Possibility grows here.

POLLINATORS IN A CHANGING CLIMATE

Wild Pollinator Biodiversity and Climate Resilience

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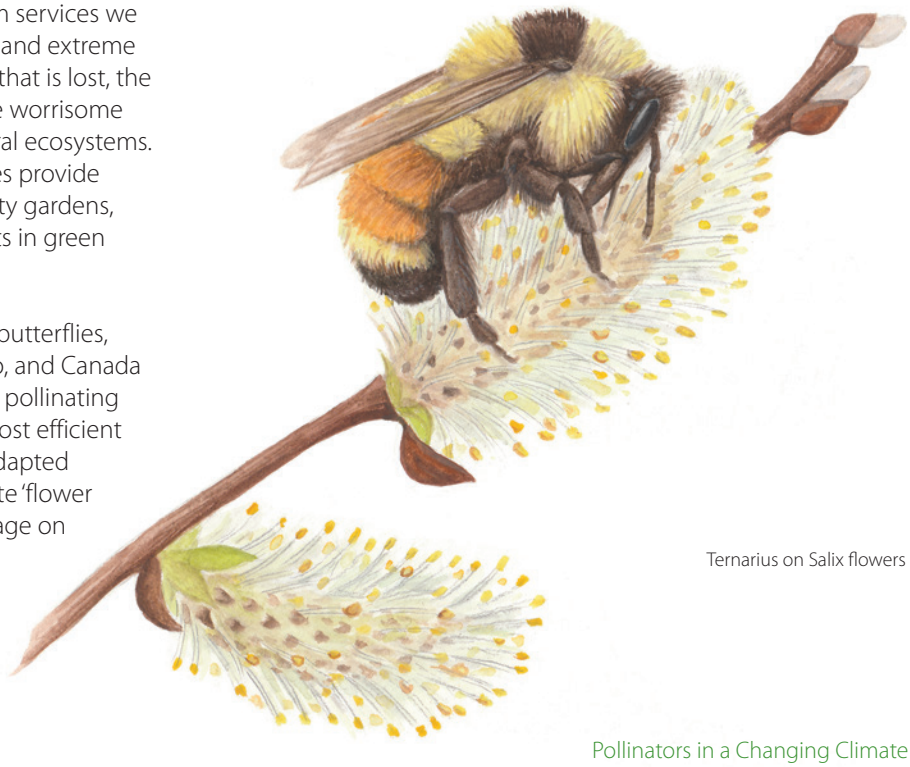
Art by Ann Sanderson (annsciart.com)

As summer approaches in Ontario, people are outside appreciating colourful flowers, as well as the insects, birds and other animals that visit them to collect pollen and nectar. These pollinators are providing a critical ecosystem service: they move pollen from flower to flower, allowing the plant to produce fruit and seed through cross-fertilization. It's been estimated that over 3/4 of wild plant and crop species are dependent on or benefit from this kind of animal pollination. Although staples like wheat, corn and other grains are wind-pollinated, approximately 1/3 of the food we eat needs insect pollination. These include fruits and vegetables like berries, peppers, tomatoes, apples and peaches. Pollinators are also integral to our wildflowers, trees and shrubs, which mammals and birds rely on for food and shelter, and which keep our natural ecosystems intact.

Pollinator biodiversity is an important part of our ability to adapt to and mitigate climate change. Ecologists have known for decades that systems with higher levels of biodiversity are more resilient to environmental disturbances. By having many different species of pollinators in various habitats, we are ensuring species adapted to different flowers, weather tolerances and so on are available to pollinate food crops and wildflowers. The redundancy of many species available to provide the ecosystem services we need buffers us against stressors like new diseases and extreme weather events. In other words, with each species that is lost, the loss of additional species becomes more and more worrisome for our food security and the sustainability of natural ecosystems. Our rich and abundant wild pollinator communities provide critical pollination services to urban and community gardens, crops in intensive agricultural systems, native plants in green spaces, and our residential flower gardens.

Animals that pollinate plants include bees, wasps, butterflies, beetles, flies, moths, and hummingbirds. In Ontario, and Canada more generally, bees make up the most important pollinating group, with flies coming in second. Bees are the most efficient pollinators, as their bodies have hairs specifically adapted to attract and carry pollen grains. They are also quite 'flower constant,' which means that once they learn to forage on a flower, they tend to stick to the same species.

This means pollen grains aren't deposited onto the wrong plant species and thus wasted. Like bees, flower flies also have hairs, making them excellent pollinators for flowering plants. Beetles, butterflies and wasps also move around pollinator grains, but not with the same efficiency as bees or flower flies.



Ternarius on Salix flowers

Ceratina with raspberry cane

While most of us are familiar with the European Honeybee, a managed species used for pollination of large-scale agriculture and honey production, we also have 855 described species of native bees in Canada, with more still likely to be described. Southern Ontario has over 350 different bee species, the majority of which are solitary (not living in hives) and ground-dwellers. An additional third of our native bees live in cavities like the pithy stems of last year's raspberry canes (image of ceratina with raspberry) or holes in the mortar between bricks. People are often surprised to find out we have so many types of bees. In fact, Ontario's bees come in many different colours, including metallic silver, green, blue, red, and the more typical black and yellow. Some are very fuzzy but many aren't.

None of our native bees make honey. Honey-production is a unique characteristic of honey bees, which evolved in warmer climates with milder winters. When moved outside their range, honey bees stay awake over the winter, feeding from their honey stores. Bees native to colder regions, like those in Canada, have evolved to hibernate. All our native bees are considered solitary or semi-social, aside from the 40 or so species of bumblebees we have in Canada. Only bumblebees live in true hives, which can reach sizes of about 50-200 individuals at the height of the season, depending on the species. This is very different from the average honeybee hive, which can have 50,000 individuals!

POLLINATOR DECLINES

Despite pollinator declines being a frequent topic in the news, we know very little about the status of most species of bees, flies, butterflies and other insect pollinators. Where we do have good baseline information for wild pollinator populations, declines in some species are often noted. For example, of North America's 46 native bumblebee species, about 1/3 of the species are considered to be "at-risk of extinction" according to the International Union for Conservation of Nature's 'Red List' of threatened species. Some bumblebee species (like the Common Eastern Bumblebee) remain abundant throughout their native range, while others (like the Rusty-patched Bumblebee) have declined by over 90% in just a few decades. Disease outbreaks and exposure to insecticides in intensive agricultural lands are among the greatest issues that impact managed bee colonies. These issues, however, are not necessarily the main threats to wild pollinators. For wild pollinators, the main threats include disease spillover from managed pollinators, loss of habitat (i.e. nesting, foraging and overwintering), climate change, as well as invasive plants (e.g. dog strangling vine) and insect species (e.g. non-native bees).

CLIMATE CHANGE IMPACTS ON POLLINATORS

There are a variety of ways scientists believe pollinators can be impacted by climate change. Flowers are blooming earlier and some pollinators are emerging earlier now than they did decades ago. This could lead to something called a "phenological mismatch," where the timing of the pollinator and the flower no longer match up, despite having evolved together over thousands of years. Mismatches can lead to pollinators not having the right type or amount of pollen and nectar when they need it. It could also result in a given species of plant not being properly pollinated. This is particularly worrisome for pollinators specialized on certain plant species (e.g. the pictured Mining bee [*Andrena erigeniae*], which specializes in feeding on Spring Beauty flower pollen). It is also worrisome for early emerging pollinators that may fail to forage sufficient pollen and nectar first thing in the spring.

Climate change is expected to increase the number and intensity of spring storms and summer droughts. These extreme weather events can directly harm pollinators or decimate the food plants they rely on. Winters may have less snowfall, which could mean pollinators overwintering underground may have less insulation from snow to protect them from frigid temperatures. Gradually warming temperatures, particularly in cities where there is a heat island effect, may make nesting habitat for pollinators less suitable due to heat exposure. We also see the southern portions of bumblebee ranges shrinking as temperatures increase with no sign of the bees moving northward, leaving them squeezed in a smaller amount of suitable habitat.

Climate change can also facilitate the spread of invasive species, which can negatively impact pollinators. These invasive species can include other insects, which may compete for forage or nesting resources, animal species, which may be predators of pollinators, and plant species, which may outcompete important food sources (e.g. garlic mustard competing with native wildflowers). Climate change is also changing microbiota like viruses, fungi, bacteria and other pathogens in ways we still need to learn much more about but which pose risks to the health of pollinators.

Mining bee on Spring Beauty

WHAT YOU CAN DO

Luckily there are quite a few ways you can help to conserve our wild pollinators in light of climate change. Here are some actions for you, your friends and family:

1

Get involved in Community Science

You can submit photos to community science projects like BumbleBeeWatch or EButterfly to help scientists locate unknown populations of rare species, record important habitat requirements and track range shifts. Long-term scientific data are critical to conservation planning and management of endangered pollinator species. Contributions from individuals provide important data needed to conserve species in the most effective and efficient ways. The most recent records of the Endangered Rusty-patched Bumblebee, for example, have come from BumbleBeeWatch submissions. These populations will be closely monitored and potentially used to re-establish new populations where the species has been extirpated.

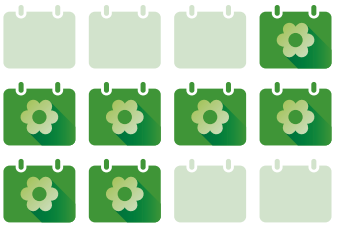
2

Plant native plants

This is a great way for citizens to support native pollinators on their properties. Native plants provide pollen and nectar, are host plants for caterpillars and in the cases of stem-nesting bees, are nest sites as well.

3

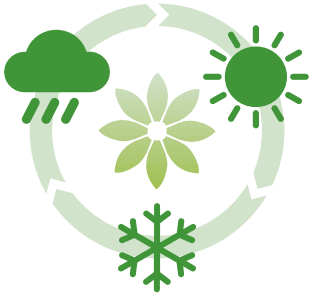
Create a garden that has something in bloom from early spring to late fall



In the spring, pollinators come out of their overwintering site having used up all their energy stores. Having nectar and pollen in those early days is critical for them to be able to find a nest site and lay eggs. Willow and wild strawberry are excellent early blooming plants. Fall forage, like goldenrod and aster, is equally important as insects need to store energy for the winter or, in the case of the Monarch, to migrate.

4

Select plants that will thrive in your area



Plant frost-tolerant species in areas with late frost, and drought-tolerant species in areas with hot, dry summers. Don't forget about flowering shrubs and trees, which can provide a lot of resources, particularly in the spring time!

5

Keep you garden messy

Leave some bare patches of dirt for ground nesting bees, some piles of logs for overwintering habitat, and some of last year's raspberry or bergamot stems for cavity-nesters. These natural materials for nesting and overwintering sites are as important as flowers for forage, but are frequently overlooked. In the spring time, delay cleaning up your garden as long as possible to allow insects overwintering in mulch, leaf litter, loose soil and last year's stems to emerge naturally. Check out guides by Credit Valley Conservation, Toronto and Region Conservation Authority and Wildlife Preservation Canada for recommendations on what to plant and how to maintain your pollinator habitat.

6 Spread the word about native bees

Invasive wasps like the German Yellowjacket and now the Giant Asian Hornet give native bees (and native wasps) a bad rap. The reality is, most pest species of bees, wasps and hornets are not native to the region. Conserving our native species is one of the best ways to fend off invasives. Additionally, most people cannot identify bees from wasps, and if they can, they may only know about the European honeybee in terms of 'bees.' Sharing what you learn about the beauty and diversity of southern Ontario's native bees will help people make different choices, as people tend to protect what they know and care about. Resources like the City of Toronto's Bees of Toronto Guide or BumbleBeeWatch.org can help you learn about all the different bees that are native to this region.

7 Plant food and herbs

One of the best ways for people to learn about the different pollinators of our food crops is to see the pollinators in action. Plant veggies like tomatoes and see which bees come to buzz-pollinate it. (Hint: bumblebees are one of the few groups of bees capable of this "buzz-pollination" behaviour, which involves grabbing onto a flower and buzzing at a high frequency to properly pollinate it.) See which pollinators are attracted to yellow flowers, to purple flowers, to white flowers. See if you can find dawn-waking squash bees sleeping in your squash flowers. The bonus is you will have some fresh, local herbs, fruits and veggies too!

8 Get involved in your local stewardship and volunteer programs

Conservation Authorities (CAs), city parks departments, local naturalist groups and business improvement associations (BIAs) often provide opportunities for you to help create or provide quality habitat for pollinators, either directly through plantings or indirectly by influencing policy. Contact your local CA, municipality and community organizations to find out about what programs they offer to support pollinator habitat. You can also help pollinators by participating in government consultations that impact pollinators and pollinator habitat.

9 Minimize insecticide use

For farmers, increased use of Integrated Pest Management schemes is beneficial (i.e. using tools and management practices to reduce pests, which consider environmental impacts). These schemes could help make farmlands more supportive for wild pollinator communities. Many Conservation Authorities offer agricultural stewardship programs to help restore natural habitat on farmland. For homeowners, consider allowing insects into your yards and gardens instead of reaching for that can of Raid. While insecticides may seem like they are targeting pest species, many of them harm a wide variety of beneficial insects, as well.

Monarch butterfly on Goldenrod

RESOURCES

General Pollinator Information:

- Credit Valley Conservation Authority, "Native plants for native pollinators"
- Toronto and Regional Conservation Authority, "Maintaining your pollinator habitat"
- Niagara Peninsula Conservation Authority, "One Mile Creek Landowner Stewardship Guide
- City of Toronto Biodiversity Series, "The Bees of Toronto"
- Xerces.org, "Pollinators and Climate Change: Climate-Smart Natural Habitat"
- BumblebeeWatch Community Science Program
- EButterfly Community Science Program

Stewardship Information for Farmers:

- Credit Valley Conservation Agricultural Stewardship
- Central Lake Ontario Conservation Stewardship
- Michigan State University Extension, "Conserving native bees on farmlands"
- Xerces.org, "Pollinators and Climate Change: Climate-Smart Agricultural Habitat"

Conserving Pollinators in Cities and on Campuses:

- Xerces.org, "Smarter Pest Management: Pollinator Protection for Cities and Campuses"
- Xerces.org, "Pollinators and Climate Change: Climate-Smart Urban Habitat"
- The Meadoway
- PollinateTO Community Grants
- Wildlife Preservation Canada, "A Flower Patch for the Rusty-patched (bumblebee)"

CONSERVATION SCIENCE Colla Lab

ABOUT THIS SERIES:

The Greenbelt Foundation partnered with experts to understand how climate change is affecting our daily lives, and ways that we can individually and collectively respond to these challenges. For other installments in the series, visit www.greenbelt.ca/changing_climate

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