



PROMOTING POLLINATORS: NIAGARA BEES AND HOW TO HELP THEM

Introduction

The Niagara Community Observatory (NCO) has partnered with Miriam Richards, a professor in the Department of Biological Sciences at Brock University to explore some of the realities of land-use in Niagara: its impact on bee communities, and ultimately on the integrity of our biodiversity. Niagara is no exception to the current “tsunami” of human-dominated land uses that are washing over natural and semi-natural habitats and compromising the welfare of bees, specifically wild bees. Bees command a functionally significant and economically vital role in our lives. Given that the vast majority of flowering plants are pollinated by insects, it is not far-fetched to imagine a “pollination crisis” in the near future if current trends and attitudes in land-use continue unabated. The combined waves of urbanization, agricultural expansion and industrial-site abandonment in Niagara and communities across Canada are creating compounding effects on bee diversity. From the analysis and recommendations put forward by Prof. Richards in this policy brief, regional and local municipalities along with ordinary residents can engage in a concerted effort to rethink land-use planning and calibrate our approach to the surrounding natural and semi-natural habitats. From a public policy standpoint, balancing the goals of efficient, effective, ethical and ecologically sound use of the land cuts across many policy objectives, and Niagara will be well prepared to navigate this landscape. A systematic campaign toward greater public awareness and strategic policy action will be necessary to preserve the pollination of crops as well as of wild flowers that we so often take for granted.

Charles Conteh, Director, NCO, Brock University

The status of bees in Niagara

It is well known that wild bee populations have declined in many regions. The main threat to bees, as to most wild animals and plants, is habitat loss. In summer, bees require places to build their nests, and flowers from which to gather nectar and pollen to feed to their offspring. In winter, bees require places

to overwinter, where they can remain dry and avoid ice crystals.

Intensive human activity has strongly reshaped the Niagara landscape, especially since European settlement, and this has undoubtedly influenced Niagara’s wild bee populations. In comparison with

other areas of southern Ontario, bee diversity in Niagara is relatively low. Niagara bees are floral generalists, which means they can utilize pollen and nectar from a variety of different types of flowers. The floral specialists still common in other parts of southern Ontario probably disappeared with extensive conversion of natural habitat to agricultural and urban uses. We cannot know for sure, because Niagara's bees remained almost unknown until the Brock Bee Lab began systematic research here in 2003.

In 2003, the **Brock Bee Lab** began long-term monitoring of bee populations at the newly restored Glenridge Quarry Naturalization Site (GQNS), in southern St. Catharines. This site, which was first a farm, then a quarry, and then one of the most notorious landfills in Canada, is now an urban oasis of bee habitat on the edge of the Niagara Escarpment.¹ Replanting the site following closure of the landfill in 2003 resulted in immediate and dramatic recolonization of the site by bee populations. By 2006, bee populations at the GQNS were higher than those of surrounding meadows at Brock University. The restoration of both vegetation and bees, as well as the many other species that now call the GQNS home, has provided crucial evidence that habitat restoration works in efforts to increase bee populations. In 2011, two additional landfills were restored in Port Colborne (Elm St. Naturalization Site) and Wainfleet (Station Rd. Naturalization Site). Monitoring of bee populations at these sites confirms the success of the approach pioneered at the GQNS: when habitat is restored, bees rapidly move in, first to find floral resources, and then to build their nests.

The success of Niagara Region's restoration projects at the Glenridge, Elm Street, and Station Road Naturalization Sites, is something about which Niagara residents can be happy and proud. But these are small spaces compared to the overall size of Niagara – they are islands in a sea of human development. The smaller an island, the fewer individuals and species it can support, even if it is protected. What bees (and many other species) need is more habitat. The naturalization sites prove that creating habitat increases

NIAGARA'S DIVERSE BEE GROUPS

Sweat bees

The sweat bees are a diverse group of bees and the most abundant bees in Niagara. Their name derives from their habit of landing on humans to lick their perspiration. Most of the sweat bees are rather plain, black bees that many people mistake for flies, but several species are bright, emerald green, at least in part. Sweat bees are an especially interesting group behaviourally that excavate burrows underground. Some species are solitary, each female digging her own nest and raising her own brood. In Niagara, most sweat bees are social, living in colonies comprised of a queen that lays most of the eggs, and workers that do the work required to raise the queen's brood, rarely laying eggs of their own. One of the most attractive and easily recognizable sweat bees is the Bicoloured Agapostemon (*Agapostemon virescens*), which has a bright green head and thorax, with a black and yellow-striped abdomen. It also lives in colonies, but with an interesting twist – instead of being dominated by one queen, Agapostemon societies are egalitarian, and each female can lay eggs.



bee populations. So, what can we do to create more habitat?

What are bees?

Technically, bees are wasps that evolved to use pollen as a protein source for feeding to their babies. Like any animal, baby insects need protein to grow – wasps are efficient predators that usually provide their offspring with insect prey, whereas adults mostly live on a carbohydrate diet, namely the nectar produced by flowers. Fossil evidence suggests that bees split from their wasp ancestors about 100

¹The landfill was located adjacent to residential communities and agencies such as the Niagara Region headquarters, Brock University, and Shaver Hospital, which amplified concerns around storm sewer overflows, gas odours, degradation of groundwater and surface water. The NCO published a policy brief in 2010 on the restoration of the quarry site: <https://brocku.ca/niagara-community-observatory/wp-content/uploads/sites/117/Niagara%E2%80%99s-Natural-Park.pdf>

million years ago, prior to the evolution of the flowering plants. In fact, bees are sometimes said to have “invented” flowers: plants that were more successful at attracting bees to collect pollen, would have produced more seeds as bees accidentally transferred pollen among them. Flowers and nectar both seem to have evolved as ways of attracting bees more efficiently.

There are at least 20,000 species of bees in the world, about 800 in Canada, and at least 150 species in Niagara, yet when most people think about bees, they think of honey bees. Most people are surprised to learn that honey bees are domesticated insects that were brought to the New World to provide European colonists with honey – they are not native to North America. Nowadays, honey-bee colonies are also shipped far and wide to provide pollination services for agricultural crops. It is important to keep this in mind, because honey bees are a non-native species that competes with wild bees for access to pollen and nectar resources. In fact, honey bees are implicated in declines of wild bees, because they compete with wild bees for pollen and nectar resources and may also spread diseases to which wild bees are susceptible.

Creating bee habitat in Niagara

Niagara’s human population is growing, and natural habitat continues to be converted to urban and industrial development. Conversion of natural landscapes is sometimes obvious, as when forest is cleared for housing developments, but more subtle types of habitat conversion often go unnoticed. Every field that is converted to a new housing development results in the deaths of thousands of bees and myriad other small creatures. The bad news is that every time flowers and nest sites are destroyed, we lose more bees. The reality is that development will continue – can we mitigate the damage to pollinator populations? The good news is, that habitat restoration on both large and small scales helps bees. The trick then is to provide more habitat – and that can happen if we learn to see the world through the eyes of bees and other pollinators.

Learning to see the world through bees’ eyes means learning to look at big spaces in landscapes as

WHY SHOULD WE CARE?

Pollinators

Pollinators are animals that help plants to reproduce by moving pollen among blossoms. Pollen is to plants what sperm is to animals – the male gametes that are required for fertilization and production of seeds. Although some plants self-fertilize, many plants require an animal intermediary to move pollen from the flower in which it was produced to another flower, where it will fertilize an ovum and produce seeds and fruits. Some plants are wind-pollinated, but many are pollinated by animals that collect pollen and accidentally deposit it on different blossoms as they move from flower to flower. There are many kinds of animal pollinators in Niagara, including butterflies, beetles, and flies, but the most important are bees. Bees are the primary pollinators of several crops important to Niagara’s agricultural sector. **Although honey bees often get the credit, Niagara’s mostly unnoticed and unappreciated wild bees are important pollinators for fruit trees, vegetables, and hay crops. Wild and cultivated flowers also require pollination and much of this is also done by Niagara’s wild bees.**

places where bees live, instead of as places to be used primarily by urban humans. We need to think about the challenges that small creatures like bees face as they go about their daily lives. As an example, imagine an abandoned farm field slated for development. Where humans see emptiness or “weeds”, bees see a cornucopia of flowers that provide pollen and nectar. Where humans see fast-growing, untidy shrubs, bees see shady resting places and nest sites. Where humans see patches of useless bare soil, ground-nesting bees find nesting and hibernation sites.

Seeing the world through bees’ eyes is not just for big

NIAGARA'S DIVERSE BEE GROUPS

Bumble bees

These large, fluffy bees live in colonies that last from spring to autumn. At least 13 species are found in Niagara, including the Common Eastern Bumble Bee, *Bombus impatiens*, a native species that is also raised commercially for pollination in greenhouses. In spring, very large young queens

leave their hibernation burrows and begin searching for places to nest. Bumble bee females do not dig their own burrows, instead renovating holes and chambers that they find in sheltered spots where the nest will remain dry.

Each queen bumble bee starts her own nest in

spring, first raising a few very small daughters that will become workers. Amazingly, queen bumble bees incubate their young, much like birds do. Once the workers have become adults, they take over the work of the colony, leaving the queen to focus on laying eggs. Towards the middle of summer, the colony begins rearing big future queens and males. These mate in late summer or fall, and the new queens enter hibernation to start the colony cycle again the next year.



spaces. Because bees are small creatures, bee habitat can be provided on a small scale – providing bee habitat is as simple as providing them with food, nest sites, and hibernation sites. For instance, a “perfect” lawn provides no resources to bees – it contains neither flowers nor nesting sites and may even be treated with bee-killing insecticides. An “imperfect” lawn that contains clover and dandelions, and a few patches of bare soil, provides both food and nest sites for bees. The main change is in our attitudes and perceptions – from the point of view of bees and bee-lovers, the “imperfect” lawn is actually the “perfect” lawn.

A crucial role for institutions, businesses, and local governments

Institutions, businesses, government, and other organizations can provide flowers for food and places for bees to nest and hibernate. Many institutions operate buildings surrounded by large lawns – consider a different approach to lawn maintenance that would encourage bees. Mow lawns less frequently and grow a mixed lawn that includes low-growing flowers that provide food for bees. Consider shrinking the lawns by replacing them with showcase gardens of native Ontario plants. Don’t promote honey-bee keeping as a way to “Save the Bees”.

Set a new aesthetic standard for gardens

Municipal and regional governments, including institutions like the Niagara Peninsula Conservation Authority, have an especially crucial role to play in promoting wild bee diversity. Scientific studies demonstrate that bee diversity can be quite high in cities – the crucial factors are whether bees can find food and nest sites. Local governments can promote an approach to gardening and landscaping that promotes wildness, instead of tidiness, as the standard for defining beauty and respectability in gardens. Government buildings could be surrounded by pollinator gardens designed to attract bees and other small creatures, rather than being designed to emphasize traditional, formal beds of non-native plants. The plants purchased to stock those gardens should be purchased from nurseries that can guarantee they were not treated with insecticides, especially systemics like neonicotinoids. The lawns surrounding these buildings could be managed to include low-growing flowers that provide food for bees. Mowing lawns less often and using fewer or no insecticides would save money for more important purposes.

Prevent habitat loss and create new habitat

The most important cause of wild bee population decline worldwide is habitat loss. Preventing habitat

loss in the first place and recreating habitat where losses have already occurred, are the two most crucial roles for government. A crucial factor influencing bee abundance and diversity in cities is the amount of impervious surface in a city, in other words, the

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Carpenter bees

Carpenter bees get their name from their habitat of excavating their nests in wood. They

do this by chewing the wood with their mandibles. The large Eastern Carpenter Bee (*Xylocopa virginica*) looks much like a bumble bee, and nowadays prefers to nest in wooden structures like railings, barn eaves, decks, and

wooden houses. In Nia-

gara, Eastern Carpenter Bees usually nest in groups, apparently preferring to nest together instead of doing the hard work of digging a nest, which takes about a week. Only the alpha female lays eggs – her nestmates must wait for her to die before one of them can become the next alpha female. In big colonies, most females never get the chance.

The small carpenter bees (*Ceratina*) nest in twigs and stems in herbaceous plants and trees, including roses, sumac, teasel, and raspberry. These tiny bees are greenish or bluish in colour and only about 5 mm long. Each female digs a nest in spring, raising her brood in a long narrow burrow, just like peas in a pod. Many of the young bees remain in the nest until the following spring, but a few fly away to dig a short hibernation burrow in a different stem or twig.

amount of pavement in an area. Wherever surfaces are paved, flowers cannot grow, and bees cannot nest. Urban spaces could be designed with less impervious surface. For instance, many strip malls and shopping malls are surrounded by enormous parking lots, and in some cases, these parking lots are never full, even

at the busiest times of the year. An additional problem created by these large impervious surfaces is the amount of rain water they collect and direct into overloaded sewer systems. Local governments could require that shopping malls and other retail and business developments limit the size of parking lots to accommodate the number of cars actually using the lot.

A success story to emulate

Niagara Region's Waste Management Division has turned three former landfill sites into naturalization sites -- beautiful parks that support pollinators, other wildlife, and recreational use by citizens. If former garbage dumps can be turned into pollinator havens, then so too can many former industrial sites. This would be especially beneficial for sites that are unlikely ever to be redeveloped due to concerns over soil contamination. Niagara's cities and towns are dotted with abandoned former industrial sites and business areas. Often, the buildings are removed from these sites, but they remain covered with impermeable surfaces like concrete floors and parking lots. While some of these may be slated for eventual redevelopment, this may take years or decades. Instead, the impermeable surfaces could be removed, and the sites planted as new naturalization sites, providing attractive green space for bees, other wildlife, and people.

What Niagara residents can do for bees

Grow flowers

The easiest thing to do is to provide bee food. Bees are active from spring to fall and during that time they need access to both nectar and pollen. Plan your garden so that there are always some flowers in bloom. Focus on flowers that don't have really complicated shapes or masses of petals that hide the centre of the flower. Grow vegetables that produce flowers – some of these attract specialist bee species. For instance, squash and pumpkin flowers are pollinated by squash bees, and the males also use the flowers as a protected place for sleeping in at night. To produce fruit, tomatoes require a special technique called buzz pollination to release their pollen – only a few native bees can do this trick, including bumble bees.

NIAGARA'S DIVERSE BEE GROUPS

Mining bees



photo by C. Sheffield

Mining bees, named for their underground burrows, are the most common bees flying in early spring, and are important but unappreciated pollinators of spring-flowering trees, including willows, cherries, and other fruit trees. Their ability to fly in chilly, breezy weather

and their habit of visiting flowers even at the tops of trees, make them important pollinators for apples, pears, and cherries. All species are solitary, meaning that each female raises her own brood in her own nest.



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Masked or yellow-faced bees

Towards the end of summer, some of the most common flowers in Niagara are Queen Anne's Lace and Goldenrod. Look closely and you will likely see lots of tiny black bees with yellow or white marks on the faces and legs. These little solitary bees carry pollen and nectar internally in their crop or "honey stomach", and are almost bare, instead of furry like most other bees. Consequently, when people do notice them, they are often mistaken for tiny wasps.



Provide nest sites

By providing nest sites, as well as food for bees, you can take this one step further. Most native bees dig nesting burrows in the ground – leave some open soil surfaces in the garden for them, instead of covering everything with mulch. Many other native bees nest in stems and twigs – resist the urge to remove all the dead stems and twigs from your plants. Don't clean up too much in the fall – bumble bees and other small creatures often spend the winter in piles of leaves or brush where they can remain dry and avoid freezing. Bees that nest in twigs often remain in those twigs for the winter – pruning them deprives their bee occupants of shelter. Cultivate a bit of a wild look – gardens don't have to be perfectly tidy to be beautiful. Put up a sign to let your neighbours and passersby know that your property and gardens are wild bee habitat!

Mow your lawn – but less often

Even your lawn can support bees if you treat it right. Lawns made of 100 per cent grass treated with fertilizers and herbicides, not only provide no resources for bees, but are the source of chemicals that leach into other parts of your garden and harm many small creatures. Ultimately, these chemicals end up in our drinking water. Try a lawn that includes low growing flowers like clover. And save yourself time and money by mowing less often. You don't have to grow a meadow in your lawn – a recent scientific study demonstrated that mowing every couple of weeks resulted in more bees visiting the area than mowing every week or every three weeks.

Remember that honey bees are not wild bees

In Ontario, awareness of the dangers of neonicotinoid insecticides came to public awareness largely due to the efforts of honey-bee keepers who realized that neonicotinoids were poisoning and killing their colonies. The drastic impacts on honey bees demonstrated the dangers of these chemicals to all bees. Ironically, honey bees, themselves, are a threat to wild bees. It is important to remember that honey bees are non-native bees domesticated for honey production. A honey-bee colony may contain 50,000 efficient foragers that compete effectively with wild bees for food resources. Scientific studies demonstrate



photo by A. Rutgers-Kelly

wild bees are negatively affected by competition from honey bees. Despite what you may have heard, honey bee populations in North America are not in danger – they are non-native, domesticated animals raised for agricultural production.

Conclusion

The recipe for bees is surprisingly straightforward – provide flowers and nesting habitat, avoid pesticide use, and like magic, bees appear and thrive! When bees thrive, the benefits reverberate well beyond the bee community. The same conditions that support healthy bee communities also support other pollinators like butterflies, moths, and syrphid flies, as well as non-pollinators like dragonflies, ladybugs, and crickets. Where insect communities are healthy, insectivorous birds and bats also flourish. And ultimately, cities that support pollinators are richer and more pleasant places to live. So let's make Niagara wild bee-friendly! Go Bees!

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Mason bees and leafcutter bees

Most bees carry pollen loads on their legs, but mason bees and leafcutter bees carry pollen on the underside of the abdomen, which makes them easy to see as they whiz by. They are all solitary and sometimes can be induced to nest in “bee hotels” because they refurbish pre-existing holes as nests. Mason bees construct their nests of mud in pre-existing crevices and holes, and they can sometimes be seen around puddles, gathering mud or dust. In Niagara, the most abundant mason bee is the dark blue Double Bumped Mason Bee, which nests in the empty shells of land snails. The first Canadian record of occurrence was at the Glenridge Quarry Naturalization Site in southern St. Catharines, where it is very abundant.

Gardeners may have noticed round holes about 5-7 mm wide appearing along the edges of some of their plants, especially roses. The culprits are leafcutter bees which use pieces of leaf or flower petals to line brood cells inside their nests. Mothers provision each brood cell with a loaf of pollen and nectar upon which a single egg is laid. When the egg hatches, the larva eats all the pollen, eventually developing to adulthood, but remaining in its brood cell until the following spring.



photo by D. Chute



Contact information

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The Niagara Community Observatory at Brock University is a public-policy think-tank working in partnership with the Niagara community to foster, produce, and disseminate research on current and emerging local issues. More information on our office, and an electronic copy of this report, can be found on our website brocku.ca/nco

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