIES

» **binoculars or magnifying glass**
» **butterfly net**
» **field guides (see Further Reading for suggestions)**
» **a watch**
» **a camera**
» **map of the study site or surrounding area**

» **field journals (consider one with waterproof paper, available from outdoor supply stores and online)**
» **smartphone with citizen science apps**
» **paper and pencils**
» **clipboards**

CONDUCT MONITORING ACTIVITIES

Collect data

During monitoring activities, have fun and enjoy being outdoors. Make casual observations as you walk to the site. For example, notice what's new since the last visit and watch how wildlife reacts. Incidental observations can be submitted as citizen science data to a project like iNaturalist. Observing natural processes as they happen will help participants shape future study questions. Open observation can also encourage a sense of awe at being around nature in all its complexity.

Follow your project protocols carefully, noting any questions participants have. Part of citizen science is providing feedback about projects. For example, if a question was unclear, mention it in the project's notes section. Note any sections you weren't able to answer, because of an obstruction on your site, for example. Be sure to note weather (including recent storms), nearby construction noise or anything else relevant in your findings.

Make reporting data part of the activity, when all the details are fresh. Enter data electronically from the field or transcribe it from paper as soon as possible.

Remind participants of the difference between negative data and no data and read the project protocol to understand how the study organizers want negative data conveyed. For example, "We looked for 20 minutes at Site A and saw zero blue jays," differs from, "We didn't notice if there were blue jays or not." There may be different sections of the form to show what you monitored.

Don't leave equipment, location markers or any other materials at the site. (This is not allowed in public spaces without a permit.) Encourage participants to go a step further toward improving the park for all by removing garbage if you find it.

Analyze data

Compile and analyze results. Data analysis tools are freely available (see Appendix). Some project websites offer specific ways to compare your results with other citizen science data. Mapping the project location helps place the results in context. The How to Participate section of project listings indicates which data and mapping tools are available.

Lester B. Pearson Public School student recording streamside habitat data at Greenwood Conservation Area in Ajax, ON (EcoSpark 2018)

NEXT STEPS

Use your data to draw connections and spark discussion. Compile naturalist observations from citizen science initiatives at the park, perhaps in an annual publication for park group members. Were there education and outreach goals of the project? Participant feedback surveys can help quantify project benefits for participants and the park, including shifts in environmental attitudes or the number of new visitors.

Many people are eager to declare what their initial findings indicate about the ecological health of a study site. It's important to note that continuous monitoring is needed to make assessments about health. One-time sampling doesn't provide a large enough dataset to draw conclusions. Talk with participants about the significance of their data in larger contexts. Participants should understand more about how environmental issues relate to the park after participating in the activity.

Encourage visitors to continue monitoring in the park and around their neighbourhood to contribute to citizen science. Repeat monitoring to strengthen observations and begin to note changes over time. What further research would build on your findings to make a more complete picture? Is there another location you can monitor in the park? How might the results be similar or different? Refer to the environmental scan from when you developed the study question to shape your next steps.
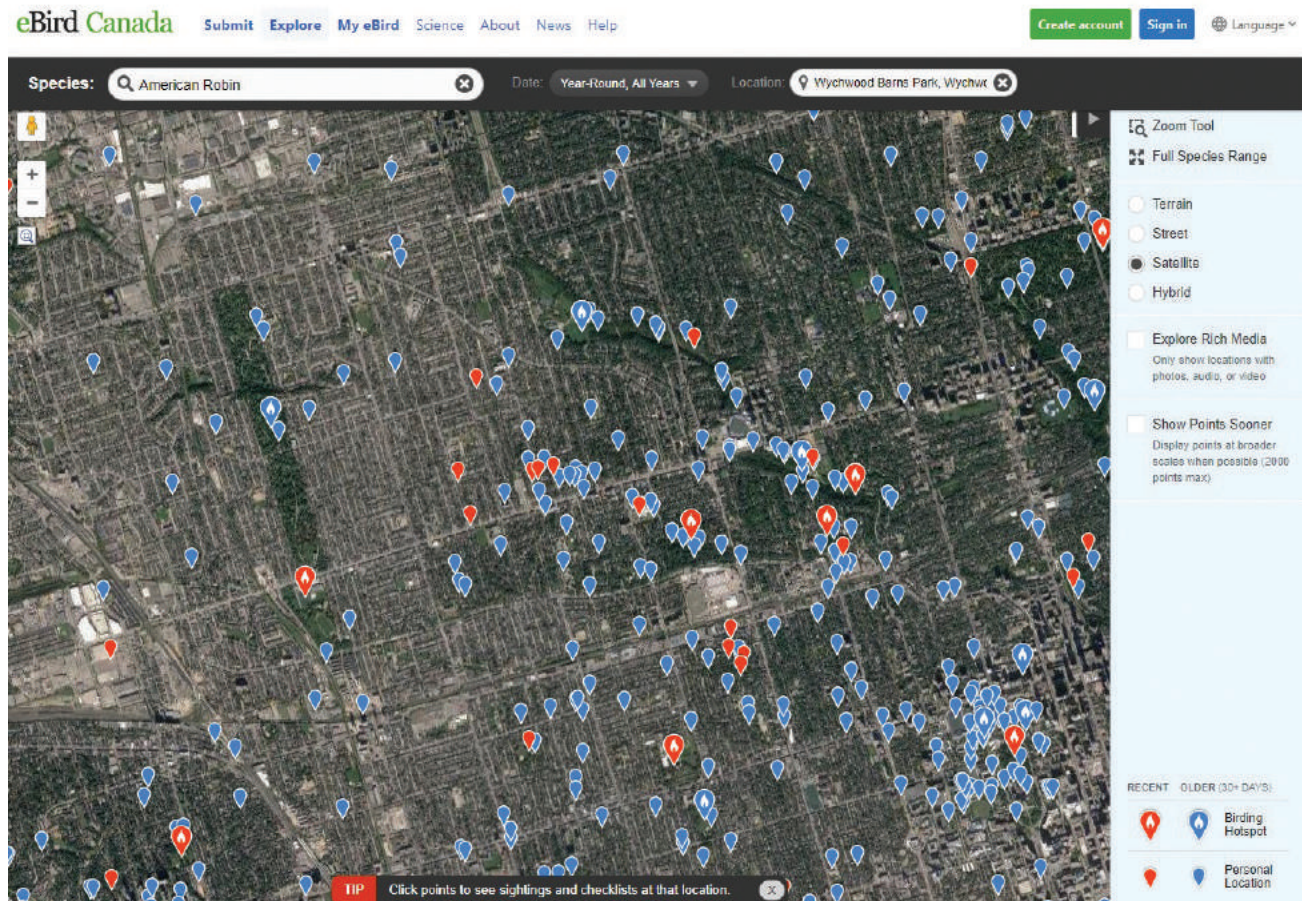
Citizen science records of American robin sightings in Toronto, ON, viewed on eBird Canada's website, available at https://ebird.org/canada/explore (eBird Canada 2018)

Draw connections from what you studied to the broader community, municipality or region. You may find your topic links to issues in environmental policy and planning. For example, Toronto participants in the Bumble Bee Watch citizen science project might draw connections to the City of Toronto's Pollinator Protection Strategy, available at **www.toronto.ca/draft-pollinator-strategy**. Can you link your project with citizen science at other parks? Contact nature centres at large parks to find out if there are ongoing citizen science activities to which you can relate your findings. Also, Ontario Nature lists naturalist groups in their Nature Network: **www.ontarionature.org/about/nature-network**. See Appendix for more resources listed by environmental topic.

Offer to share data and details about your project with your parkland's managers, as the information could be useful to direct management decisions. For example, if a citizen scientist photographs and reports a Species at Risk (to a project such as the Ontario Reptile and Amphibian Atlas) from a site where the species was not formerly observed, that information could alert managers to an area that should be protected. Citizen science projects based in Ontario report observations of Species at Risk to the Natural Heritage Information Centre (NHIC), but you can also notify the park's management about your findings. Citizen scientists can also report observations of rare plants and animals directly to the NHIC by visiting their website at **www. ontario.ca/page/natural-heritage-information-centre**.

Volunteers involved in your project could also share any "lessons learned" in a presentation for another park volunteer group, for the general public at a public library event, or in a town hall meeting with local counselors. Participants may wish to write editorials to local online or print publications, and create social media posts, blogs, newscasts, etc., to communicate about the project and findings. For example, EcoSpark has published guest blogs by citizen scientists, available at **www.ecospark.ca/blog**. Share your park's citizen science stories with EcoSpark and Park People! Use the contact info in the beginning of this guide. We'd love to hear from citizen scientists about their research in public green space.

Common Eastern bumble bee
© Sheila Colla (Bumble Bee Watch 2018)
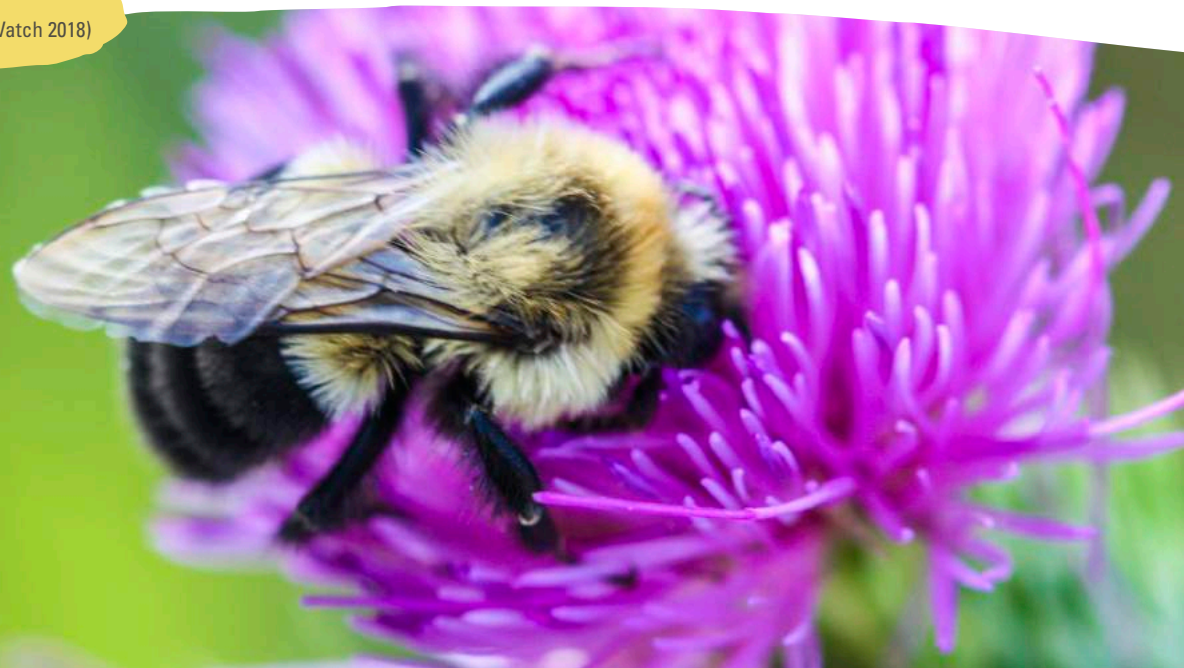
Citizen Science Projects

ABOUT THIS LIST

EcoSpark reviewed citizen science projects available online and considered their suitability for Park Watch volunteers. Projects are included if they are relevant for public green space in Toronto, Ontario (although they may also be useful for groups and individuals in other locations). The list is a starting point, and not exhaustive.

With few exceptions, participation in citizen science projects is free for groups of all sizes and costs for materials are minimal. All of the included projects involve real data, so environmental monitoring information submitted to these projects can be used to understand ecosystem health, environmental policy implications and trends at different scales (locally, provincially, federally, or even globally).

The listed projects encourage passive monitoring activities that can generally be conducted by individuals and small groups without special permits. However, ensure that any activities align with park rules and don't harm the environment. See Preventing disturbance while monitoring above.

Data submitted to these projects is available for anyone: students, the public and professional scientists. Because many people rely on the data for research,

participants should review data for accuracy to the best of their ability to help with citizen science data quality control. When leading a citizen science project, more experienced naturalists in the group can help others with species identification or data submission. However, some projects don't require any naturalist knowledge. For example, an unidentified photo can still be valuable data for a project like iNaturalist. The projects were selected to suit a range of experience levels.

Each project listing includes information about participating in the project and resources to further explore the topic. An important extension activity is having participants compare their data with observations collected at other times or locations. With this in mind, several projects are included that offer maps, data download features or free accounts to let a group track repeated monitoring.

Tree canopy cover (EcoSpark 2018)

iNaturalist

OWNER: California Academy of Sciences and National Geographic Society

LINK: www.inaturalist.org

SUMMARY: Observe and photograph any species in any location and get identification feedback from an online naturalist community.

DESCRIPTION: iNaturalist is an online social network of people sharing biodiversity information to help each other learn about nature. It's also a crowdsourced species identification system and an organism occurrence recording tool. You can use it to record your own observations, get help with identifications, collaborate with others to collect this kind of information for a common purpose, or access the observational data collected by iNaturalist users. However, despite the fact that iNaturalist can be a bit technical and seems scientific, the primary goal in operating iNaturalist is to connect people to nature.

HOW TO PARTICIPATE: *Note: No one under 13 can have an iNaturalist account. This project needs close supervision for classroom use; teachers interested in using iNaturalist with students should visit www.inaturalist.org/pages/teacher's+guide for information.*

Visit the iNaturalist website or download the app to learn about naturalist observations. Report findings in a free account online. Use the iNaturalist website to keep track of your own observations with tools like maps, calendars and journals, and get help from the iNaturalist online community in identifying what you observed. Explore local iNaturalist guides and download data for further inquiry.

SCOPE: International

TIMING: iNaturalist can be used any time of year.

COST AND FEES: There is no fee to participate in this project. The cost of materials is very low.

RESOURCES: Visit www.inaturalist.org/pages/teacher's+guide to find iNaturalist's suggestions for teachers. iNaturalist Projects, available at http://inaturalist.ca/projects, are useful tools because users pool observations by location (such as observations from a local park) or subject. For example, see Moths of Ontario, available at http://inaturalist.ca/projects/moths-of-ontario).

City Nature Challenge (www.citynaturechallenge.org), based in California, developed a helpful guide to using iNaturalist with students. The guide includes age-specific lesson plans and is available at https://education.eol.org/cnc_materials/iNaturalistWithStudents.pdf.

ATTRIBUTION INFORMATION: iNaturalist. California Academy of Sciences and National Geographic Society. Available from www.inaturalist.org. Accessed: 2018. iNaturalist.org began as the Master's final project of Nate Agrin, Jessica Kline and Ken-ichi Ueda at UC Berkeley's School of Information in 2008.

Monarch Watch

OWNER: Monarch Watch

LINK: www.monarchwatch.org

SUMMARY: Learn to identify monarch butterflies and their habitat and track their migration across North America. Report monarch sightings through partner projects. Participate in activities to increase pollinator habitat. Learn about Ontario permit requirements to capture, rear or tag monarchs.

DESCRIPTION: Monarch Watch focuses on the annual North American migration of the monarch butterfly, an indicator species for the need for pollinator habitat conservation. The program engages citizen scientists of all ages in large-scale research projects involving the tagging and tracking of migrating monarchs.

HOW TO PARTICIPATE: Visit the MonarchWatch website at www.monarchwatch.org. View observation maps of recaptured, tagged butterflies to learn about species distribution. Learn to follow special protocols to capture, tag and release monarchs (see Permit Requirements below). Report found monarchs that have a tag. Recovery data is available on the website for viewing. Report general monarch observations by participating in the Monarch Calendar Project: https://monarchwatch. org/blog/2018/03/10/2018-monarch-calendar-project. These projects produce significant data on related migration and conservation issues.

PERMIT REQUIREMENTS: In Ontario, the Ministry of Natural Resources and Forestry (MNRF) regulates the collection, transportation, rearing and/or release of any wildlife species scheduled in the Fish and Wildlife Conservation Act. As a scheduled wildlife species, the monarch butterfly is protected under this Act. To conduct activities that involve the collection, rearing and/or releasing of monarchs, special permission must be obtained from the MNRF by applying for Wildlife Scientific Collector's Authorization (WSCA) and complying with any terms of approval. The Monarch Teacher Network of Canada at www.monarchteacher.ca provides training workshops to help teachers learn the best conservation and handling practices and obtain certification.
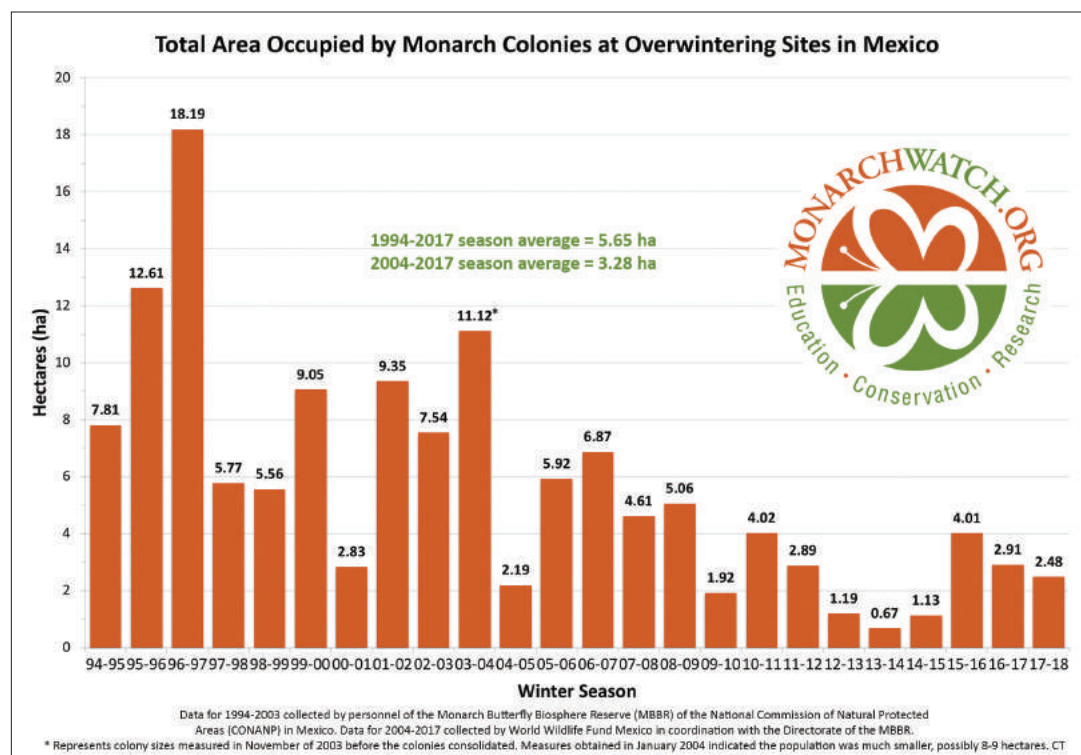
SCOPE: North America

TIMING: Monarch populations gather in the fall around the north shore of Lake Ontario for southern migration. Springtime is best for habitat planting projects. Observe caterpillars and pupae in the spring and summer.

COST AND FEES: There is no fee to access online resources for this project. The material costs are moderate for tagging monarchs or rearing larva and slightly higher for planting and maintaining a monarch habitat. There is a fee to certify a monarch waystation (habitat) with MonarchWatch. For tagging, monarch tagging kits must be purchased at www.monarchwatch.org, and you will also need good quality butterfly nets. Monarch larva are not available for purchase in Ontario, but you can observe monarchs in the wild. Milkweed plants are not available for Ontario through MonarchWatch, but plants and other supplies can be purchased locally (see Appendix C).

PARTNER PROJECTS: The Butterfly Network has information about butterfly monitoring projects across North America, available at **www.thebutterflynetwork.org**. Register with the Monarch Larva Monitoring Project at **https://monarchlab.org/mlmp** to submit observation data about larva and milkweed monitoring. Overnight roosts of migrant monarch sightings can be submitted to Journey North at **www.learner.org/jnorth/tm/monarch/SpringWatch.html**.

RESOURCES: Visit **www.monarchwatch.org** for extensive information on the biology and conservation of monarch butterflies. The web page **www.monarchwatch.org/class/index.htm** has ideas for student research questions and information for teachers about participating in monarch citizen science research with classes.

ATTRIBUTION INFORMATION: Monarch Watch. An affiliate program of the Kansas Biological Survey at The University of Kansas. Available from **www.monarchwatch.org**. Accessed: 2018.

Total Area Occupied by Monarch Colonies at Overwintering Sites in Mexico

1994-2017 season average = 5.65 ha
2004-2017 season average = 3.28 ha

Data for 1994-2003 collected by personnel of the Monarch Butterfly Biosphere Reserve (MBBR) of the National Commission of Natural Protected Areas (CONANP) in Mexico. Data for 2004-2017 collected by World Wildlife Fund Mexico in coordination with the Directorate of the MBBR.
* Represents colony sizes measured in November of 2003 before the colonies consolidated. Measures obtained in January 2004 indicated the population was much smaller, possibly 8-9 hectares. CT

Total area occupied by monarch colonies at overwintering sites in Mexico (Monarch Watch 2018)

e-Butterfly

OWNER: e-Butterfly

LINK: www.e-butterfly.org

SUMMARY: e-Butterfly is an international, data driven project dedicated to butterfly biodiversity, conservation, and education.

DESCRIPTION: A real-time, online checklist and photo storage program, e-Butterfly is providing a new way for the butterfly community to report, organize and access information about butterflies in North America. Launched in 2011, e-Butterfly provides rich data sources for basic information on North American butterfly abundance, distribution, and flight times. Over time, each participant, each observation, each checklist, and each verification builds the database. This information will become the foundation for a better understanding of butterfly distribution and population trends across North America and beyond.

HOW TO PARTICIPATE: Participants create a free account online at www.e-butterfly.org and enter when, where, and how they saw their butterflies. They are prompted to fill out a checklist of all the butterflies seen, photographed, or collected during the outing. Regional experts review all submissions before they enter the database as a viable record. Taxonomic experts review unusual records that are flagged by the regional experts. Tools are provided to store, retrieve, and visualize data. e-Butterfly data is shared with a global community of citizen scientists, educators, lepidopterists, conservationists, and land managers.

SCOPE: North America

TIMING: Butterfly flight times are Spring through Fall and vary by species. Species ranges and flight times can be found at www.e-butterfly.org/ebutterflyapp/#/observations.

COST AND FEES: There is no fee to participate in this project. The material costs are very low.

PARTNER PROJECTS: The Ontario Butterfly Atlas Online at www.ontarioinsects.org/atlas is an interactive map of butterfly records in Ontario, including records automatically transferred from e-Butterfly. The Atlas is managed by the Toronto Entomologists' Association (TEA), www.ontarioinsects.org (created by Alan Macnaughton, Ross Layberry, Colin Jones and Bev Edwards, accessed 2018). View records with selected characteristics on the map or retrieve data in tables. The database contained more than 350,000 records of butterflies as of February 2018, including historical records. Post records for inclusion in the Atlas on www.e-butterfly.org or www.iNaturalist.ca, or for large batches, email the TEA at info@ontarioinsects.org. Try the TEA's new Ontario Moth Atlas as well, at www.ontarioinsects.org/moth.

RESOURCES: e-Butterfly features are currently available in English and French with Spanish coming soon. Species profiles are available at **www.e-butterfly.org/ebutterflyapp/#/observations**. Bug Guide is a comprehensive website with insect information and identification resources, available at **https://bugguide.net**. The Toronto Entomology Association website shows an example of how citizen science data has advanced butterfly research, available at **www.ontarioinsects.org/azures.html**.

ATTRIBUTION INFORMATION: Larrivee M, Prudic KL, McFarland K and J Kerr 2014. e-Butterfly: a citizen-based butterfly database in the biological sciences. Available from **www.e-butterfly.org**. Accessed: 2018.
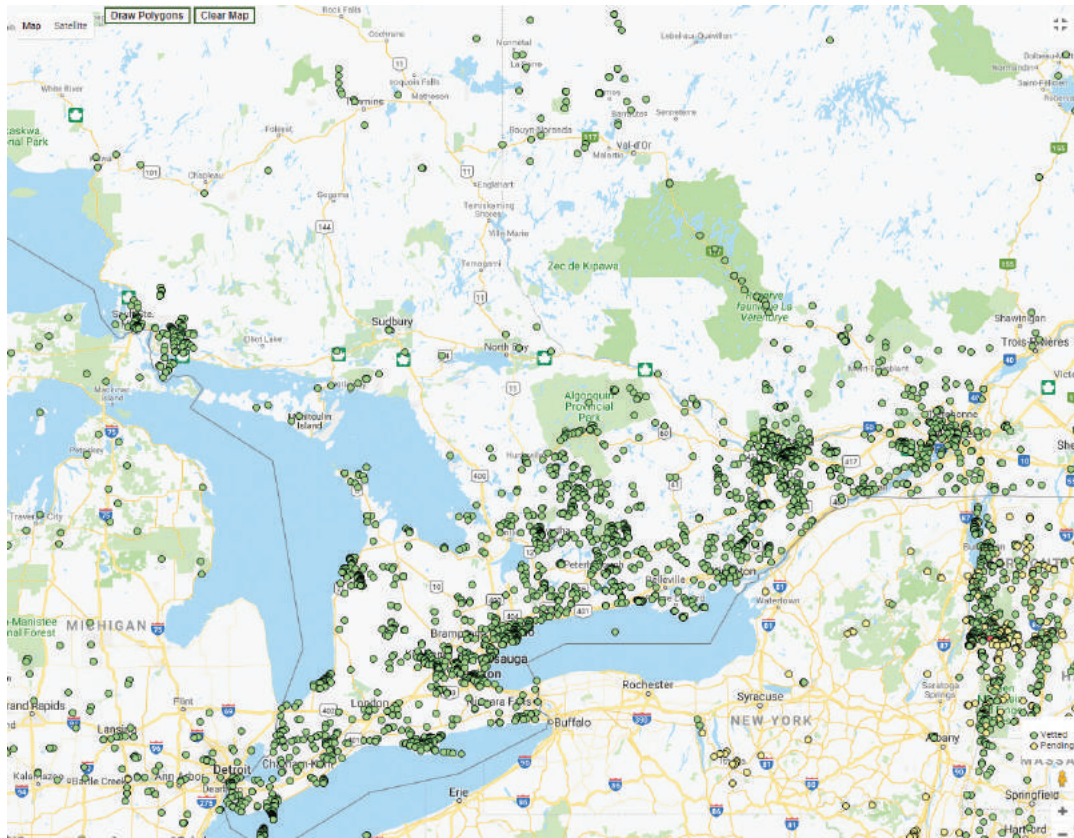

Image of online map showing swallowtail butterfly records. Image provided by e-Butterfly (www.e-butterfly.org) and created April 2018.

Bumble Bee Watch

OWNER: Bumble Bee Watch

LINK: www.bumblebeewatch.org

SUMMARY: Bumble Bee Watch is a collaborative effort to track and conserve North America's bumble bees. Learn to identify and photograph bumble bees outdoors and submit photos for expert review. Track distributions and spatial trends of bumble bees over time.

DESCRIPTION: Have fun while learning more about bumble bees and the vital role they play in our environment! This citizen science project allows individuals to:
- upload photos of bumble bees to start a virtual bumble bee collection;
- identify the bumble bees in your photos and have your identifications verified by experts;
- help researchers determine the status and conservation needs of bumble bees;
- help locate rare or endangered populations of bumble bees;
- learn about bumble bees, their ecology and ongoing conservation efforts and;
- connect with other citizen scientists.

HOW TO PARTICIPATE: Visit **www.bumblebeewatch.org** to create a free account. Go outside and check your garden, parks or any other natural areas you frequent for bumble bees. Be sure to snap a photo (learn more at **www.bumblebeewatch.org/photo-tips**), then sign in and submit your data via the Bumble Bee Sightings form. Or, download the free app and search species by location, access identification tools and submit your sightings.

Experts provide identification feedback (review may take some time). Bumble Bee Watch gathers and shares information about bumble bee species distributions and abundances across Canada and the United States (such as maps and data tables) among its community of users.

SCOPE: Canada and the United States

TIMING: Depending on your location, bumble bees are active from March through October. They are most abundant in mid-summer through early fall, when colonies are large. See the profile page of each species on the Bumble Bee Watch website for specific flight period information of the bumble bees in your region. Bumble bees are often active during their flight period, most daylight hours; in the heat of the summer, they seem to prefer the cooler morning and evening hours. They are generally most easily spotted and photographed while foraging on flowers for pollen and nectar.

COST AND FEES: There is no fee to participate in this project. The cost of materials is very low.

RESOURCES: A good illustrated field guide for bees is *The Bees in Your Backyard: A Guide to North America's Bees*, by Joseph S. Wilson and Olivia J. Messinger Carril, (Princeton University Press, 2015). Learn about bumble bee biology and conservation at **www.xerces.org/bumblebees**. See Appendix C for additional pollinator conservation resources. Conservation actions specifically supporting bumble bees include:
- Create habitat! You can find more information about how to create bumble bee habitat at **www.xerces.org/bumblebees**.
- Support local and organic agriculture. Many pesticides are harmful to bumble bee colonies and many vegetable and fruit plants provide great food sources for bees. Visit **www.ontarionature.org/campaigns/pollinators** to learn about an Ontario youth initiative to protect pollinators.
- Spread the word! Many people are afraid of bumble bees and other insects. Let your friends and family know how important they are and encourage them to take photos too!

ATTRIBUTION INFORMATION: The Xerces Society, Wildlife Preservation Canada, York University, University of Ottawa, The Montreal Insectarium, The London Natural History Museum, BeeSpotter. 2017. Data accessed from Bumble Bee Watch, a collaborative website to track and conserve North America's bumble bees. Available from **www.bumblebeewatch.org**. Accessed: 2018.

Bird Studies Canada projects

LINK: www.birdscanada.org

OVERVIEW: Bird Studies Canada (BSC) is Canada's leading, charitable organization dedicated to bird research, citizen science, education and conservation. It coordinates a diverse range of bird-focused citizen science programs throughout the year, including the following programs, listed chronologically.

- *Project FeederWatch* Project FeederWatch is a joint program of Bird Studies Canada and the Cornell Lab of Ornithology. Register a bird feeding station, receive educational materials, and monitor bird visits through the winter. At regular intervals from **November to April**, thousands of FeederWatchers count the kinds and numbers of birds at their feeders, then submit their observations online. This information helps scientists study winter bird populations. There is an annual Bird Studies Canada membership fee to participate in Project FeederWatch. Available at **www.birdscanada.org/pfw**.

- *Christmas Bird Count* Started in 1900, the Christmas Bird Count is North America's longest-running citizen science project. The information collected by thousands of volunteer participants forms one of the world's largest sets of wildlife survey data. The results are used daily by conservation biologists and naturalists to assess the population trends and distribution of birds. Each Christmas Bird Count is conducted on a single day between **December 14 and January 5**. Counts are carried out within a 24 km diameter circle that stays the same from year to year. A program of National Audubon Society with Bird Studies Canada, counts are organized, usually as group efforts, at the local level, often by a birding club or naturalist organization. Available at **www.birdscanada.org/volunteer/cbc**.

- *Christmas Bird Count for Kids* This junior version is a fun winter birdwatching event for kids and families. Join **December to January** to learn about birds, connect with young naturalists, and become a Citizen Scientist! Available at **www.birdscanada.org/cbc4kids**.

- *Great Backyard Bird Count* Launched in 1998 by the Cornell Lab of Ornithology and National Audubon Society, the Great Backyard Bird Count was the first online citizen-science project to collect data on wild birds and to display results in near real-time. Now, more than 160,000 people worldwide join the four-day count each **February** to create an annual snapshot of the distribution and abundance of birds. For at least fifteen minutes on one or more days of the count, (February 16–19 in 2018), simply tally the numbers and kinds of birds you see. You can count from any location, anywhere in the world, for as long as you wish! Create a free online account to enter your checklists. Available at **www.birdcount.org**.

- *Schoolyard Bird Blitz* Join the Schoolyard Bird Blitz! Each spring, students conduct this fun bird count in schoolyards and communities across Canada. Choose any day in **May** and tally bird observations in a survey as brief as fifteen minutes at your school. Region-specific bird identification tools on the website assist with bird counts across the country. Learn about your local birdlife, and contribute citizen science observations that help build the NatureCounts database. Available at **www.birdscanada.org/birdblitz**.

- *eBird Canada* Report any bird observations, **any time of year,** anywhere in the world to be included in the eBird database. See full description below. Available at **www.ebird.ca**.

eBird Canada

OWNER: eBird was Launched in 2002 by the Cornell Lab of Ornithology and National Audubon Society and is now a global, collaborative project. Bird Studies Canada manages the eBird Canada portal.

LINK: www.ebird.ca

SUMMARY: Monitor birds and track bird sightings online. eBird transforms your bird sightings into science and conservation. Plan trips, find birds, track your lists, and explore range maps and bird migration.

DESCRIPTION: eBird is the world's largest biodiversity-related citizen science project, with more than a hundred million bird sightings contributed each year by eBirders around the world. A collaborative enterprise with hundreds of partner organizations, thousands of regional experts, and hundreds of thousands of users, eBird is managed by the Cornell Lab of Ornithology. eBird data document bird distribution, abundance, habitat use, and trends through checklist data collected within a simple, scientific framework.

HOW TO PARTICIPATE: Birders enter when, where, and how they went birding, and then fill out a checklist of all the birds seen and heard during the outing. eBird's free mobile app allows offline data collection anywhere in the world, and the website provides many ways to explore and summarize your data and other observations from the global eBird community. eBird data is stored across secure facilities, archived daily, and is freely accessible. eBird data has been used in hundreds of conservation decisions and peer-reviewed papers and thousands of student projects and it helps inform bird research worldwide.

SCOPE: Global

TIMING: Winter is a good time to observe birds in locations where trees drop their leaves and at feeders, but different species are observed year round. Projects with Bird Studies Canada are listed chronologically, above.

COST AND FEES: There is no fee to participate in eBird. The material costs are very low. Many educational resources are available online for free, and additional materials may be purchased for classrooms.

RESOURCES: Learn about bird biology and conservation with Cornell Lab of Ornithology online resources, including Bird Academy interactive features (https://academy.allaboutbirds.org). Most features are free, such as All About Feathers and Songs and Calls. Free K–12 lesson plans such as Bird Sleuth (www.birdsleuth.org/free-resources) help teachers introduce topics and lead citizen science activities. Resources that highlight tools and tips for educators are available from Bird Studies Canada at www.bsc-eoc.org/education.jsp?lang=EN and https://ebird.org/canada/about/resources.

ATTRIBUTION INFORMATION: Bird Studies Canada. 2018. Available from www.birdscanada.org. eBird. 2018. eBird: An online database of bird distribution and abundance. eBird, Cornell Lab of Ornithology, Ithaca, New York. Available from www.ebird.org. Accessed: March 2018.

Red-winged blackbird by Liza Barney
(Bird Studies Canada, 2018)

Ontario Reptile and Amphibian Atlas

OWNER: Ontario Nature

LINK: www.ontarionature.org/atlas

SUMMARY: Learn to identify Ontario's reptiles and amphibians and report sightings. Track distributions and spatial trends of reptiles and amphibians over time.

DESCRIPTION: The Ontario Reptile and Amphibian Atlas tracks distributions and spatial trends of reptiles and amphibians across the province over time. The overarching goal is to increase the collective knowledge base of reptiles and amphibians. Equally important, however, is the engagement of non-scientists of all ages and abilities, in all parts of the province, in nature study and conservation.

HOW TO PARTICIPATE: Visit the Ontario Reptile and Amphibian Atlas website. A web- and app-based field guide provides species information. View observation maps to learn about species distribution. Submit sightings and photos of frogs, toads, snakes, skinks, salamanders and turtles via the smartphone or web-based app. Recordings of frog and toad calls are also accepted. Data submitted to this project is used to inform research and conservation efforts. Data (except sensitive data, such as exact locations of Species at Risk) is available on the website for download and viewing after Ontario Nature reviews submissions.

SCOPE: Ontario

TIMING: Reptile and amphibian activity peaks in the spring and summer. Observations generally occur between late March and October.

COST AND FEES: There is no fee to participate in this project. The cost of materials is very low.

RESOURCES: Visit www.ontarionature.org/programs/citizen-science/reptile-amphibian-atlas/species for species descriptions, habitat, biology, threats and trends, range maps and current status and protection. Read about stewardship to help protect species, including Species at Risk, at www.ontarionature.org/programs/citizen-science/reptile-amphibian-atlas/stewardship. Be careful not to disturb reptiles and amphibians or their habitat: read project guidelines at www.ontarionature.org/programs/citizen-science/reptile-amphibian-atlas/tips.

ATTRIBUTION INFORMATION: Ontario Nature. *Ontario Reptile and Amphibian Atlas*. Available from www.ontarionature.org. Accessed: 2018.

Northern ring-necked snake
© Joe Crowley (Ontario Nature 2018)
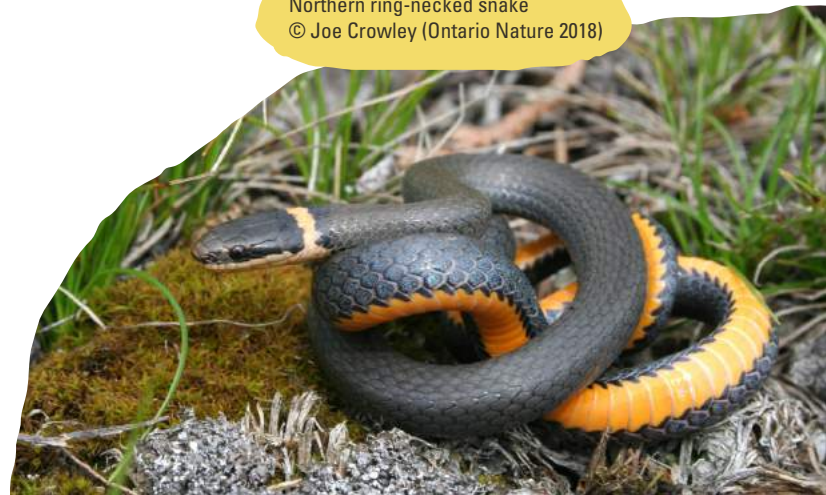
PlantWatch

OWNER: NatureWatch Canada

LINK: www.naturewatch.ca/plantwatch

SUMMARY: Monitor plants and track spring blooming times online.

DESCRIPTION: The PlantWatch program enables citizen scientists to get involved by recording flowering times for selected plant species and reporting these dates to researchers, who work to identify ecological changes that may be affecting our environment. When you submit your data, it is added to an online map showing bloom dates across Canada. Your observations make a difference! By participating in PlantWatch, you can learn more about our country's botanical diversity, while helping scientists track the effects of global warming and climate change in Canada.

HOW TO PARTICIPATE: Visit the PlantWatch website to learn about observing local plants. Follow PlantWatch protocols (provided with data sheets on the website) to identify plants near you and observe them throughout the blooming season. Report findings in a free account on the NatureWatch website. Track species with online maps and download data for further study. Information you submit to NatureWatch is pooled with information submitted by other participants across Canada and is used by researchers at several Canadian universities to improve scientific knowledge of changes in Canada's biodiversity, climate and natural environment.

RESOURCES: Visit www.naturewatch.ca/plantwatch/resources to find PlantWatch curriculum resources and activities for science, mathematics, social studies and language arts. Regional coordinators listed on the website can provide local PlantWatch information for each province and territory.

SCOPE: Canada

TIMING: Plants can be monitored at any time throughout the blooming season, from about April till October. For PlantWatch observations it is ideal to locate and start monitoring specific plant species listed on the website before each one blooms.

COST AND FEES: There is no fee to participate in this project. The cost of materials is very low.

ATTRIBUTION INFORMATION: PlantWatch is a program of NatureWatch, which is operated as a partnership between the geography departments of Wilfrid Laurier University and the University of Ottawa, Nature Canada, the David Suzuki Foundation, the Toronto Zoo and the University of Ottawa's Centre for e-Learning. Available from www.naturewatch.ca/plantwatch. Accessed: 2018.

Teachers making PlantWatch observations of a larch at Milne Dam Conservation Park in Markham, ON (EcoSpark 2018)

TD Tree Bee

FORESTS ONTARIO

OWNER: Forests Ontario

LINK: https://treebee.ca

SUMMARY: TD Tree Bee is a tree identification tool used to engage classrooms, families and communities in learning more about the trees and forests in their own backyards.

DESCRIPTION: Can't tell a pine from a poplar? Don't know the colour of a paper birch tree's bark? To help answer these questions and more, Forests Ontario created TD Tree Bee, a tree identification tool for communities, families and classrooms. It's a great chance to get kids excited about our forests, and the perfect opportunity for friends, families and teachers to spend time learning together outdoors. Heritage Trees of cultural or historical significance are also included on the TD Tree Bee map.

HOW TO PARTICIPATE: Visit the TD Tree Bee website to access a pictorial identification key for trees in Ontario. Answer a series of questions about the tree (for example, does it have leaves or needles?) to narrow down the choices. By creating a free account at **https://treebee.ca**, you will be able to use the TD Tree Bee website to save and track the trees that you identify, add photos and place trees on a map. Tree data submitted to TD Tree Bee may be used or shared by Forests Ontario and the public. The primary purpose of TD Tree Bee is to help individuals practice tree identification skills, rather than to collect data about trees.
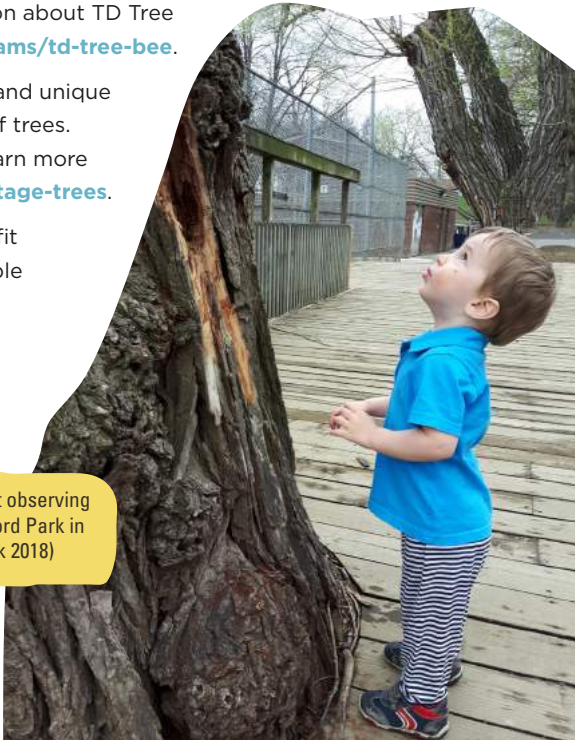
SCOPE: Ontario

TIMING: Many trees are easiest to identify when leaves, flowers, or fruit are present. However, you can identify trees year-round.

COST AND FEES: There is no fee to participate in this project. The cost of materials is very low.

RESOURCES: Find TD Tree Bee education resources at **https://treebee.ca/education-resources** and more extensive Forests Ontario tree education resources, including lesson plans, fact sheets, and more, at **www.forestsontario.ca/education/resources**. Focus on Forests is a Forests Ontario program which provides lesson plans free online for a range of grades and age levels, available at **www.forestsontario.ca/education/programs/focus-on-forests**. More information about TD Tree Bee community programs is available at **www.forestsontario.ca/education/programs/td-tree-bee**.

Forests Ontario's Heritage Trees collects and tells the stories of Ontario's diverse and unique trees and brings awareness to the social, cultural, historical and ecological value of trees. Heritage trees associated with a historic person, event or location may qualify. Learn more about Heritage Trees at **www.forestsontario.ca/community/in-the-spotlight/heritage-trees**.

ATTRIBUTION INFORMATION: TD Tree Bee. A program of Forests Ontario, a non-profit charity dedicated to making Ontario's forests greener. TD Tree Bee is made possible with the support of TD Friends of the Environment Foundation. Available from **https://treebee.ca**. Accessed: 2018.

Young citizen scientist observing a willow tree at Bickford Park in Toronto, ON (EcoSpark 2018)

EDDMapS Ontario

EDD MapS Ontario
Early Detection & Distribution Mapping System

OWNER: EDDMapS Ontario

LINK: www.eddmaps.org/ontario

SUMMARY: Early Detection and Distribution Mapping System (EDDMapS) Ontario is a web-based mapping system for documenting invasive species wherever they occur in Ontario. It is fast, easy to use and doesn't require specialized mapping experience.

DESCRIPTION: Learn about species that have invaded Ontario and record sighting details to help monitor their distribution and spread. Alien species are plants, animals and micro-organisms that have been accidentally or deliberately introduced into areas beyond their native range. Invasive species are alien species whose introduction or spread negatively impacts the environment, economy and/or society, including human health (Ontario Invasive Plants Council 2018). In Ontario, numerous agencies and monitoring programs collect information about invasive species. EDDMapS aims to maximize the effectiveness and accessibility of the immense numbers of invasive species observations recorded each year.

HOW TO PARTICIPATE: Visit www.eddmaps.org/ontario to learn about invasive species. When you identify an invasive organism, enter information about the infestation and images into the standardized online data form or via the EDDMapS app. All information is reviewed by Ontario Federation of Anglers and Hunters' (OFAH) staff to ensure it is accurate before it is made viewable by the public—good photographs are key for this. Once verified, the information is made freely available to scientists, researchers, land managers, land owners, educators, conservationists, ecologists, farmers, foresters, government personnel and members of the public. View individual records in a free EDDMapS account, or submit queries to the EDDMapS database and explore interactive maps on the website.
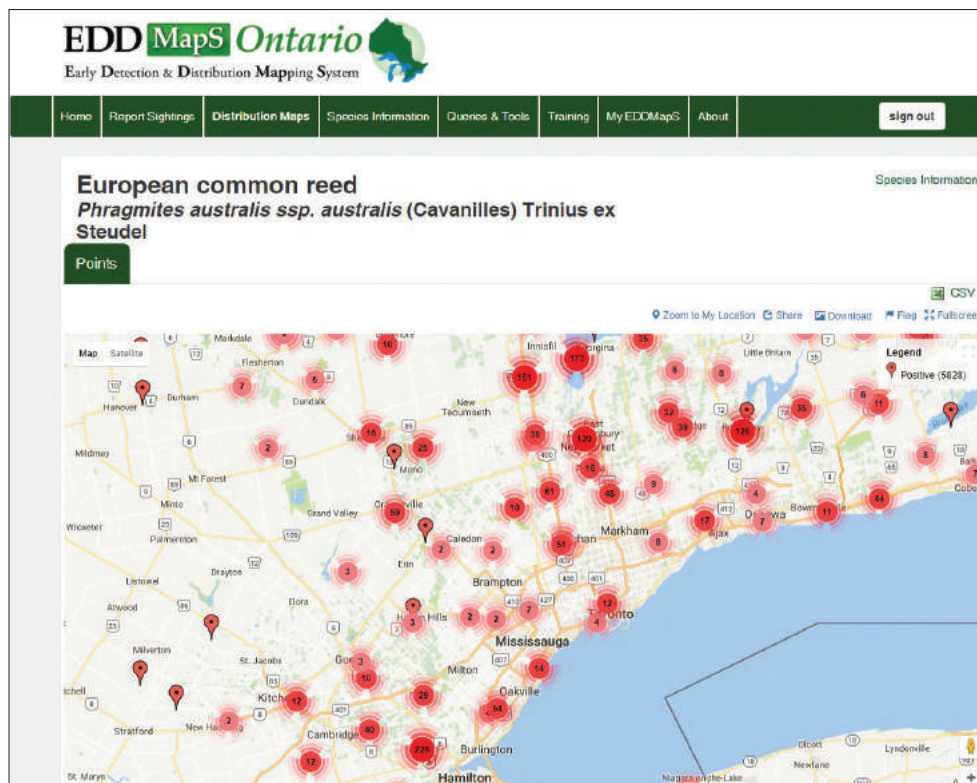
SCOPE: Ontario

TIMING: Invasive species can be reported year-round. Plants are easier to identify when they have leaves, and animals may be less active in winter.

COST AND FEES: There is no fee to participate in this project. Resources are free to order through the Invading Species Awareness Program webpage, below.

RESOURCES: EDDMapS Ontario was developed in partnership between the University of Georgia (UoG) and the OFAH. This is the same department at the UoG that runs the Bugwood Image Database System and Bugwood Wiki. These resources provide over 50,000 images and over 1,000 articles on invasive species across the United States and Canada, available at www.eddmaps.org. These resources also provide a library of identification and management information as well as additional training resources at www.eddmaps.org/ontario/training. The Invading Species Awareness Program (ISAP) delivered by the OFAH has a number of resources available including both aquatic and terrestrial invasive species. They also have two educational curriculums for grade 4 (Making Waves!) and grade 6 (A Biodiversity Challenge). Visit www.invadingspecies.com/shop to place an order on these free resources! The Ontario Invasive Plants Council also has educational resources, including lesson plans for teachers, at www.ontarioinvasiveplants.ca.

EDDMapS Ontario map showing reports of European common reed, an invasive plant
(EDDMapS Ontario, January 2018)

Habitat Network

Habitat Network
powered by yard**map**

The Nature Conservancy | The Cornell Lab of Ornithology

OWNER: Cornell Lab of Ornithology and The Nature Conservancy

LINK: www.habitat.network or http://content.yardmap.org

SUMMARY: Habitat Network is a citizen science project designed to cultivate a richer understanding of wildlife habitat, for both professional scientists and people concerned with their local environments. Create a map of features that provide habitat for wildlife and support ecosystem functions at your location and compare it with other areas.

DESCRIPTION: Create a map of features that provide habitat for wildlife and support ecosystem functions at your location and compare it with other areas. Habitat Network collects data by asking individuals across the country to literally draw maps of their backyards, parks, farms, favorite birding locations, schools, and gardens. Connect with landscape details and find tools to make better decisions about how to manage landscapes sustainably. Use embedded GoogleMaps satellite imagery to find your site and as a reference for creating your YardMap. Learn about creating habitat by using custom tools, articles, and community pages for guidance.

HOW TO PARTICIPATE: *Note: No one under 18 can have a Habitat Network account*. Visit http://content.yardmap.org to create a free Habitat Network account. Assess your habitat by drawing an online map, including various habitat types at your location and objects like trees, flowers, rocks, compost bins, and rain barrels. Put in the boundaries of your site. Get outside, create habitat, and update your map to show the world the positive changes you've made!

Habitat Network organizers and public users view your map data at http://content.yardmap.org to help answer questions like: What practices improve the wildlife value of residential landscapes? What impact do urban and suburban wildlife corridors and stopover habitats have on birds?

SCOPE: International participation, with supplemental resources focusing on the United States

TIMING: Habitat supports different species throughout the year, but can be mapped at any time.

COST AND FEES: There is no fee to participate in this project. The cost of materials is very low.

RESOURCES: Visit http://content.yardmap.org/learn for ideas about creating and improving habitat. Learn how various habitat features support wildlife and ecosystem functions. For example, read articles like "The Wildlife Value of a Messy Garden," available at http://content.yardmap.org/learn/wildlife-value-of-a-messy-garden. Local pollinator plants recommended for the Lake Erie Lowlands are available at http://pollinator.org/assets/generalFiles/LakeErieLowlands.2017.pdf. The City of Toronto is developing a Pollinator Protection Strategy. The goal is to improve the health of local pollinator populations, which support resilient ecosystems and urban biodiversity. The strategy identifies six priorities and a series of proposed actions, including habitat support. Available at www.toronto.ca/draft-pollinator-strategy.
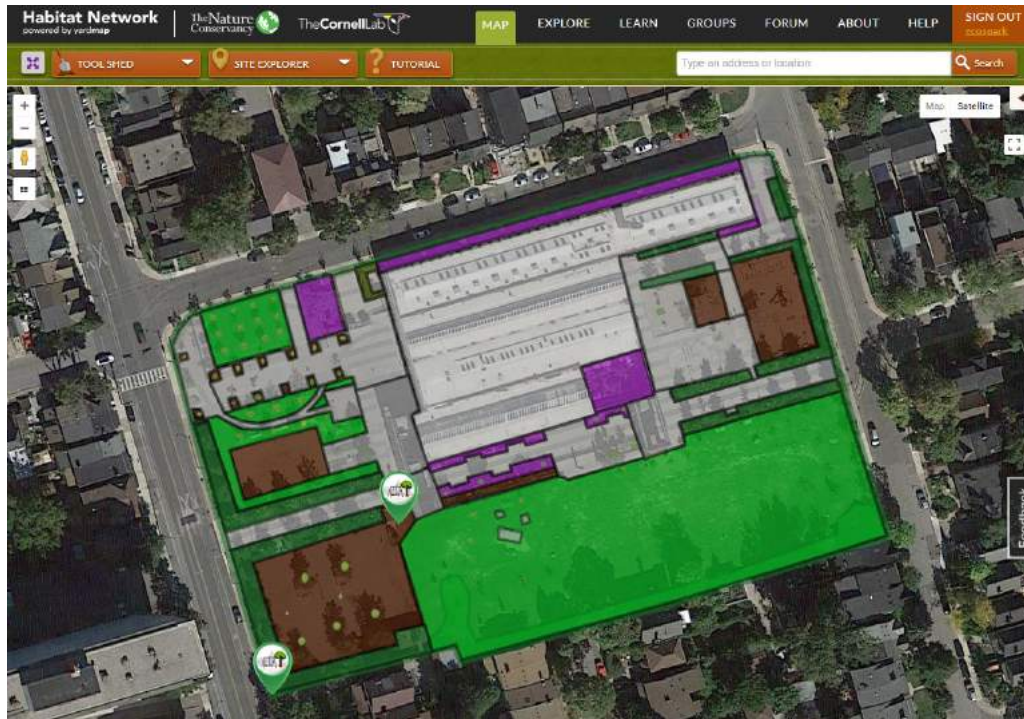
Habitat map of Wychwood Barns Park in Toronto, ON. Provided by Habitat Network (http://content.yardmap.org) with DigitalGlobe, U.S. Geological Survey, and created by EcoSpark 2018.

Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) Canada

OWNER: Colorado Climate Center at Colorado State University

LINK: www.cocorahs.org/Canada

SUMMARY: Canada's Community Collaborative Rain, Hail and Snow Network (CoCoRaHS Canada) is a unique, non-profit, community-based network of volunteers of all ages and backgrounds working together to measure and map precipitation (rain, hail and snow) across Canada.

DESCRIPTION: The mission of CoCoRaHS Canada is to collect and display accurate high-quality precipitation data while providing educational opportunities and experiences for volunteers. By using low-cost measurement tools, stressing training and education, and utilizing an interactive website, the aim is to provide the highest quality data for natural resource, education and research applications. The data gathered by volunteer observers through the CoCoRaHS network is freely available to governments, academic institutions and the private sector as well as participants and the general public for the purposes of promoting learning, enhancing scientific knowledge and protecting life and property. CoCoRaHS data are made available to the public via the website (www.cocorahs.org).

HOW TO PARTICIPATE: Visit the CoCoRaHS website to watch training videos (www.cocorahs.org/Content.aspx?page=training_slideshows) and register to report precipitation at your location (www.cocorahs.org/Canada-Application.aspx). Volunteers must purchase a CoCoRaHS-approved, 4" diameter rain gauge, complete a training session (online or in-person), and be able to read and empty the rain gauge at the same time each day. Each time a rain, hail or snow storm crosses your area, take measurements of precipitation. Complete data collection sheets and submit reports on the website. The data are then displayed and organized for many end users to analyze and apply to daily situations ranging from water resource analysis and severe storm warnings to neighbours comparing how much rain fell in their backyards.
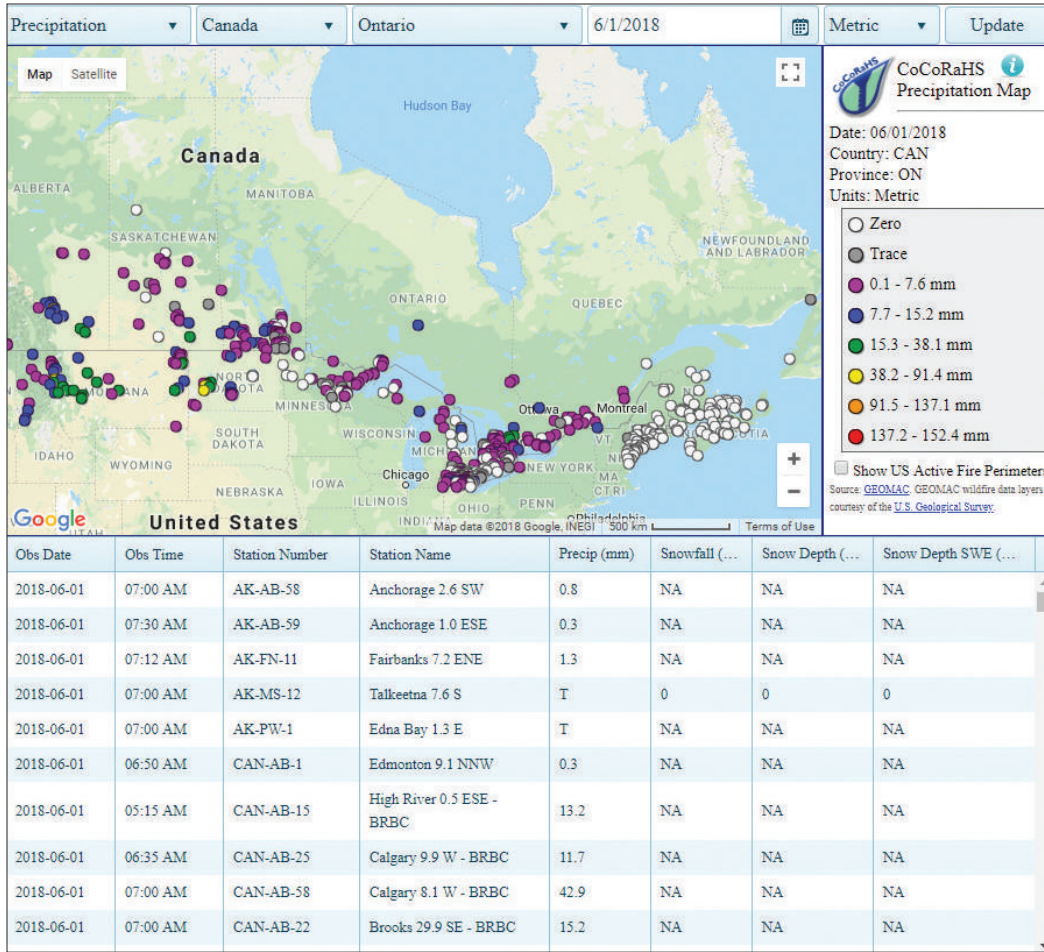
RESOURCES: Training videos available on the CoCoRaHS YouTube website use cartoon animation to explain monitoring techniques and concepts (www.youtube.com/user/cocorahs). Meteorology teacher resources and lesson plans are available on the CoCoRaHS Education webpage, at www.cocorahs.org/Content.aspx?page=education.

SCOPE: Canada, with partner organizations in the United States and the Bahamas

TIMING: Begin this project at any time. Participants should spend a few minutes to read and empty the rain gauge at the same time each day and submit reports on the website.

COST AND FEES: There is no cost to participate in CoCoRaHS, but participants must use an approved rain gauge. Gauges can be ordered on the CoCoRaHS Canada store (www.shopcocorahs.ca) for the subsidized price of $30 CAD+ shipping for all volunteers who join and include their unique station number which they receive once they have registered to the network.

ATTRIBUTION INFORMATION: CoCoRaHS Canada. Available from www.cocorahs.org/Canada. Accessed: 2018.

33

Precipitation ▼	Canada ▼	Ontario ▼	6/1/2018 📅	Metric ▼	Update			

Map | Satellite

CoCoRaHS Precipitation Map ℹ

Date: 06/01/2018
Country: CAN
Province: ON
Units: Metric

○ Zero
⬤ Trace
⬤ 0.1 - 7.6 mm
⬤ 7.7 - 15.2 mm
⬤ 15.3 - 38.1 mm
⬤ 38.2 - 91.4 mm
⬤ 91.5 - 137.1 mm
⬤ 137.2 - 152.4 mm

☐ Show US Active Fire Perimeters
Source: GEOMAC. GEOMAC wildfire data layers courtesy of the U.S. Geological Survey.

Map data ©2018 Google, INEGI | 500 km | Terms of Use

Obs Date	Obs Time	Station Number	Station Name	Precip (mm)	Snowfall (...	Snow Depth (...	Snow Depth SWE (...
2018-06-01	07:00 AM	AK-AB-58	Anchorage 2.6 SW	0.8	NA	NA	NA
2018-06-01	07:30 AM	AK-AB-59	Anchorage 1.0 ESE	0.3	NA	NA	NA
2018-06-01	07:12 AM	AK-FN-11	Fairbanks 7.2 ENE	1.3	NA	NA	NA
2018-06-01	07:00 AM	AK-MS-12	Talkeetna 7.6 S	T	0	0	0
2018-06-01	07:00 AM	AK-PW-1	Edna Bay 1.3 E	T	NA	NA	NA
2018-06-01	06:50 AM	CAN-AB-1	Edmonton 9.1 NNW	0.3	NA	NA	NA
2018-06-01	05:15 AM	CAN-AB-15	High River 0.5 ESE - BRBC	13.2	NA	NA	NA
2018-06-01	06:35 AM	CAN-AB-25	Calgary 9.9 W - BRBC	11.7	NA	NA	NA
2018-06-01	07:00 AM	CAN-AB-58	Calgary 8.1 W - BRBC	42.9	NA	NA	NA
2018-06-01	07:00 AM	CAN-AB-22	Brooks 29.9 SE - BRBC	15.2	NA	NA	NA

Ontario Precipitation Map of volunteer data by CoCoRaHS Canada, **Attribution 3.0 Unported (CC-BY-3.0)**, (CoCoRaHS Canada 2018)

EcoSpark's Changing Currents

OWNER: EcoSpark

LINK: www.ecospark.ca/changing-currents

SUMMARY: Changing Currents is a citizen science program that connects students to their local watershed through a hands-on water quality investigation. EcoSpark staff trains teachers and facilitates Changing Currents field activities with students.

DESCRIPTION: EcoSpark's Changing Currents introduces grades 6-12 students from across the Greater Toronto Area (GTA) to their local watersheds and teaches them about watershed science. Students get outside, put on hip waders, explore their local stream, and learn about its importance. Students will use the aquatic bugs (benthos) that live at the bottom of the stream as well as chemical and physical indicators to monitor local water quality. The data they collect will contribute to a regional water quality monitoring effort! Following the stream study, students will have the chance to take action in their community concerning what they discover during their stream study.

HOW TO PARTICIPATE: Learn about the Changing Currents program and register online at www.ecospark.ca/changing-currents. Classes are welcome to choose a study site wherever they like! Classes may travel to a familiar site or investigate their local water in the streams, rivers, and creeks that are walking distance from the school. EcoSpark provides FREE teacher training for every teacher participating in the program. Training day is a fun event where you meet other teachers, learn new monitoring skills, get into the water and try the equipment. EcoSpark collects and verifies stream data with students in the field. The data is shared with participants, the public, and water quality research networks, and can be viewed on an interactive map at www.ecospark.ca/changing-currents-water-quality-results.

SCOPE: Greater Toronto Area of Ontario

TIMING: The studies take place during Spring (mid-April to mid-June) and Fall (mid-September through October), with registration prior to the season. A session for one class (max. 30 students) will last three hours, and can be booked in the morning or afternoon. If you would like to register a large number of students, please contact our staff directly to discuss what accommodations can be made.

COST AND FEES: The fee for this facilitated program is $10/student (half day study) or $500/class (full day SHSM). Subsidies are available. Cost structure details are available at www.ecospark.ca/register. All materials are included.

RESOURCES: EcoSpark's website has Changing Currents resources for students and teachers. These include curriculum connections, information about how and why we monitor water quality, cool videos and pictures to help identify benthos, and an interactive map with data we have collected since 2000. Available at www.ecospark.ca/changing-currents.

ATTRIBUTION INFORMATION: EcoSpark's Changing Currents Program. Available from www.ecospark.ca/changing-currents. Accessed: April 2018.

Students from Unionville High School participating in Changing Currents at Bruce's Mill Conservation Area in Whitchurch-Stouffville, ON (EcoSpark 2018)

Ontario Residential Tree Benefits Estimator
(Citizen Science Tool)

OWNER: LEAF (Local Enhancement and Appreciation of Forests)

LINK: www.yourleaf.org/estimator

SUMMARY: The Ontario Residential Tree Benefits Estimator is an online tool that estimates the energy savings and other environmental benefits provided by your existing tree. It can also help you to decide where to plant new trees around your home.

DESCRIPTION: The Estimator has the ability to both model future benefits of a newly planted tree as well as estimate the current and accumulated benefits of an existing tree. Among other benefits, the Estimator models conserved electricity (kWh), instantaneous electricity demand savings (kW) and sequestered/avoided CO_2 for residential trees planted in Ontario based upon empirical data including tree species, size, aspect and planting distance from house. The calculations incorporate regionally specific growth curves particular to native and generic tree selections and use climate normals for Ontario cities to evaluate length of growing season, air temperature and humidity.

HOW TO PARTICIPATE: Access the Tree Benefits Estimator online at www.yourleaf.org/estimator. Consider a tree at your location or a proposed planting site. Input species (if known), and trunk size or planting date. Input the tree's location relative to your house and your house's heating source. The Tree Benefits Estimator calculates the suite of benefits provided by your tree or potential planting. The website provides information about how trees save electricity, sequester carbon, and more. There is no aggregate data feature, so the Estimator user inputs are not stored or collected. (You won't be able to view your data after you close the browser.)

SCOPE: Ontario

TIMING: Many trees are easiest to identify when leaves, flowers, or fruit are present. However, you can calculate benefits information with the Tree Benefits Estimator year-round.

**COST AND FEES:** There is no fee to participate in this project. The cost of materials is very low.

RESOURCES: While the Ontario Residential Tree Benefits Estimator does not collect citizen science data, values calculated with this tool can be used in conjunction with other citizen science projects. For example, you can use the Estimator to inform conservation changes in a Habitat Network project (see the Habitat Network project description in this section). Practice basic concepts for tree benefit calculation with the Estimator, then use the more advanced tools in iTree Canopy (a freely available online software application described in Appendix C) to contribute data for a citizen science project. View a chart of illustrated tree benefits at www.yourleaf.org/estimator. While using the Tree Benefits Estimator, hover your cursor over highlighted words to read more details about how trees provide benefits. Find out much more about urban forest benefits in LEAF's learning webpages, available at www.yourleaf.org/urban-forest.

ATTRIBUTION INFORMATION: The Ontario Residential Tree Benefits Estimator (ORTBE). Developed by LEAF in partnership with Dr. Andrew Millward of Ryerson University's Urban Forest Research & Ecological Disturbance (UFRED) Group. Available from www.yourleaf.org/estimator. Accessed: 2018.
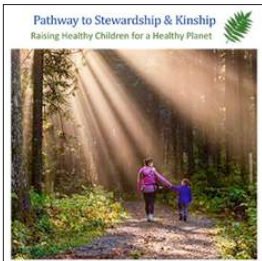
Further Reading

OUTDOOR EDUCATION RESOURCES

Park volunteers may find these books inspiring when planning citizen science activities with children.
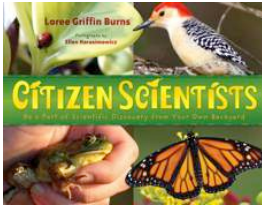
Burns, Loree Griffin and Ellen Harasimowicz. *Citizen Scientists: Be a Part of Scientific Discovery from Your Own Backyard*, Henry Holt and Co. (2012).

Dueck, Cathy and Jacob Rodenburg. *Pathway to Stewardship and Kinship: Raising Healthy Children for a Healthy Planet* (2017). Available at **www.camp kawartha.ca/pathway-to-stewardship**.
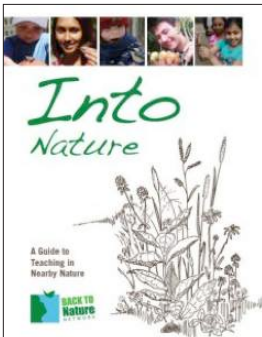
Kilburn, Bill. *Into Nature: A guide to teaching in nearby nature.* Illustrations by Jocelyne Bond. Royal Botanical Gardens, on behalf of the Back to Nature Network (2012). Revised 2016. ISBN 978-0-9691759-8-8. Available at **www.back2nature.ca**.
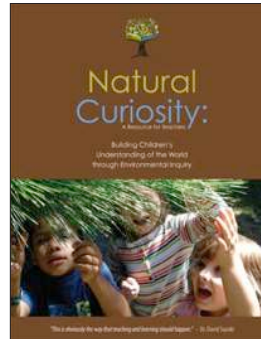
Natural Curiosity: A Resource for Teachers. The Laboratory School at The Dr. Eric Jackman Institute of Child Study, University of Toronto (2011). Available at **www.naturalcuriosity.ca**.
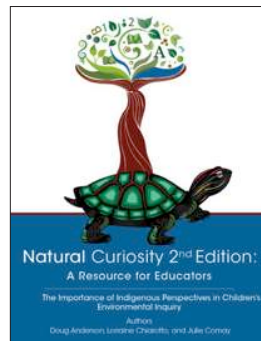
"The Importance of Indigenous Perspectives in Children's Environmental Inquiry." *Natural Curiosity 2nd Edition*, The Laboratory School at The Dr. Eric Jackman Institute of Child Study, University of Toronto (2011). Available at **www.naturalcuriosity.ca**.
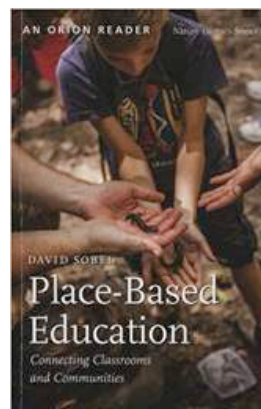
Sobel, David. "Place-based education: Connecting classroom and community," excerpt from *Place-Based Education: Connecting Classrooms and Communities*, Orion Nature Literacy Series (2004): 1-7 Available at **www.antioch.edu**.

LOCAL FIELD GUIDES

Ontario-specific field guides are useful for identifying species while participating in the Park Watch citizen science projects. Many excellent guides are available at libraries, bookstores, and online; the following selection is a starting point. While written for adults, these guides use clear images for identification and are also fairly easy for youth to understand.
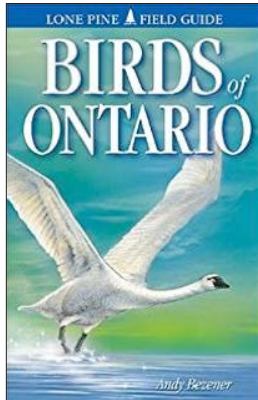
The Lone Pine Field Guide *Birds of Ontario*, by Andy Bezener, is a useful resource for novice birders (Lone Pine Pub., 2000).
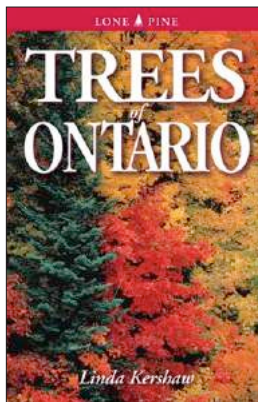
The Lone Pine Field Guide *Trees of Ontario*, by Linda Kershaw, provides a useful introduction to identifying tree species (Lone Pine Pub., 2001). See also the Lone Pine Field Guide *Plants of Southern Ontario* by Richard Dickinson and France Royer (Lone Pine Pub., 2014), and *Best Garden Plants for Ontario* by Alison Beck and Liz Klose (Lone Pine Pub., 2005).
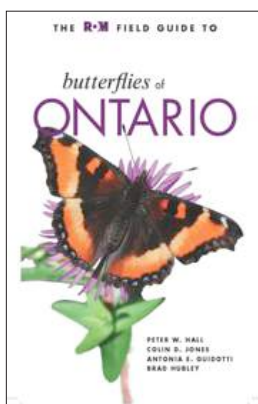
An illustrated field guide to Ontario's butterflies that corresponds to e-Butterfly range maps is *Butterflies of Ontario*, by Peter W. Hall, Colin D. Jones, Antonia Guidotti, and Brad Hubley, (Royal Ontario Museum, 2014).

The City of Toronto Biodiversity Series includes *Bees of Toronto: A Guide to their Remarkable World*, about the GTA's more than 350 bee species and how to support "these essential, yet often maligned, little insects," (City of Toronto 2016). The Biodiversity Series includes Toronto-specific books on many types of organism (spiders, mushrooms, reptiles and amphibians, etc.) and is available for free from Toronto Public Library branches or online at **www.toronto.ca/explore-enjoy/parks-gardens-beaches/ravines-natural-parklands/biodiversity-in-the-city-2.**
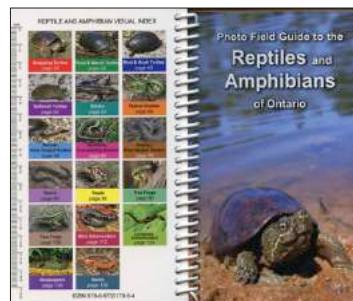
Participants of the Ontario Reptile and Amphibian Atlas will find extensive species information and identification guidance in the *Photo Field Guide to the Reptiles and Amphibians of Ontario*, by Scott D. Gillingwater and Alistair S. MacKenzie (St. Thomas Field Naturalist Club Inc. 2015). Email stfnfieldguides@gmail.com to inquire about purchase.
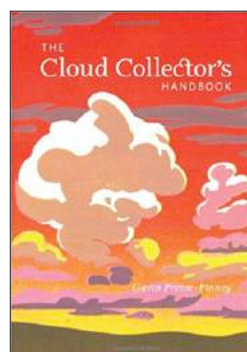
While not specific to Ontario, *The Cloud Collector's Handbook*, by Gavin Pretor-Pinney, is a field guide to cloud formations that may be useful for participants in weather projects such as the Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) Canada (Chronicle Books 2011).

APPENDIX: ADDITIONAL RESOURCES

Funding opportunities and local resources

- Park People's mission is to build strong communities across Canada by animating and improving parks, placing them at the heart of life in the city. Park People builds park connections and interest, provides community park groups with training and mentorship to support their capacity and highlights innovative park projects. The Park People website has publications about park-related research; funding opportunities; guides to help park groups engage seniors, organize park events, lead park nature walks and cleanups; and more: **https://parkpeople.ca**.

- The City of Toronto Community Stewardship Program involves teams of volunteers in ongoing maintenance and monitoring activities at various naturalization sites throughout Toronto Parks. Participants in this program help to care for natural areas across the city, with teams that meet weekly from April to September: **www.toronto.ca/ community-people/get-involved/volunteer-with- the-city/community-stewardship-program**.

- Contact local environmental organizations to learn from experts. For example, in Toronto, LEAF runs Adopt-A-Park-Tree to enhance the urban tree canopy and Toronto parks: **www.yourleaf.org/ adopt-park-tree**.

- The Biodiversity Education and Awareness Network (BEAN) provides grants up to $500 for groups to support eligible International Day for Biodiversity (IDB) events across Ontario. BEAN connects scientists and governments with teachers, parents and students to provide education and practical actions to recover and prevent the loss of biodiversity in the province: **https://biodiversityeducation.ca**.

- Permits are required to make changes to public green space, like installing new plantings. If your group is involved in a planting project with permission, citizen science monitoring before and after can help you track project impacts. Alternatively, you could encourage park neighbours to plant native species on private land and demonstrate citizen science plant monitoring activities at the park. Below are some local resources:

  - Native Plants in Claremont sells Native Wildflower Garden Kits with pollinator-friendly native wildflower plugs for planting projects in the GTA: **www.nativeplants.ca/030~Wildflower_Kits**.
  - Tree for Me is a Toronto Parks and Trees program that supports tree planting initiatives on private land in Toronto. Non-profit and charitable organizations host community-led Tree for Me events where participants take part in a tree planting and care workshop prior to receiving their tree: **www.torontoparksandtrees.ca/ Programs/Programs/Tree-for-Me**.

Citizen science resources

- The Citizen Science Association website has information about citizen science best practices and publishes a citizen science journal: **http://citizenscience.org**.

- A BioBlitz brings together taxonomic experts, citizen scientists and the general public to inventory all species (plants, animals, fungi and more) in a particular area over a twenty-four-hour period. Participants record all the organisms they find, then experts verify their identity. Species records are compiled into a single data set, a.k.a. the species list, which provides a snapshot of the biodiversity in that location on that date. A BioBlitz activity could also be conducted with species inventories on a smaller scale. Visit the Ontario BioBlitz website to learn about citizen science events and find out what's involved in planning any BioBlitz activities: **www.ontariobioblitz.ca**.

- SciStarter is a large collection of online and local field-based citizen science projects: **https://scistarter.com**.

- Zooniverse is a large collection of online citizen science projects: **www.zooniverse.org**.

- These directories list additional citizen science projects: Government of Canada **http://science.gc.ca/eic/site/063.nsf/eng/h_97169.html**, NatureWatch **www.naturewatch.ca**, and Ontario Nature **https://ontarionature.org/docs**.

- Search citizen science projects for data sets near your location. For example, use the iNaturalist bird list from Rouge National Park to help you identify local birds: **www.inaturalist.org/guides/4826?view=card**.

Data and mapping resources

- Open data resources give everyone access to maps and data sets. For example, OpenStreetMap is a map of the world, created by people like you and free to use under an open license: **www.openstreetmap.org**.

- Ontario's Open Data Directive maximizes access to government data by requiring all data to be made public on the Ontario Data Catalogue, unless it is exempt for legal, privacy, security, confidentiality or commercially-sensitive reasons. Learn more about Ontario Government Data Sharing: **www.ontario.ca/page/sharing-government-data**.

- i-Tree is a state-of-the-art, peer-reviewed software suite from the USDA Forest Service that provides free urban and rural forestry analysis and benefits assessment tools. The i-Tree tools can help strengthen forest management and advocacy efforts by quantifying forest structure and the environmental benefits that trees provide: **www.itreetools.org**. For example, use i-Tree Canopy

to estimate tree cover and tree benefits for a given area (which you select on an aerial map), with a random sampling process that lets you easily classify ground cover types. You can download your data to save it: **https://canopy.itreetools.org**.

- The Neptis Geoweb is a continually evolving interactive mapping and information platform about the Greater Golden Horseshoe. It was created by bringing together policy, administrative and census data, which are typically siloed in different governmental organizations, to help you better visualize and understand the forces shaping the city region. The public is invited to navigate, highlight and comment on issues involving the intersection of land use, transportation and environmental policies: **www.neptisgeoweb.org**. EcoSpark's Growing in the Greater Golden Horseshoe teacher resource guide and lesson plans introduce community mapping on the Neptis Geoweb: **www.ecospark.ca/complete-communities**.

Resources for understanding environmental topics in Ontario

AIR QUALITY:

- Information about Environment Canada's Air Quality Health Index: **www.canada.ca/en/ environment-climate-change/services/air- quality-health-index.html**

BIODIVERSITY:

- Biodiversity Education and Awareness Network (BEAN): **https://biodiversityeducation.ca/resources**

- Ontario Species at Risk: **www.ontario.ca/ environment-and-energy/species-risk-ontario-list**

CLIMATE CHANGE AND ENERGY:

- Local Conservation Authorities, such as Credit Valley Conservation: **https://cvc.ca/your-land- water/countryside-stewardship/stewardship- resource-centre/your-wetlands-streams-and- ponds/climate-change**

- Environment and Climate Change Canada information: **www.canada.ca/en/services/ environment/weather/climatechange.html**

INVASIVE SPECIES:

- Ontario Ministry of Natural Resources and Forestry: **www.ontario.ca/page/invasive-species-ontario**

- Ontario Invasive Plant Council: **www.ontarioinvasiveplants.ca**

ONTARIO GREENBELT:

- EcoSpark's Greenbelt resources: **www.ecospark.ca/greenbelt**

PLANNING FOR HEALTHY COMMUNITIES:

- EcoSpark's Complete Communities resources: **www.ecospark.ca/complete-communities**

POLLINATORS:

- The City of Toronto Pollinator Protection Strategy: **www.toronto.ca/draft-pollinator-strategy**

- Pollinator.org Learning Center: **http://pollinator.org/learning-center**

- Xerces Society pollinator conservation information: **https://xerces.org/pollinator-conservation**

WATER QUALITY:

- EcoSpark's Changing Currents resources: **www.ecospark.ca/changingcurrentstudents**

- City of Toronto Lake, River and Stream Water Quality: **www.toronto.ca/services-payments/water- environment/protecting-improving-lake-river- stream-water-quality**

- Lake Ontario Water Keeper: **www.waterkeeper.ca**

- Ontario Great Lakes and Watersheds information: **www.ontario.ca/page/great-lakes-and-watersheds**

- Canadian Great Lakes information: **www.canada.ca/en/environment-climate-change/ services/great-lakes-protection.html**

General environmental resources

- Visit the website of your local Conservation Authority for resources about their watersheds and educational programs offered: **http:// conservationontario.ca/conservation-authorities/ about-conservation-authorities**.

- Naturalist clubs can point you to local field guides and resources for every age group. Ontario Nature lists naturalist groups in their Nature Network: **www.ontarionature.org/about/nature-network**.

- The Environmental Commissioner of Ontario publishes annual reports, as well as special reports on a number of topics, including environmental protection, climate change, and energy conservation: **https://eco.on.ca/our-reports**.

Rain gauge (CoCoRaHS Canada 2018)
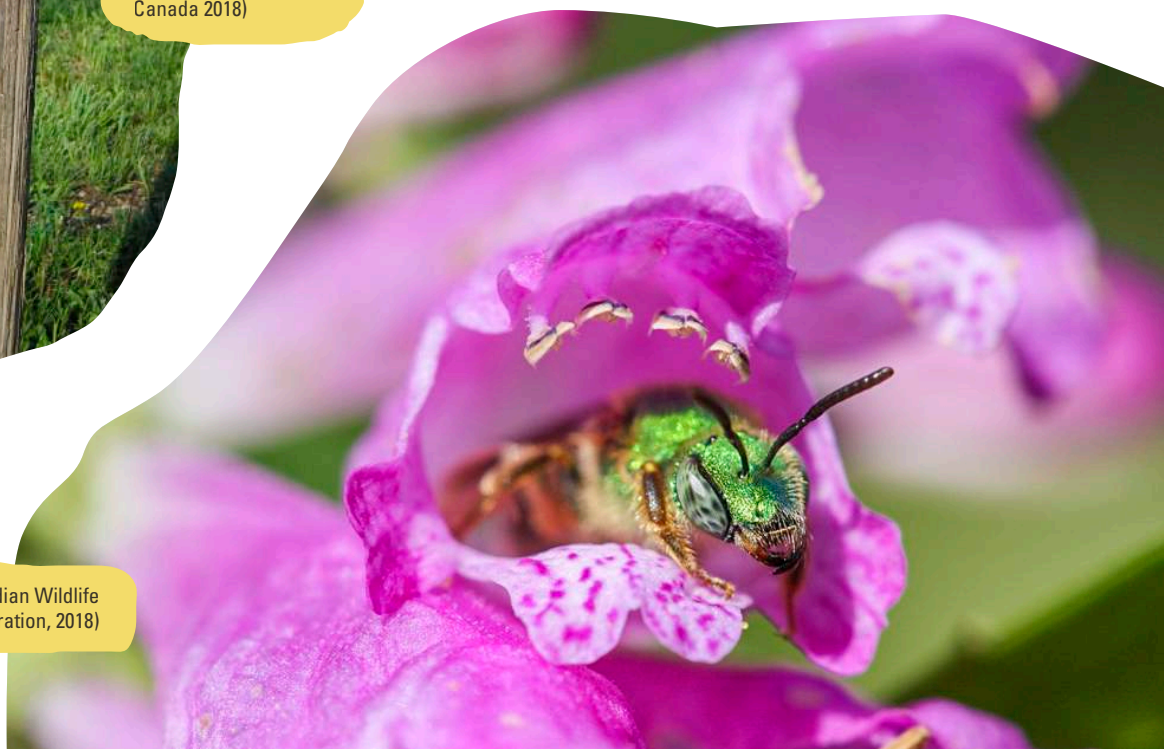
Sweat Bee (Canadian Wildlife Federation, 2018)

This Park Watch Guide is a resource to help volunteers lead citizen science activities in public green spaces. It includes a step-by-step guide to facilitating real environmental monitoring projects with people of all ages, citizen science projects, and additional information to help you get started. Contribute bird sightings and other wildlife observations to citizen science databases, identify invasive species, map habitat, and more! The focus of this guide is Toronto, Ontario. However, park groups everywhere may find the Park Watch Guide resources helpful for implementing citizen science activities with volunteers and the general public.

This resource was developed by EcoSpark, in consultation with Park People and the City of Toronto, as part of the Park Watch project to animate Toronto's public green spaces through citizen science. The Park Watch project enables volunteers to support the health and maintenance of public parks and ravines, foster a stronger connection to our public green spaces and contribute scientifically meaningful data at municipal, provincial and national scales.

For more information, visit
www.ecospark.ca