

# School Watch Guide

Green Spaces as Learning Places



COVER PHOTOS: (clockwise from top left): Student recording tree data (EcoSpark 2018), map of American robin sightings in Toronto, ON (eBird Canada 2018), monarch caterpillar by Michelle Holmes (EcoSpark 2018), and rain gauge (CoCoRaHS Canada 2018).



EcoSpark  
School Watch Guide:  
Green Spaces as Learning Places

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**TD Friends of the  
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Bumble bee on flower by Sheila Colla  
(Bumble Bee Watch 2018)

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# Introduction

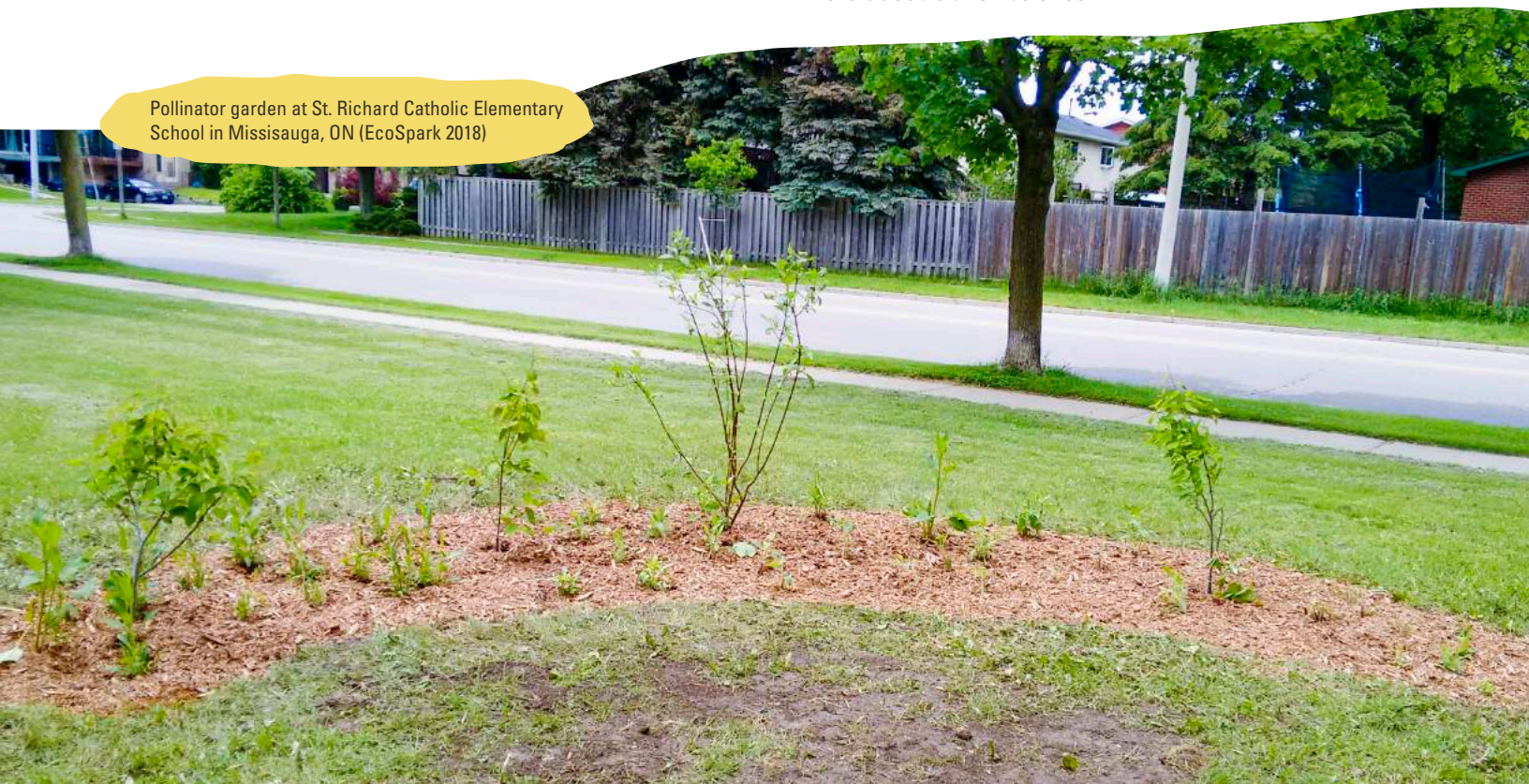
## WHAT IS THE SCHOOL WATCH GUIDE?

This School Watch Guide helps teachers lead outdoor citizen science activities with students. It was developed as part of School Watch: Green Spaces as Learning Places, an EcoSpark project that addresses the need to support teachers and students to ensure the success of existing school ground green space. The project provides teachers and their students with the knowledge, tools and support to effectively participate in, and contribute to, citizen science using natural assets on school grounds as a learning laboratory. Information collected in environmental monitoring can inform further school ground greening projects and direct conservation, stewardship and maintenance activities.

This School Watch Guide is available for free at [www.ecospark.ca](http://www.ecospark.ca). It includes:

1. an overview of **Citizen Science**, a participatory approach to environmental research where students learn by contributing to real scientific studies;
2. a teacher's **Step-by-Step Guide** to conducting citizen science research with grades 6–12 on school grounds (with ideas for conducting citizen science activities with elementary students);
3. recommended **Citizen Science Projects** and everything you need to know to implement them outside with students. Find pollinators, measure tree canopy, map habitat and more! Projects are listed with the links you need to get started. The Resources section of each project listing highlights any associated lesson plans, teacher resources and extension activities; and
4. **Additional Resources**, including further reading, links to educational resources about environmental topics, funding sources for outdoor activities, and more about citizen science.

Pollinator garden at St. Richard Catholic Elementary School in Mississauga, ON (EcoSpark 2018)



## WHO IS THIS GUIDE FOR?

The School Watch Guide was developed for Ontario grade 6–12 teachers interested in engaging students with school ground greening projects by participating in real environmental monitoring activities. The activities introduced in this guide are aligned with the Ministry of Education’s Ontario Curriculum. The relevant connections to subjects and strands are specified in Appendix A. Most activities have a science focus, but these outdoor projects can be tied to lessons across the curriculum. Many of the activities and resources can be adapted for younger grades.

Teachers who use this guide to implement outdoor education activities with students can earn points toward Ontario EcoSchools certification. See Appendix B for the Ontario EcoSchools framework alignment. Visit [www.ontarioecoschools.org](http://www.ontarioecoschools.org) to learn more about Ontario EcoSchools certification and for additional information about creating and caring for school ground greening projects.

Teachers without access to school ground greening projects may wish to use this guide to learn about a range of citizen science projects, including projects

that can take place outdoors almost anywhere. For example, students can study street trees or monitor birds. Informal educators may also find the School Watch resources useful for planning activities with children. See EcoSpark’s Park Watch Guide (available at [www.ecospark.ca](http://www.ecospark.ca)) for information about leading citizen science activities with volunteers of all ages in public green space.

## 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 and 15 publicly-funded school boards.

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



Teachers practicing citizen science monitoring activities at an EcoSpark professional development workshop (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.**

Students are important contributors in citizen science. Many projects produce findings of publishable quality using observation data collected by people of all ages and school groups (see, for example, **PlantWatch** and **eBird** publications). For additional resources about citizen science, see Appendix C.

## WHY CONDUCT CITIZEN SCIENCE WITH STUDENTS?

Citizen science is a way for students to “give back” to the ecosystems that support life by paying attention to their closest patch of nature — right on their own school grounds. Volunteers contribute valuable environmental monitoring data to support the health of their school ground green spaces, while acquiring and applying new skills. With school ground lessons, students enjoy active learning time outdoors.

Can you remember inspiring experiences as a child outdoors? How can you draw from your own motivations as an educator to spark student interest in nature? Citizen science is an opportunity for you to connect with students about, in, and for the environment.

Restored 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). Certified Ontario EcoSchools have installed gardens and planted trees where once there was inhospitable pavement. (Visit [www.ontarioecoschools.org](http://www.ontarioecoschools.org) to learn more.) Such projects provide habitat for native species, shade for play areas, flood control, and more, and can become an outdoor laboratory of hands-on learning.

School ground green spaces benefit from ongoing care to ensure these projects continue to thrive. Stewardship goes beyond weeding and watering when students are involved in environmental monitoring with citizen science. The monitoring activities featured in this guide can be used to inform stewardship actions and policies that promote ecological health of school ground green spaces.

Many citizen science activities in the School Watch Guide are accessible for students with diverse abilities and learning styles. For example, in the Bird Studies Canada Schoolyard Bird Blitz project, some participants can watch or listen for birds from any location on the school grounds, while others help identify birds with printed guides, record group observations, and submit total bird counts online. With such flexible project roles, everyone can enjoy learning outdoors, together.

By learning about multiple perspectives on environmental education, teachers can help students connect with nature and learn to be effective environmental stewards. *Natural Curiosity: A Resource for Teachers* and *Natural Curiosity 2nd Edition* (which focuses on Indigenous perspectives) are recommended as comprehensive resources for inquiry-based outdoor learning (University of Toronto 2011).

Nearby learning outdoors has well-established benefits for students. For example, David Sobel’s seminal work “Place-based Education: Connecting Classroom and Community” shows how resources right where you are can help students understand interconnections with their communities and environment. Read his overview at [www.antioch.edu](http://www.antioch.edu) (Sobel 2004).



*Pathway to Stewardship and Kinship: Raising Healthy Children for a Healthy Planet* is a valuable resource about raising engaged and caring citizens, developed by community groups in Peterborough (Dueck and Rodenburg 2017). See the Further Reading section at the end of this guide for more resources.

### **SAFETY CONSIDERATIONS**

Citizen science encourages students to explore green spaces in new ways. Use outdoor sense and check school board guidelines and policies regarding outdoor work.

Review school board first aid policies. 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).

Also review school board digital safety policies before participating in citizen science with students. Citizen

science projects may 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. Read the project’s data policies on its website to learn what information will be shared with other project participants, researchers, or the public. Teachers can submit student-collected data without personal identifying information by creating a classroom account for the project. Or you may choose to supervise students in submitting environmental monitoring data, such as species photos. Be careful not to include photos of students without permission.

Be aware of hazards including adverse weather, poison ivy, and extra risks when monitoring near traffic or water. Ensure everyone has adequate water and sun protection in hot weather and layered clothing with boots in the cold. Set clear site boundaries with students in advance to facilitate supervision.

## Step-by-Step Guide

This guide will help you plan and lead a class citizen science project start to finish. You will start by exploring your school ground green space with students and deciding what type of project suits your needs. Next, you'll plan a project by developing a study question, 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, students can share their results with others and use citizen science research to spark action for the environment.

### EXPLORE YOUR SCHOOL GROUND GREEN SPACE

The citizen science projects in this guide were selected because they are suitable for a variety of existing school ground greening projects. Students won't need to leave school grounds to participate in outdoor learning. (If you are interested in leaving school property for additional citizen science exploration, refer to your school board's policies around field trips.)

What type of school ground greening project or projects does your school have? Gardens, outdoor classrooms, natural areas, water features, forests? School ground greening projects usually include a management plan of some kind, so check in with the original project organizers to learn what was intended for the project and how the project has been incorporated into lessons in the past. Visit Ontario EcoSchools at [www.ontarioecoschools.org](http://www.ontarioecoschools.org) to learn more about different types of greening projects.

Visit natural features of your school grounds (i.e., school ground greening projects) to begin brainstorming citizen science ideas. Involve students from the very beginning by asking for their input with site exploration. Try a nature exploration activity outside with students, such as the Nature Hunt activity in Appendix D. Students can create their own field journals to record initial observations (see the Make a Field Journal lesson plan in Appendix D). This visit could take place at any time in the school year. However, going out in the same season you intend to participate in a monitoring project will give you a good feel for what plants and animals are likely to be active. (The Citizen Science Projects list includes a Timing section with project-specific notes.)

Tree canopy cover (EcoSpark 2018)







Wind turbine used to aerate a pond on a school ground greening site at Milliken Mills High School in Markham, ON (EcoSpark 2018)



American goldfinches at feeder by Liza Barney (Bird Studies Canada, 2018)

During site exploration with a class, look for treasures and challenges together outside, then brainstorm ideas. Elementary students might gravitate on their own toward interesting features of the green space in a planning walk. Older students can research environmental issues to focus on projects with wider impact (see Appendix C for resources). Discuss the underutilized areas of the school grounds, ecological highlights to protect and green space in need of support.

If you are using this guide as inspiration but you don't have a school ground greening project in place yet, think broadly! Walk around the school to get a feel for environmental monitoring opportunities, like trees students could measure or water runoff patterns students could map. Remember that citizen science data is just as valuable in impaired ecosystems as in healthy ones. Consider using citizen science data to support a campaign for improving green space at your school.

Consider the green space history and ties to existing projects. Ask students to research local context. 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, including The Ontario Butterfly Atlas Online at [www.ontarioinsects.org/atlas](http://www.ontarioinsects.org/atlas). You can also visit neighbour schools if they have undertaken citizen science on their school grounds (find certified Ontario EcoSchools listed at [www.ontarioecoschools.org](http://www.ontarioecoschools.org)).

Conduct a social scan in addition to an environmental scan. Students, parents, or other school community members may have naturalist experience that would help with your project. Students can interview relatives and neighbours to learn about perspectives on the environment. Community volunteers may support your work, perhaps by continuing monitoring activities during school vacations.

## PLAN A PROJECT

### *Develop a study question*

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

When choosing a study question, you will also need to decide how a citizen science project fits your planning needs. How does a project fit the school schedule, particularly if the natural features you're interested in monitoring have their own schedules? Use the Timing section in project listings to plan engaging monitoring activities year-round. Could your class manage a continuous monitoring schedule of five minutes a day throughout the school year, as with the rain gauge monitoring in the CoCoRaHS project? 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 Plant Watch project from spring till fall.

“With citizen science you could use monitoring to springboard into inquiry. Or inquiry to springboard into monitoring.”

CATHERINE KURUCZ, ONTARIO EDUCATOR

In selecting a project, you'll also need to decide how related activities fit with curriculum planning needs. See Appendix A for overall curriculum alignment, and the Resources section of individual Citizen Science Project listings to check if there are ready-made lessons that fit your grade and subject. See Appendix B for Ontario EcoSchools framework alignment to help you plan which EcoSchool certification points your EcoTeam might be eligible for.

A citizen science project is a good fit if you can complete it start to finish. Not only will the data be more valuable, students will benefit from seeing projects that have a “before and after” component or from creating solid baseline data from which there can be 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.

Common purple lilac, a PlantWatch species (EcoSpark 2018)

## EXAMPLES OF CITIZEN SCIENCE STUDY QUESTIONS

- » How many birds and bird species can our class find in 15 minutes on our school ground?
- » When do we observe the first spring buds of plants blooming at our site?
- » How many pollinators are counted before and after we plant a pollinator garden?
- » How does the water quality of our nearby stream compare with other sites?
- » How much precipitation falls on our site in one week, one month, and one year?

Decide in advance what you will do with the information you collect. Some projects have guidance on using citizen science contributed data to inform stewardship actions (the Ontario Reptile and Amphibian Atlas, for example). Look for opportunities to monitor changes, such as before and after nearby construction occurs or before and after a habitat improvement project is installed.

Bear in mind that it can take many years of repeated monitoring to get a large enough sample size for answering a question. That said, many small datasets contributed by many citizen scientists may offer a more

complete picture than any individual researcher could achieve. By participating in a citizen science project, your class data can be a vital part of a larger study.

Many projects allow you to register your location and keep track of data so you can revisit the same project in later weeks, seasons, or years, building a more complete dataset as you go. You can schedule long-term monitoring activities by spreading the work across several classes using a group calendar. Communicate results with all participants by using a school field guide (described below) or by using shared accounts on project websites.

Students planting trees for an outdoor classroom at St. Richard Catholic Elementary School in Mississauga, ON (EcoSpark 2018)





### **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 lesson plans. All of the School Watch Guide citizen science projects have easy-to-follow protocols to help you conduct specific monitoring activities. Have students help choose activities. Some projects also include ready-made lessons for specific age groups or expansions with guidance on using citizen science contributed data (from your class and others) in classroom lessons. This material is listed in each project's Resources section. Plant Watch, TD Tree Bee, or Bird Studies Canada projects are good projects to start with if you are interested in accessing lots of "off-the-shelf" material. For ideas on additional resources to introduce environmental topics for any project, see Appendix C.

Depending on the grade level, student outdoor time can be extended by linking activities to other subjects. While projects mostly address science and technology connections, several project listings feature cross-curricular links in the Resources section. Any project can be related to civics by reading about current events in environmental policy related to the topic. Then, discuss and debate ideas in an outdoor classroom space. (Appendix C provides learning resources for environmental topics).

Involve students in scientific planning stages to engage them in activities like equipment preparation, site selection and data management. Review project protocols together. Divide tasks among students. For example, one small group could meet with the principal about the planned project, and another could organize monitoring equipment.

## **CHOOSING ONE VERSUS MULTIPLE CITIZEN SCIENCE PROJECTS**

### **CHOOSING ONE PROJECT HAS BENEFITS OF:**

- » contributing continuous monitoring data, which helps strengthen scientific findings (try using PlantWatch throughout an entire school year to monitor garden species);
- » highlighting patterns and changes over time; and
- » engaging students in the full scope of the scientific process, from formulating hypotheses to evaluating data in context (try EcoSpark's Changing Currents program for in-depth analysis of water quality).

### **CHOOSING MULTIPLE PROJECTS HAS BENEFITS OF:**

- » allowing students to observe a single site from many angles (try researching how one garden contributes habitat for pollinators and reduces runoff for improved water quality by using Bumble Bee Watch and Habitat Network);
- » introducing a range of tools and techniques for data collection and analysis; and
- » encouraging students to gather and use data from a range of sources (for example, LEAF's Tree Benefits Estimator provides a quick snapshot of the quantified benefits of a single tree, whereas TD Tree Bee or the more advanced iTree Canopy, described in Appendix C, would allow for a full tree inventory in a defined location).



### **Prepare equipment**

Have students help 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 classroom materials. The most common type of activity is monitoring, which can often be achieved with nothing more than a pencil and paper.



Teachers making PlantWatch observations at George Peck Public School in Toronto, ON (EcoSpark 2018)

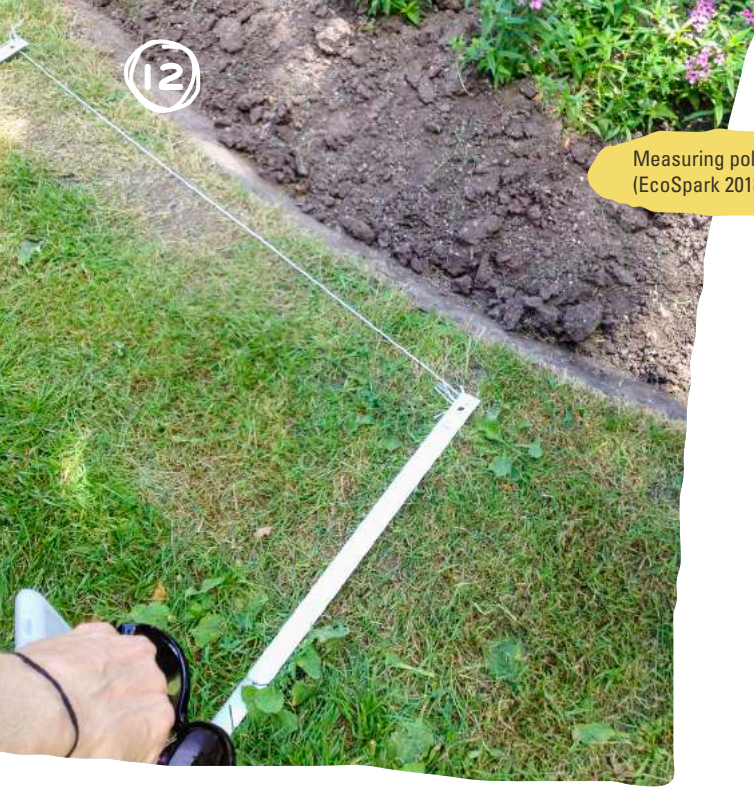


Citizen science equipment used in EcoSpark's Changing Currents program (EcoSpark 2018)

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).

## **EQUIPMENT THAT MAY BE USEFUL FOR CITIZEN SCIENCE ACTIVITIES**

- » **tape measures or string of known length (for measuring sites, tree diameter, etc.)**
- » **binoculars or magnifying glass**
- » **butterfly net**
- » **field guides (see Further Reading for suggestions)**
- » **flagging tape (to mark the monitoring site)**
- » **a whistle (for signalling to students)**
- » **a watch**
- » **a camera**
- » **map of the study site or surrounding area**
- » **field journals (see Appendix D to make your own)**
- » **paper and pencils**
- » **clipboards**
- » **project-specific data collection sheets or smartphone app**



### **Plan outdoor activities**

For site selection, consider selecting multiple sites at the school to compare and contrast. Safety (see above) and accessibility are additional considerations. Students might seek recommendations from experts or community members for selecting monitoring sites. For example, a gardener familiar with blooming times can help plan pollinator monitoring sites in a school garden.

Think through outdoor logistics before conducting the monitoring activity. Build in time for kids to put on jackets if needed, gather materials (worksheets, equipment) and time to walk across the school grounds. It can be more difficult to project your voice outside and corral excited students, but simple expectations and systems help. See “Tips for Teaching Outside,” created by City Nature Challenge, and other

outdoor teaching resources in Further Reading at the end of this guide. Review with students your school’s walking field trip permission and safety policies for outdoor classwork. Also see the Safety section, above.

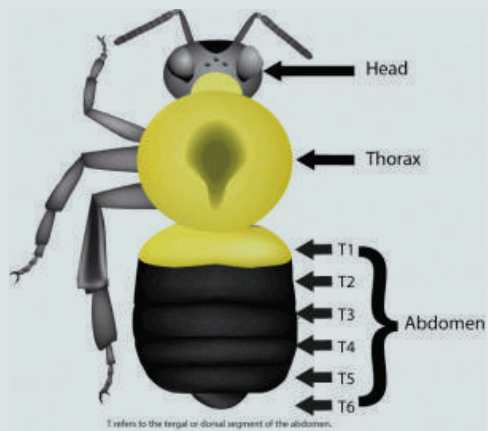
Plan for the unexpected. With proper clothing, even rainy days can be outdoors, but decide any modifications in advance. Some teachers worry that the project won’t succeed if the class doesn’t see what they’re looking for. This is an important and potentially enlightening part of field studies! If you don’t see the target birds, plants, or other organisms you’re seeking, prepare to discuss possible reasons for their absence (note site conditions, for example). Something interesting will always be found outside if you explore with an open attitude.

Enter observations of what you do find in a field journal (see the field journal lesson plan in Appendix D). Students can use the lesson plan to create individual field journals (decorating with pressed leaves or clippings from gardening magazines or seed catalogues) and make individual observations or drawings. For example, a student might trace a leaf to learn about its structure, or draw an unfamiliar insect for identification.

Consider submitting photographs of incidental species sightings to a project like iNaturalist. Classes can also start a field guide for their school that can act as a resource for other and future students. Add to field journals and the school field guide as you collect citizen science data.

“In terms of monitoring the students outside, I have done a number of things — I set an outdoor meeting space where I give instructions. Students are also made aware of the signal [whistle, bird call, etc.] used to gather them back to our meeting spot [older students can use a meet-up time]. Depending on the age group, you may wish to practice this on a smaller scale before setting them off. It is important to go over the boundaries. I teach grade 7/8 so I always tell them that they need to be able to see me and I need to be able to see them. Timelines are also helpful. I ask kids to be in groups where at least one person has a watch. Telling them ahead of time how long they will have to complete the project keeps them on task. Sometimes I will shout out ‘Five minutes!’ so they have an idea to start wrapping up their work.”

FARAH WADIA, ONTARIO EDUCATOR



## SCIENTIFIC ILLUSTRATION

Scientific illustration is an interesting cross-disciplinary career to explore. Citizen science projects including Bumble Bee Watch use diagrams to showcase identifying features of an organism. To see scientific illustration in action, launch the interactive All About Feathers feature at <https://academy.allaboutbirds.org/all-about-feathers> to supplement the Bird Studies Canada citizen science project listings (Cornell Lab Bird Academy 2018).

Diagram of bumble bee anatomy  
(Bumble Bee Watch 2018)

## CONDUCT MONITORING ACTIVITIES

### Collect data

Going outside is the fun part! At the start of a monitoring day, take a moment to enjoy being outdoors as a group. Make casual observations as you walk to the site, engaging the senses (ask students to note what they see, smell, hear, etc.) Take note of what's new since the last visit. Watch how wildlife reacts as you approach different habitats.

Consider choosing specialist roles for individual students for the day:

- Data recorder, timekeeper
- Photographer/videographer and interviewer to document the day in action
- Project provisions pro (i.e., equipment manager) to check materials out and in so nothing gets left behind
- Environmental protection officer to ensure the habitat features you visit are minimally disturbed and natural material is left where you found it
- Roving naturalist with field guides (see Further Reading), or other resources to identify species encountered
- Site mapping specialist to sketch or GPS-mark monitoring locations

Follow the project protocols carefully, noting any questions students 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.

Remind students 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 twenty 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.

Monitoring pollinator plants and photographing bumble bees (EcoSpark 2018)





Citizen scientists from Sandalwood Heights Secondary School in Brampton, ON recording field data (EcoSpark 2018)

great place to record data that doesn't fit a particular question in your protocol's data form. Citizen science project coordinators also welcome these incidental observations in the comments section of data forms. Observing natural processes as they happen will help students shape future study questions. Open observation can also encourage a sense of awe at being around nature in all its complexity.

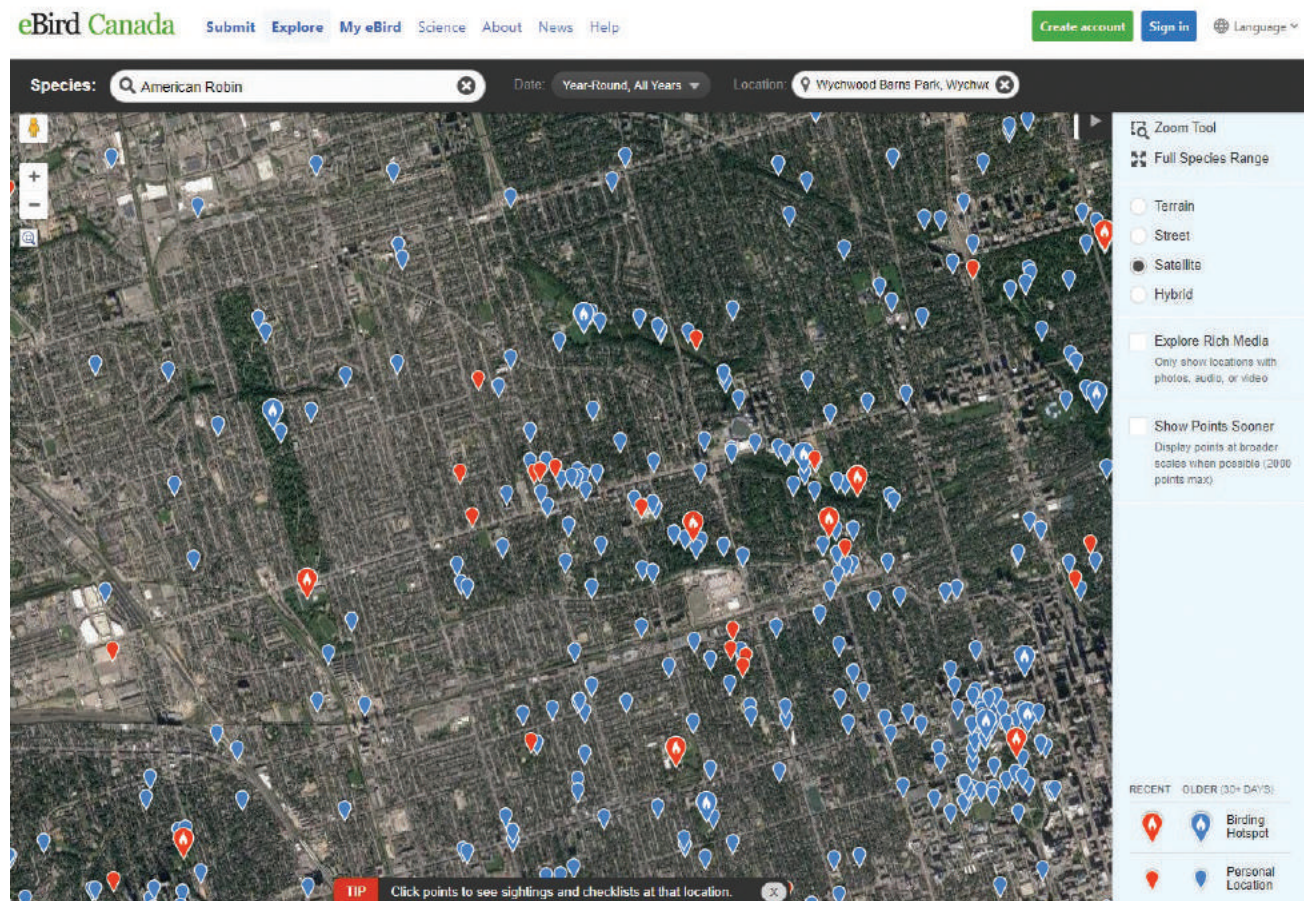
### Report data

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. Be sure to note weather (including recent storms), nearby construction noise or anything else you think would be relevant in your findings.

Your observations can always include species or natural activities you encounter that aren't part of your project. The field journals (Appendix D) are a

### Analyze data

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



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)



## NEXT STEPS

Use your data to draw connections and spark discussion. 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 in order to make assessments about health. One-time sampling doesn't provide a large enough dataset to draw conclusions. Talk with students about the significance of their data in larger contexts.

Ask students what further research would build on your findings to make a more complete picture. Is there a park or green space near their homes they could monitor as well? How might the results be similar or different? Refer back to the environmental scan from when you developed the study question to shape your next steps.

Students should understand more about how environmental issues relate to your school after participating in the activity. Are there connections from what you studied to the community, municipality or region? For example, Toronto students participating in the Bumble Bee Watch citizen science project might research the City of Toronto's Pollinator Protection Strategy, available at [www.toronto.ca/draft-pollinator-strategy](http://www.toronto.ca/draft-pollinator-strategy). Students in Peel Region could participate in Habitat Network to learn how healthy habitats support water quality, and relate their project to the Region of Peel Drinking Water Quality Management System, available at [www.peelregion.ca/pw/water/quality/dwqms-peel.htm](http://www.peelregion.ca/pw/water/quality/dwqms-peel.htm). See Appendix C for more resources to supplement learning in environmental topics.

Students can widely share data and information about their study to help others understand environmental issues. For example, a student group could share any "lessons learned" in a presentation for a nearby school. Can you link your project with citizen science at other locations? As a starting point for potential locations, find nearby schools with EcoSchool certification

using the Ontario EcoSchools map, available at [www.ontarioecoschools.org/certified-ecoschools](http://www.ontarioecoschools.org/certified-ecoschools).

Students can teach citizen science protocols to other students. By mentoring other students (e.g., in younger grades) they will build sustainability of the monitoring and data over time. This is an excellent opportunity for strengthening environmental leadership skills.

Ask students to write editorials to local online or print publications, and create social media posts, blogs, newscasts, etc., to communicate about their project and findings. For example, EcoSpark has published guest blogs by student citizen scientists, available at [www.ecospark.ca/blog](http://www.ecospark.ca/blog). EcoSpark's past participants have also made delegations to their local council.

Repeat monitoring at your site to strengthen observations and note changes over time. Compile naturalist observations from citizen science initiatives at your school, whether in an annual publication, in a school time capsule project, or in a field guide to the school grounds kept in the school library/learning commons.

Share citizen science activities far and wide. Encourage students to continue monitoring with their families around their neighbourhood to contribute to citizen science. Share your school's citizen science stories with EcoSpark! Use the contact info in the beginning of this guide. We'd love to hear from students and teachers about this important work.



An inspiring Twitter post celebrating a Milliken Mills High School delegation taking action for the environment, available at <https://twitter.com/coachy8326/status/930432867334844421>.

"The key elements in the acquisition of scientific knowledge by citizens — knowledge that makes them responsible citizen scientists — include a strong motivation, a confidence in their own common sense and a non-competitive atmosphere in which participants are both teachers and learners. This is not difficult to achieve."

URSULA FRANKLIN

Franklin, U. (2006). "Reflections on Science and the Citizen," in *The Ursula Franklin Reader: Pacifism as a Map*, Intro. by M. Swenarchuk, pp. 315-317 (Toronto: Between the Lines). Original work published 1990.

# Citizen Science Projects

## ABOUT THIS LIST

EcoSpark reviewed citizen science projects available online and considered their suitability for School Watch educators. Projects are included if they are relevant for school ground greening projects in Ontario. They are suitable for a variety of common greening projects. Students won't need to leave school grounds to participate. 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).

Data submitted to these projects is available for everyone: students, the public, and professional scientists. Because many people rely on the data for research, teachers are asked to review student data

for accuracy to the best of their ability to help with quality control of citizen science data. See the note in the Safety section about personal information and data submission.

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



Swallowtail butterfly on Echinacea bloom,  
Christine Currie (EcoSpark 2018)

## iNaturalist



**OWNER:** California Academy of Sciences and National Geographic Society

**LINK:** [www.inaturalist.org](http://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](http://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](http://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](http://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](https://education.eol.org/cnc_materials/iNaturalistWithStudents.pdf).

**ATTRIBUTION INFORMATION:** iNaturalist. California Academy of Sciences and National Geographic Society. Available from [www.inaturalist.org](http://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](http://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](http://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 (MNR) 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 MNR 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](http://www.monarchteacher.ca) provides training workshops to help teachers learn the best conservation and handling practices and obtain certification.

**SCOPE:** North America

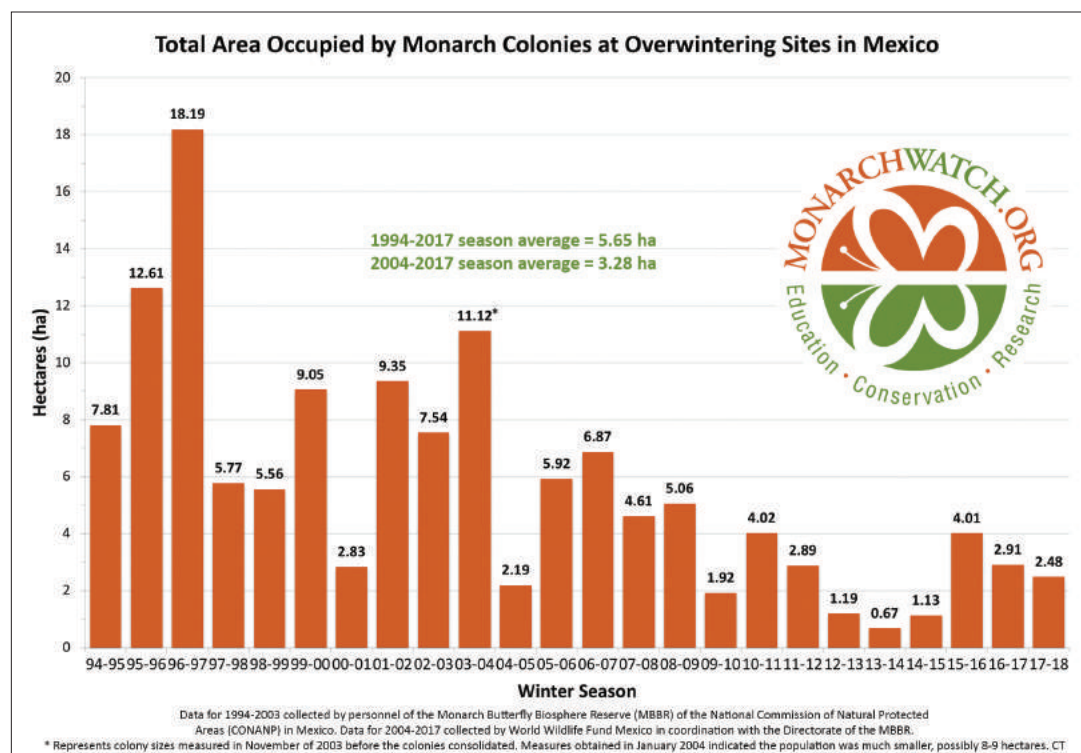
**TIMING:** Monarch populations gather in the fall around the north shore of Lake Ontario for southern migration. Springtime is best for habitat planting projects. Observe caterpillars and pupae in the spring and summer.

**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](http://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](http://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](http://www.learner.org/jnorth/tm/monarch/SpringWatch.html).

**RESOURCES:** Visit [www.monarchwatch.org](http://www.monarchwatch.org) for extensive information on the biology and conservation of monarch butterflies. The web page [www.monarchwatch.org/class/index.htm](http://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](http://www.monarchwatch.org). Accessed: 2018.



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

## e-Butterfly



**OWNER:** e-Butterfly

**LINK:** [www.e-butterfly.org](http://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](http://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](http://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](http://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](http://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](http://www.e-butterfly.org) or [www.iNaturalist.ca](http://www.iNaturalist.ca), or for large batches, email the TEA at [info@ontarioinsects.org](mailto:info@ontarioinsects.org). Try the TEA's new Ontario Moth Atlas as well, at [www.ontarioinsects.org/moth](http://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/e-butterflyapp/#/observations](https://www.e-butterfly.org/e-butterflyapp/#/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](https://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](https://www.e-butterfly.org). Accessed: 2018.

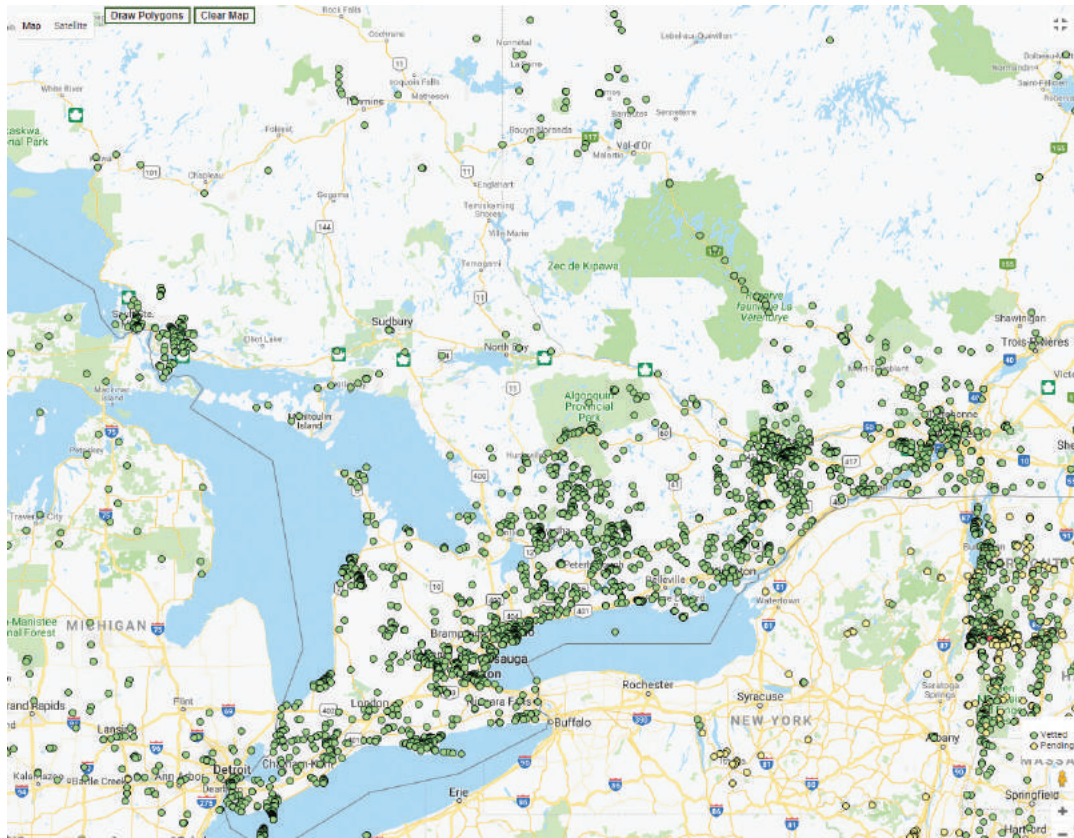


Image of online map showing swallowtail butterfly records. Image provided by e-Butterfly ([www.e-butterfly.org](https://www.e-butterfly.org)) and created April 2018.

## Bumble Bee Watch



**OWNER:** Bumble Bee Watch

**LINK:** [www.bumblebeewatch.org](http://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](http://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](http://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](http://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](http://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](http://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](http://www.bumblebeewatch.org). Accessed: 2018.



## Bird Studies Canada projects



LINK: [www.birdscanada.org](http://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](http://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](http://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](http://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](http://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](http://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](http://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](http://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](http://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](http://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](http://www.birdscanada.org). (Accessed: March 2018).

eBird. 2018. eBird: An online database of bird distribution and abundance. eBird, Cornell Lab of Ornithology, Ithaca, New York. Available from [www.ebird.org](http://www.ebird.org). Accessed: March 2018.

## Ontario Reptile and Amphibian Atlas



**OWNER:** Ontario Nature

**LINK:** [www.ontarionature.org/atlas](http://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](http://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](http://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](http://www.ontarionature.org/programs/citizen-science/reptile-amphibian-atlas/tips).

**ATTRIBUTION INFORMATION:** Ontario Nature. *Ontario Reptile and Amphibian Atlas*. Available from [www.ontarionature.org](http://www.ontarionature.org). Accessed: 2018.

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



## PlantWatch



**OWNER:** NatureWatch Canada

**LINK:** [www.naturewatch.ca/plantwatch](http://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](http://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](http://www.naturewatch.ca/plantwatch). Accessed: 2018.



Dandelions observed by PlantWatch participants during an EcoSpark teacher training activity in Toronto, ON (EcoSpark 2018)

## TD Tree Bee



**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](http://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](http://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](http://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](http://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.

## EDDMapS Ontario

### EDD MapS Ontario

Early Detection & Distribution Mapping System



**OWNER:** EDDMapS Ontario

**LINK:** [www.eddmaps.org/ontario](http://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](http://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.

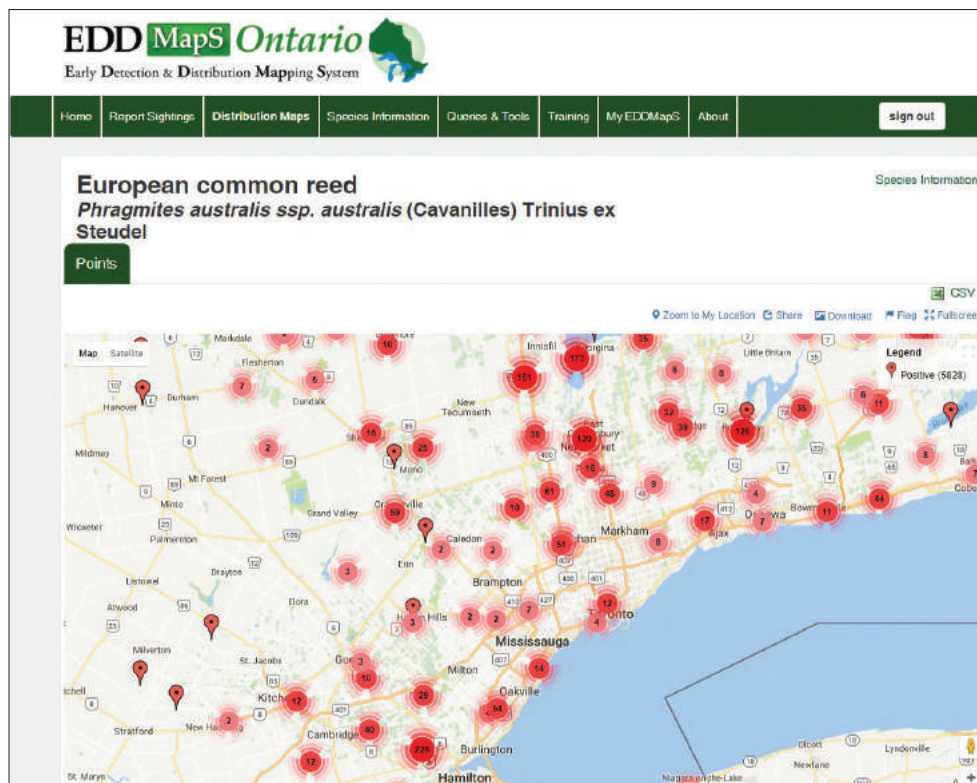
**SCOPE:** Ontario

**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](http://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](http://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](http://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](http://www.ontarioinvasiveplants.ca).

**ATTRIBUTION INFORMATION:** EDDMapS Launched in 2005 by the Center for Invasive Species and Ecosystem Health at the University of Georgia. EDDMapS Ontario was developed through the support and funding provided by the Canada/Ontario Invasive Species Centre, the Ontario Federation of Anglers and Hunters and the Ontario Ministry of Natural Resources. Available from [www.eddmaps.org](http://www.eddmaps.org). Accessed: 2018.



EDDMapS Ontario map showing reports of European Common Reed, an invasive plant (EDDMapS Ontario, January 2018)

## Habitat Network

# Habitat Network

powered by yardmap



**OWNER:** Cornell Lab of Ornithology and The Nature Conservancy

**LINK:** [www.habitat.network](http://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

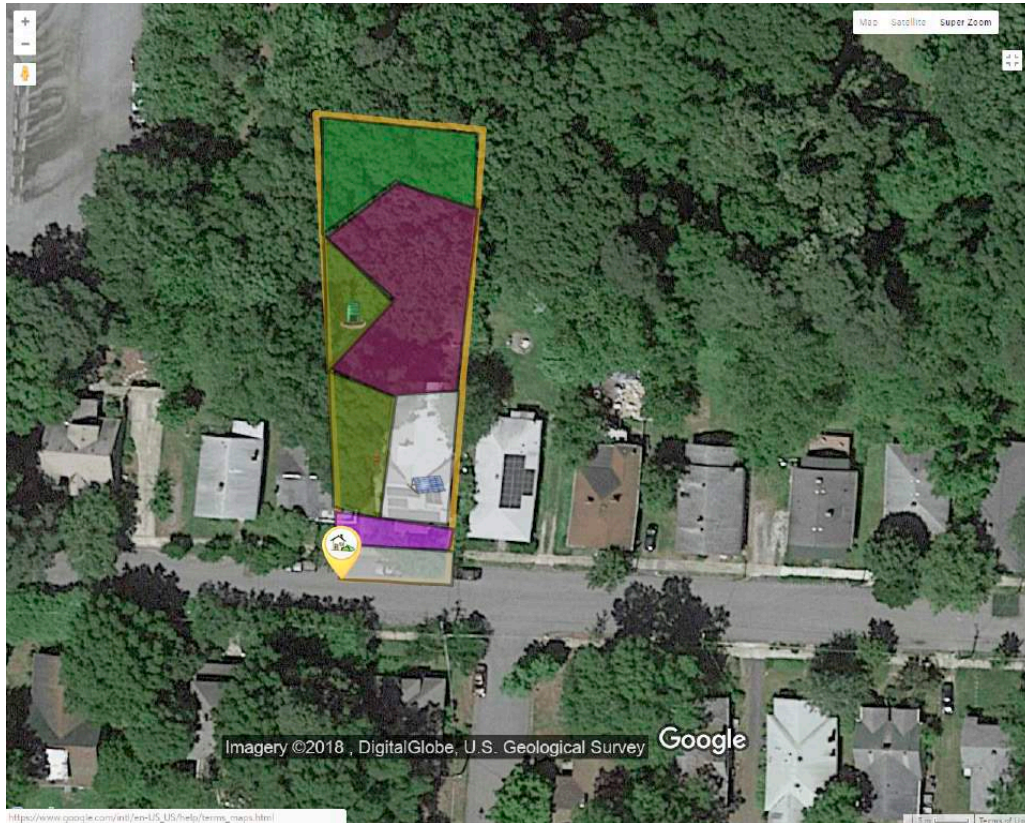
**TIMING:** Habitat supports different species throughout the year, but can be mapped at any time.

**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](http://www.toronto.ca/draft-pollinator-strategy).



**ATTRIBUTION INFORMATION:** Habitat Network. Powered by YardMap. Joint partnership between The Nature Conservancy and the Cornell Lab of Ornithology, with support from the National Science Foundation. Available from <http://content.yardmap.org>. Accessed: 2018.



Habitat map, D. Buchbinder. Provided by Habitat Network (<http://content.yardmap.org>) with DigitalGlobe, U.S. Geological Survey, and created March 2018.

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



**OWNER:** Colorado Climate Center at Colorado State University

**LINK:** [www.cocorahs.org/Canada](http://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](http://www.cocorahs.org)).

**HOW TO PARTICIPATE:** Visit the CoCoRaHS website to watch training videos ([www.cocorahs.org/Content.aspx?page=training\\_slideshows](http://www.cocorahs.org/Content.aspx?page=training_slideshows)) and register to report precipitation at your location ([www.cocorahs.org/Canada-Application.aspx](http://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.

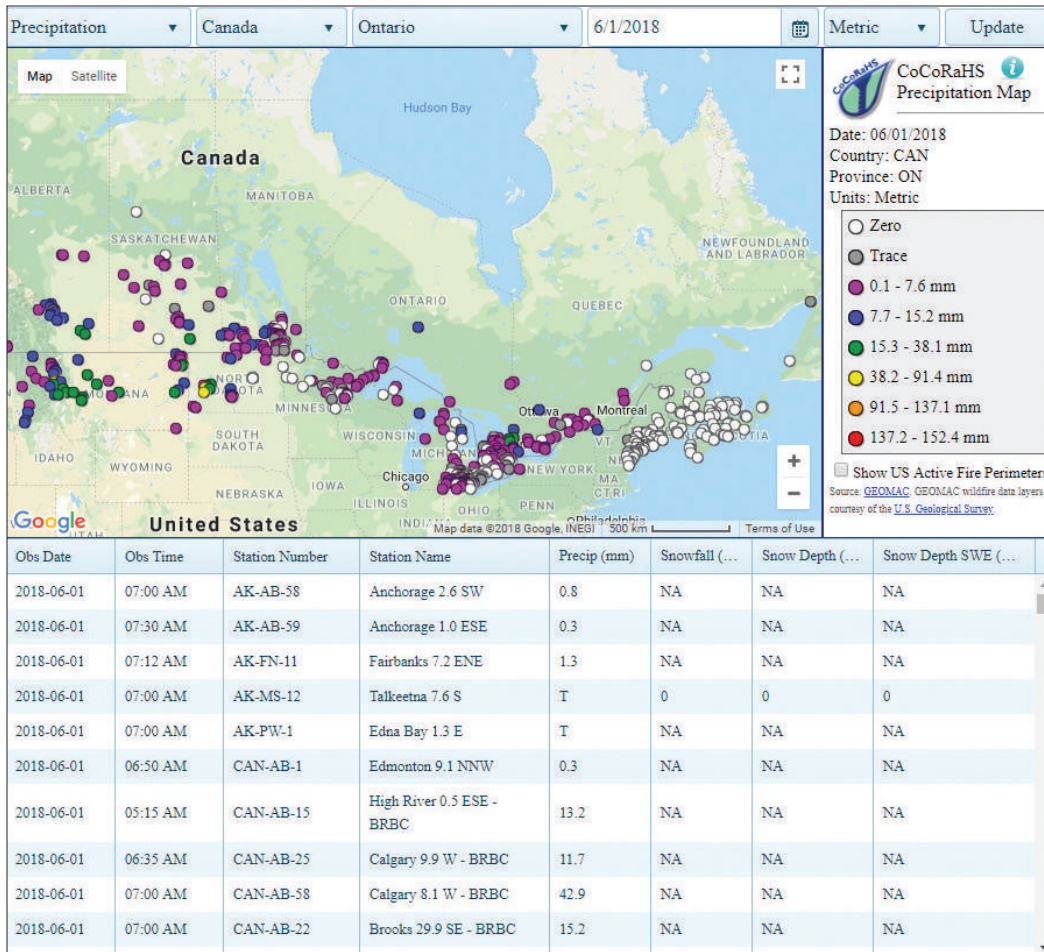
**RESOURCES:** Training videos available on the CoCoRaHS YouTube website use cartoon animation to explain monitoring techniques and concepts ([www.youtube.com/user/cocorahs](http://www.youtube.com/user/cocorahs)). Meteorology teacher resources and lesson plans are available on the CoCoRaHS Education webpage, at [www.cocorahs.org/Content.aspx?page=education](http://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](http://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](http://www.cocorahs.org/Canada). Accessed: 2018.



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

Rain gauges (CoCoRaHS Canada 2018)



## EcoSpark's Changing Currents



**OWNER:** EcoSpark

**LINK:** [www.ecospark.ca/changing-currents](http://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](http://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](http://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](http://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](http://www.ecospark.ca/changing-currents).

**ATTRIBUTION INFORMATION:** EcoSpark's Changing Currents Program. Available from [www.ecospark.ca/changing-currents](http://www.ecospark.ca/changing-currents). Accessed: April 2018.



Students from Unionville High School in Markham, ON participating in Changing Currents stream assessment (EcoSpark 2018)

## Ontario Residential Tree Benefits Estimator (Citizen Science Tool)



**OWNER:** LEAF (Local Enhancement and Appreciation of Forests)

**LINK:** [www.yourleaf.org/estimator](http://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<sub>2</sub> 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](http://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](http://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](http://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](http://www.yourleaf.org/estimator). Accessed: 2018.

## Further Reading

### CITY NATURE CHALLENGE EDUCATION TOOLKIT

As a part of the City Nature Challenge Education Toolkit, a group of educators at institutions around the world gathered and reviewed hundreds of resources about biodiversity and citizen science:

<http://citynaturechallenge.org/education-toolkit>. The Toolkit includes these resources:

- Tips for facilitating, managing and supporting students outside:  
[https://education.eol.org/cnc\\_materials/TipsForTeachingOutside.pdf](https://education.eol.org/cnc_materials/TipsForTeachingOutside.pdf)
- A guide to using iNaturalist with students in any formal or informal education setting:  
[https://education.eol.org/cnc\\_materials/iNaturalistWithStudents.pdf](https://education.eol.org/cnc_materials/iNaturalistWithStudents.pdf)
- Age-specific Educator Basecamp resources to integrate citizen science activities related to the City Nature Challenge in curriculum/education programs:  
<http://citynaturechallenge.org/education-toolkit/>
- Ages 5–8:  
[https://education.eol.org/cnc\\_materials/EducatorBasecamp\\_5-8.pdf](https://education.eol.org/cnc_materials/EducatorBasecamp_5-8.pdf)
- Ages 8–11:  
[https://education.eol.org/cnc\\_materials/EducatorBasecamp\\_8-11.pdf](https://education.eol.org/cnc_materials/EducatorBasecamp_8-11.pdf)
- Ages 11–14:  
[https://education.eol.org/cnc\\_materials/EducatorBasecamp\\_11-14.pdf](https://education.eol.org/cnc_materials/EducatorBasecamp_11-14.pdf)
- Ages 14–18:  
[https://education.eol.org/cnc\\_materials/EducatorBasecamp\\_14-18.pdf](https://education.eol.org/cnc_materials/EducatorBasecamp_14-18.pdf)
- Higher Education:  
[https://education.eol.org/cnc\\_materials/EducatorBasecamp\\_Undergrad.pdf](https://education.eol.org/cnc_materials/EducatorBasecamp_Undergrad.pdf)
- General Public:  
[https://education.eol.org/cnc\\_materials/EducatorBasecamp\\_generalpublic.pdf](https://education.eol.org/cnc_materials/EducatorBasecamp_generalpublic.pdf)

The City Nature Challenge is an international event to celebrate Citizen Science Day each spring. Participating cities compete to gather citizen science observations submitted by people of all ages and experience levels. Visit <http://citynaturechallenge.org> to learn more.

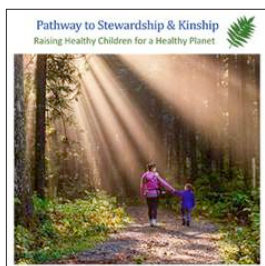
The City Nature Challenge is organized by the California Academy of Sciences and the Natural History Museum of Los Angeles County, with more than 60 cities participating globally in 2018.

## OUTDOOR EDUCATION RESOURCES

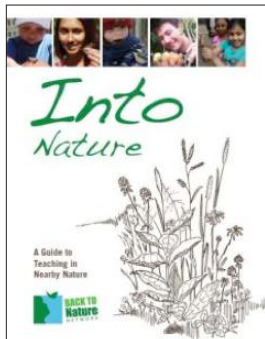
Teachers may find these books inspiring when planning outdoor citizen science activities with children.



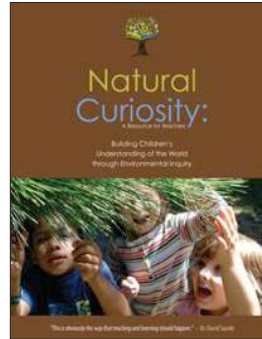
Burns, Loree Griffin and Ellen Harasimowicz. *Citizen Scientists: Be a Part of Scientific Discovery from Your Own Backyard*, Henry Holt and Co. (2012).



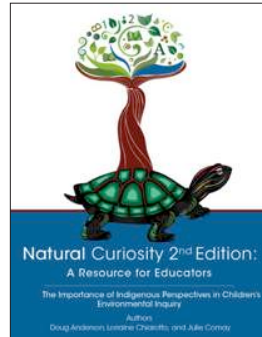
Dueck, Cathy and Jacob Rodenburg. *Pathway to Stewardship and Kinship: Raising Healthy Children for a Healthy Planet* (2017). Available at [www.campkawartha.ca/pathway-to-stewardship](http://www.campkawartha.ca/pathway-to-stewardship).



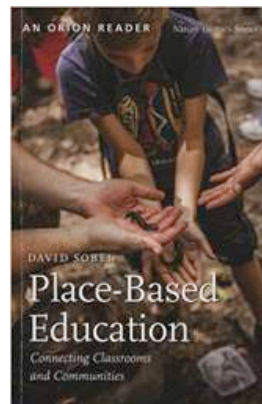
Kilburn, Bill. *Into Nature: A guide to teaching in nearby nature*. Illustrations by Jocelyne Bond. Royal Botanical Gardens, on behalf of the Back to Nature Network (2012). Revised 2016. ISBN 978-0-9691759-8-8. Available at [www.back2nature.ca](http://www.back2nature.ca).



*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](http://www.naturalcuriosity.ca).



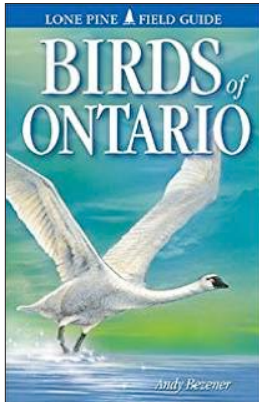
“The Importance of Indigenous Perspectives in Children’s Environmental Inquiry.” *Natural Curiosity 2nd Edition*, The Laboratory School at The Dr. Eric Jackman Institute of Child Study, University of Toronto (2011). Available at [www.naturalcuriosity.ca](http://www.naturalcuriosity.ca).



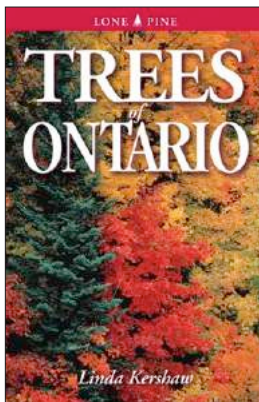
Sobel, David. “Place-based education: Connecting classroom and community,” excerpt from *Place-Based Education: Connecting Classrooms and Communities*, Orion Nature Literacy Series (2004): 1-7 Available at [www.antioch.edu](http://www.antioch.edu).

## LOCAL FIELD GUIDES

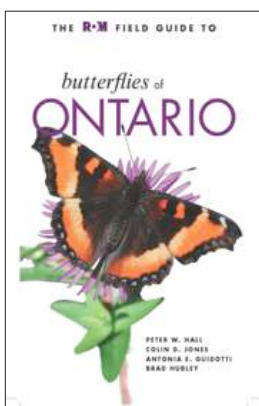
*Ontario-specific field guides are useful for identifying species while participating in the School Watch citizen science projects. Many excellent guides are available at libraries, bookstores, and online; the following selection is a starting point. While written for adults, these guides use clear images for identification and are fairly easy for students 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).

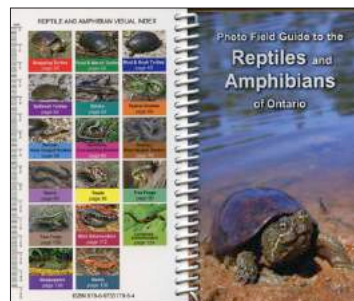


An illustrated field guide to Ontario's butterflies that corresponds to e-Butterfly range maps is *Butterflies of Ontario*, by Peter W. Hall, Colin D. Jones, Antonia Guidotti, and Brad Hubley, (Royal Ontario Museum, 2014).



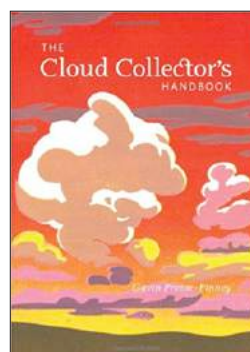
The City of Toronto Biodiversity Series includes *Bees of Toronto: A Guide to their Remarkable World*, about the GTA's more than 350 bee species and how to

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](http://www.toronto.ca/explore-enjoy/parks-gardens-beaches/ravines-natural-parklands/biodiversity-in-the-city).



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](mailto: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 students participating in weather projects like the Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) Canada (Chronicle Books 2011).



## APPENDIX A: OVERVIEW OF RELEVANT ONTARIO CURRICULUM CONNECTIONS TO SCHOOL WATCH ACTIVITIES

Policy documents in the Ontario Curriculum outline mandatory requirements and standards. They are available at [www.edu.gov.on.ca/eng/curriculum](http://www.edu.gov.on.ca/eng/curriculum). For grades 6 through 12, School Watch activities have the most relevant connections to the curriculum strands and topics highlighted in the tables below.

School Watch activities are well aligned with the resource documents: *Environmental Education, Scope and Sequence of Expectations, Grades 1-8, 2017*, and *Environmental Education: Scope and Sequence of Expectations, Grades 9-12, 2017*.

GRADE 1-8 SCIENCE AND TECHNOLOGY CURRICULUM OVERVIEW				
Course	Understanding Life Systems	Understanding Matter and Energy	Understanding Earth and Space Systems	Understanding Structures and Mechanisms
Grade 6	Biodiversity	Electricity and Electrical Devices	Space	Flight
Grade 7	Interactions in the Environment	Pure Substances and Mixtures	Heat in the Environment	Form and Function
Grade 8	Cells	Fluids	Water Systems	Systems in Action

GRADE 1-8 MATHEMATICS CURRICULUM OVERVIEW				
Number Sense and Numeration	Measurement	Geometry and Spatial Sense	Patterning and Algebra	Data Management and Probability

GRADE 9 AND 10 SCIENCE CURRICULUM OVERVIEW					
Course	A. Scientific Investigation Skills and Career Exploration	B. Biology	C. Chemistry	D. Earth and Space Systems	E. Physics
<b>Grade 9</b>					
Academic SNC1D	Scientific Investigation Skills and Career Exploration	Sustainable Ecosystems	Atoms, Elements, and Compounds	The Study of the Universe	The Characteristics of Electricity
Applied SNC1P	Scientific Investigation Skills and Career Exploration	Sustainable Ecosystems and Human Activity	Exploring Matter	Space Exploration	Electrical Applications
<b>Grade 10</b>					
Academic SNC2D	Scientific Investigation Skills and Career Exploration	Tissues, Organs, and Systems of Living Things	Chemical Reactions	Climate Change	Light and Geometric Optics
Applied SNC2P	Scientific Investigation Skills and Career Exploration	Human Tissues, Organs, and Systems	Chemical Reactions and Their Practical Applications	Earth's Dynamic Climate	Light and Applications of Optics

### GRADE 9 AND 10 TECHNOLOGICAL EDUCATION CURRICULUM OVERVIEW: GREEN INDUSTRIES STRANDS

Grade 9 Exploring Technologies Open TIJ10	Course may include an Exploring Green Industries Section			
Grade 10 Green Industries OpenTHJ2O	Green Industry Fundamentals	Green Industry Skills	Technology, the Environment, and Society	Professional Practice and Career Opportunities

### GRADE 9 AND 10 MATHEMATICS CURRICULUM OVERVIEW

Grade 9 Principles of Mathematics (Academic)	Number Sense and Algebra	Linear Relations	Analytic Geometry	Measurement and Geometry
Grade 9 Foundations of Mathematics (Applied)	Number Sense and Algebra	Linear Relations	Measurement and Geometry	
Grade 10 Principles of Mathematics (Academic)	Quadratic Relations	Analytic Geometry	Trigonometry	
Grade 10 Foundations of Mathematics (Applied)	Measurement and Trigonometry	Modeling Linear Relations	Quadratic Relations	

### GRADE 9 AND 10 CANADIAN AND WORLD STUDIES CURRICULUM OVERVIEW

<b>Grade 9</b>					
Geography Academic CGC1D	Geographic Foundations: Space and Systems	Human-Environment Interactions	Global Connections	Understanding and Managing Change	Methods of Geographic Inquiry and Communication
Geography Applied CGC1P	Geographic Foundations: Space and Systems	Human-Environment Interactions	Global Connections	Understanding and Managing Change	Methods of Geographic Inquiry and Communication
<b>Grade 10</b>					
Civics Open CHV2O	Informed Citizenship	Purposeful Citizenship	Active Citizenship	<i>(Some expectations in each strand may be addressed)</i>	

## GRADE 11 AND 12 SCIENCE CURRICULUM OVERVIEW

Course	Strand A	Strand B	Strand C	Strand D	Strand E	Strand F
<b>Grade 11</b>						
Biology University SBI3U	Scientific Investigation Skills and Career Exploration	Diversity of Living Things	Evolution	Genetic Processes	Animals: Structure and Function	Plants: Anatomy, Growth, and Function
Biology College SBI3C	Scientific Investigation Skills and Career Exploration	Cellular Biology	Microbiology	Genetics	Anatomy of Mammals	Plants in the Natural Environment
Environmental Science University/College SVN3M	Scientific Investigation Skills and Career Exploration	Scientific Solutions to Contemporary Environmental Challenges	Human Health and the Environment	Sustainable Agriculture and Forestry	Reducing and Managing Waste	Conservation of Energy
Environmental Science Workplace SVN3E	Scientific Investigation Skills and Career Exploration	Human Impact on the Environment	Human Health and the Environment	Energy Conservation	Natural Resource Science and Management	The Safe and Environmentally Responsible Workplace
<b>Grade 12</b>						
Biology University SBI4U	Scientific Investigation Skills and Career Exploration	Biochemistry	Metabolic Processes	Molecular Genetics	Homeostasis	Population Dynamics
Science Workplace SNC4E	Scientific Investigation Skills and Career Exploration	Hazards in the Workplace	Chemicals in Consumer Products	Disease and Its Prevention	Electricity at Home and Work	Nutritional Science

## GRADE 11 AND 12 TECHNOLOGICAL EDUCATION CURRICULUM OVERVIEW

<b>GREEN INDUSTRIES</b>					
Course	Strand A	Strand B	Strand C	Strand D	
<b>Grade 11</b>					
Green Industries University/College THJ3M	Green Industry Fundamentals	Green Industry Skills	Technology, the Environment, and Society	Professional Practice and Career Opportunities	
Green Industries Workplace THJ3E	Green Industry Fundamentals	Green Industry Skills	Technology, the Environment, and Society	Professional Practice and Career Opportunities	
<b>Grade 12</b>					
Green Industries University/College THJ4M	Green Industry Fundamentals	Green Industry Skills	Technology, the Environment, and Society	Professional Practice and Career Opportunities	
Green Industries Workplace THJ4E	Green Industry Fundamentals	Green Industry Skills	Technology, the Environment, and Society	Professional Practice and Career Opportunities	

## GRADE 11 AND 12 CANADIAN AND WORLD STUDIES CURRICULUM OVERVIEW

GEOGRAPHY COURSES					
Course	Strand A	Strand B	Strand C	Strand D	Strand E
<b>Grade 11</b>					
The Americas: Geographic Patterns and Issues University/ College CGD3M	Geographic Foundations: Space and Systems	Human-Environment Interactions	Global Connections	Understanding and Managing Change	Methods of Geographic Inquiry and Communication
Physical Geography: Patterns and Processes University/College CGF3M	Geographic Foundations: Space and Systems	Human-Environment Interactions	Global Connections	Understanding and Managing Change	Methods of Geographic Inquiry and Communication
Geographics: The Geographers Toolkit Workplace CGT3E	Geographic Foundations: Space and Systems	Human-Environment Interactions	Global Connections	Understanding and Managing Change	Methods of Geographic Inquiry and Communication
Travel and Tourism: A Regional Geographic Perspective Open CCG3O	Geographic Foundations: Space and Systems	Human-Environment Interactions	Global Connections	Understanding and Managing Change	Methods of Geographic Inquiry and Communication
<b>Grade 12</b>					
Canadian and World Issues: A Geographic Analysis University CGW4U	Geographic Foundations: Space and Systems	Human-Environment Interactions	Global Connections	Understanding and Managing Change	Methods of Geographic Inquiry and Communication
World Geography: Human Patterns and Interactions University CGU4U	Geographic Foundations: Space and Systems	Human-Environment Interactions	Global Connections	Understanding and Managing Change	Methods of Geographic Inquiry and Communication
The Environment and Resource Management University/College CGR4M	Geographic Foundations: Space and Systems	Human-Environment Interactions	Global Connections	Understanding and Managing Change	Methods of Geographic Inquiry and Communication
Geomatics: Geotechnologies in Action University/ College CGO4M	Geographic Foundations: Space and Systems	Human-Environment Interactions	Global Connections	Understanding and Managing Change	Methods of Geographic Inquiry and Communication
World Geography: Urban Patterns and Interactions College CGU4C	Geographic Foundations: Space and Systems	Human-Environment Interactions	Global Connections	Understanding and Managing Change	Methods of Geographic Inquiry and Communication
The Environment and Resource Management Workplace CGR4E	Geographic Foundations: Space and Systems	Human-Environment Interactions	Global Connections	Understanding and Managing Change	Methods of Geographic Inquiry and Communication

## APPENDIX B: SCHOOL WATCH CONNECTIONS TO ONTARIO ECOSCHOOLS CERTIFICATION

Teachers who use this guide to implement outdoor education activities with students can earn points toward Ontario EcoSchools certification by applying directly to Ontario EcoSchools. Qualifying activities must be determined by Ontario EcoSchools. School Watch activities are generally best aligned with the highlighted EcoSchools Guiding Questions in this framework chart (Ontario EcoSchools, 2018). Please visit [www.ontarioecoschools.org](http://www.ontarioecoschools.org) to learn more.

SECTION	SECTION TITLE	GUIDING QUESTION
<b>I</b>	Teamwork and Leadership	
	1.5	Opportunities for Student Leadership
	1.8	Workshops/presentations
<b>II</b>	Energy Conservation	
<b>III</b>	Waste Minimization	
<b>IV</b>	School Ground Greening	
	4.3	To what extent did your EcoTeam follow a research and/or planning process to ensure that your project improves biodiversity and encourages ecological sustainability?
	4.4	To what extent do your school ground greening project(s) have an impact on the broader community? (e.g., provides useful shade for students; grows food; provides a venue for events; reduces runoff.)
	4.5	How do students and teachers regularly use the school ground greening project(s) mentioned in 4.1a to enrich student learning? (Curriculum-linked lessons, Learning in the outdoors)
<b>V</b>	Curriculum	
	5	How do students learn In, about, and for the environment as a regular part of teaching and learning?
<b>VI</b>	Environmental Stewardship	
	6	School-wide Citizen Science Program

## APPENDIX C: ADDITIONAL TEACHER RESOURCES

### *Funding opportunities and local resources*

- The Ontario Ministry of Education's Community-Connected Experiential Learning is a fund for elementary and secondary students:  
[www.edu.gov.on.ca/eng/policyfunding/memos/dec2017/community\\_connected\\_projects.html](http://www.edu.gov.on.ca/eng/policyfunding/memos/dec2017/community_connected_projects.html).
- EduGAINS provides information about the Ministry's Innovation Learning Fund (21st Century Learning):  
[www.edugains.ca/newsite/21stCenturyLearning/innovation\\_learning\\_funding.html](http://www.edugains.ca/newsite/21stCenturyLearning/innovation_learning_funding.html).
- The Ontario EcoSchools website lists year-round funding opportunities for related activities:  
[www.ontarioecoschools.org/tools-resources/funding-opportunities](http://www.ontarioecoschools.org/tools-resources/funding-opportunities).
- World Wildlife Fund (WWF) offers WWF Go Wild School Grants:  
[www.wwf.ca/takeaction/gowildschools](http://www.wwf.ca/takeaction/gowildschools)
- 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>.
- Contact local environmental organizations to learn from local experts. For example,
  - in Toronto, LEAF runs an Adopt-a-Street-Tree program:  
[www.yourleaf.org/adopt-street-tree](http://www.yourleaf.org/adopt-street-tree);
  - in Wellington, Elora Environmental Centre runs tree citizen science and citizen pruner programs:  
<https://eloraenvironmentcentre.ca/trees>.
- If you are making changes to your school ground greening space or installing new features like plantings, be sure the project follows best practices for the environment (for example, that you only use native plants) and that you have permission. Visit the Ontario EcoSchools website for guidance ([www.ontarioecoschools.org](http://www.ontarioecoschools.org)). If your group is involved in a planting project, citizen science monitoring before and after can help you track project impacts. Alternatively, you could encourage neighbours to plant native species on private land and demonstrate citizen science monitoring at a community event. 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](http://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](http://www.torontoparksandtrees.ca/Programs/Programs/Tree-for-Me).
  - A comprehensive resource for taking action to protect native pollinators by providing flowering habitat and nesting sites, with an identification guide, is *Attracting Native Pollinators: Protecting North America's Bees and Butterflies*, by The Xerces Society, (Storey Publishing, 2011).

### ***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. The 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, including existing events for classes, and find out what's involved in planning BioBlitz activities at your site: [www.ontariobioblitz.ca](http://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](http://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](http://science.gc.ca/eic/site/063.nsf/eng/h_97169.html), NatureWatch [www.naturewatch.ca](http://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](http://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](http://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](http://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](http://www.itreetools.org).
  - 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 for the (FYI: the GGH goes much beyond the Toronto area) 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](http://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](http://www.ecospark.ca/complete-communities).

### *Resources for understanding environmental topics in Ontario*

#### **AIR QUALITY**

- Classroom resources for Environment Canada's Air Quality Health Index: [www.canada.ca/en/environment-climate-change/services/air-quality-health-index/publications.html](http://www.canada.ca/en/environment-climate-change/services/air-quality-health-index/publications.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](http://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](http://www.canada.ca/en/services/environment/weather/climatechange.html) and <https://climatekids.ca>

#### **INVASIVE SPECIES**

- Ontario Ministry of Natural Resources and Forestry: [www.ontario.ca/page/invasive-species-ontario](http://www.ontario.ca/page/invasive-species-ontario)
- Ontario Invasive Plant Council: [www.ontarioinvasiveplants.ca](http://www.ontarioinvasiveplants.ca)

#### **ONTARIO GREENBELT**

- EcoSpark's Greenbelt resources: [www.ecospark.ca/greenbelt](http://www.ecospark.ca/greenbelt)

#### **PLANNING FOR HEALTHY COMMUNITIES**

- EcoSpark's Complete Communities resources: [www.ecospark.ca/complete-communities](http://www.ecospark.ca/complete-communities)

#### **POLLINATORS**

- The City of Toronto Pollinator Protection Strategy: [www.toronto.ca/draft-pollinator-strategy](http://www.toronto.ca/draft-pollinator-strategy)
- Pollinator.org Learning Center: <http://pollinator.org/learning-center/education>
- Xerces Society Resources for Educators: <https://xerces.org/educational-resources>

#### **WATER QUALITY**

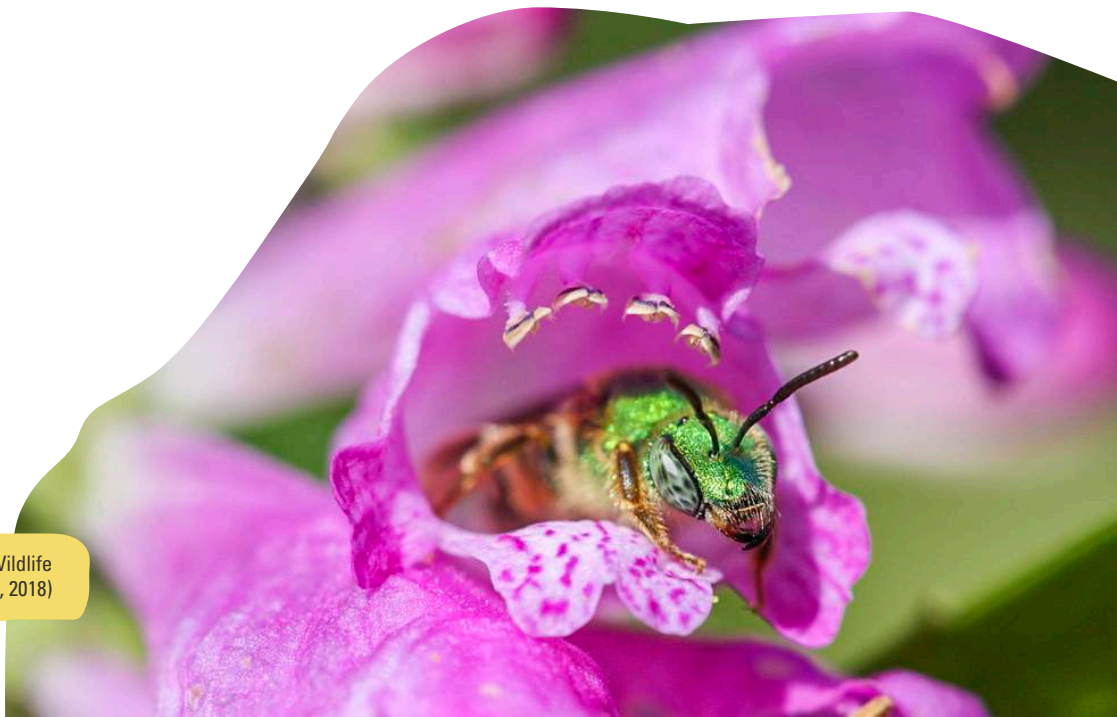
- EcoSpark's Changing Currents resources: [www.ecospark.ca/changingcurrentstudents](http://www.ecospark.ca/changingcurrentstudents)
- City of Toronto Lake, River and Stream Water Quality: [www.toronto.ca/services-payments/water-environment/protecting-improving-lake-river-stream-water-quality](http://www.toronto.ca/services-payments/water-environment/protecting-improving-lake-river-stream-water-quality)
- Lake Ontario Water Keeper: [www.waterkeeper.ca](http://www.waterkeeper.ca)
- Ontario Great Lakes and Watersheds information: [www.ontario.ca/page/great-lakes-and-watersheds](http://www.ontario.ca/page/great-lakes-and-watersheds)
- Canadian Great Lakes information: [www.canada.ca/en/environment-climate-change/services/great-lakes-protection.html](http://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 resources and program 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](http://www.ontarionature.org/about/nature-network).
- International School Grounds has more ideas for outdoor learning on school grounds:  
[www.internationalschoolgrounds.org/isgm](http://www.internationalschoolgrounds.org/isgm).
- The Environmental Commissioner of Ontario publishes annual reports, as well as special reports on a number of topics, including environmental protections, climate change, and energy conservation:  
<https://eco.on.ca/our-reports>.
- Ontario EcoSchools has a Resource Library for teachers and EcoTeams:  
[www.ontarioecoschools.org/tools-resources/resource-library](http://www.ontarioecoschools.org/tools-resources/resource-library).

Sweat Bee (Canadian Wildlife Federation, 2018)



## APPENDIX D. NATURE EXPLORATION ACTIVITIES

**Nature Scavenger Hunt** is an activity for secondary students to use as they explore the school grounds on a nature hike. Students try to complete the card or check off enough items to get five in a row (EcoSpark 2018).

# Nature Scavenger Hunt

See how many items you can find outside!

CANADA GOOSE	LICHEN	BICYCLE	LITTER	GARDENING EQUIPMENT
POLLINATING INSECT	DANDELION	TWO DIFFERENT TYPES OF BARK	SOMETHING GROWING	SOMETHING DECAYING
CARDINAL OR CHICKADEE	SALAMANDER	FREE SPACE	EVIDENCE OF INSECTS EATING PLANTS	FLOWER OR LEAF BUD
TWO DIFFERENT TYPES OF LEAVES	AMERICAN ROBIN	CONIFEROUS TREE	DECIDUOUS TREE	SEED OR PINECONE
ANT HILL	RED-WINGED BLACKBIRD OR SEAGULL	WILD FLOWER	PLANTED FLOWER	SOMETHING MAKING NOISE

**MAKE A FIELD JOURNAL** is a lesson plan for elementary or secondary students to create a field journal for outdoor observations. A field journal is not a special product; a field journal can simply be a dedicated notebook. In this activity adapted from EcoSpark's Nature Academy program, students will make their own field journals (and a writing surface) out of classroom materials and learn how to use them for the purpose of developing scientific observation, research and inquiry skills (EcoSpark 2018). Students can use their field journals in conjunction with School Watch citizen science projects.

### **CLASS PREPARATION**

Share the following article with your students to introduce how and why to keep a field journal, as explained by anthropologist Eleanor Sterling:

“Doing Science: Researchers and Exhibition Staff Talk About Their Work: Keeping a Field Journal 1, Biodiversity Counts,” a teacher resource by AMNH. Available at [www.amnh.org/explore/curriculum-collections/biodiversity-counts/what-is-biodiversity](http://www.amnh.org/explore/curriculum-collections/biodiversity-counts/what-is-biodiversity), © American Museum of Natural History (Accessed 2018).

### **MAKE A FIELD JOURNAL**

Remind students to label their journals with their names and you can collect the journals for assessment.

#### **You'll need:**

- Paper (lined, blank, graphed or a mixture of all three)
- Pieces of cardboard or foam core
- Scissors or Xacto knives
- Extra-large paperclips or binder clips
- Transparent sheet protectors or poly zip letter-size envelopes

#### **Steps:**

- Have students cut the cardboard or foam core to size (about 8" x 10"), making a sturdy writing surface.
- Students then insert the cardboard into a sheet protector or poly zip envelope, making a makeshift clipboard.
- Students attach some sheets of paper to their clipboard using a paperclip or binder clip.
- Students can keep notes together and safe from rain by storing them in the sheet protector or envelope.

### **FIELD JOURNAL TIPS**

- Consider using waterproof paper, available online and from outdoor supply stores
- Write in pencil so your notes do not bleed if they get wet
- Number your pages so you will know if any pages fall out or go missing
- Begin each field session by writing down the basics: site name/location, date, time of day, temperature and weather conditions
- Record citizen science data and individual observations: *Are there fruits or flowers on individual trees or plants in your site? Do you observe any kind of interaction among insects, like mating or fighting? Or between insects and plants, like feeding and pollinating? Can you notice any changes from the last time you were there?*

The School Watch Guide is a resource to help teachers lead outdoor citizen science activities with students. It includes a step-by-step guide to conducting citizen science research with students on school grounds, citizen science projects, and additional information to help you get started. Find pollinators, measure tree canopy, map habitat, and more!

This resource was developed as part of School Watch: Green Spaces as Learning Places, an EcoSpark project that addresses the need to support teachers and students to ensure the success of existing school ground green space. The project provides teachers and their students with the knowledge, tools and support to effectively participate in, and contribute to, citizen science using natural assets on school grounds as a learning laboratory. Information collected in environmental monitoring can inform further school ground greening projects and direct conservation, stewardship and maintenance activities.

For more information, visit [www.ecospark.ca](http://www.ecospark.ca)