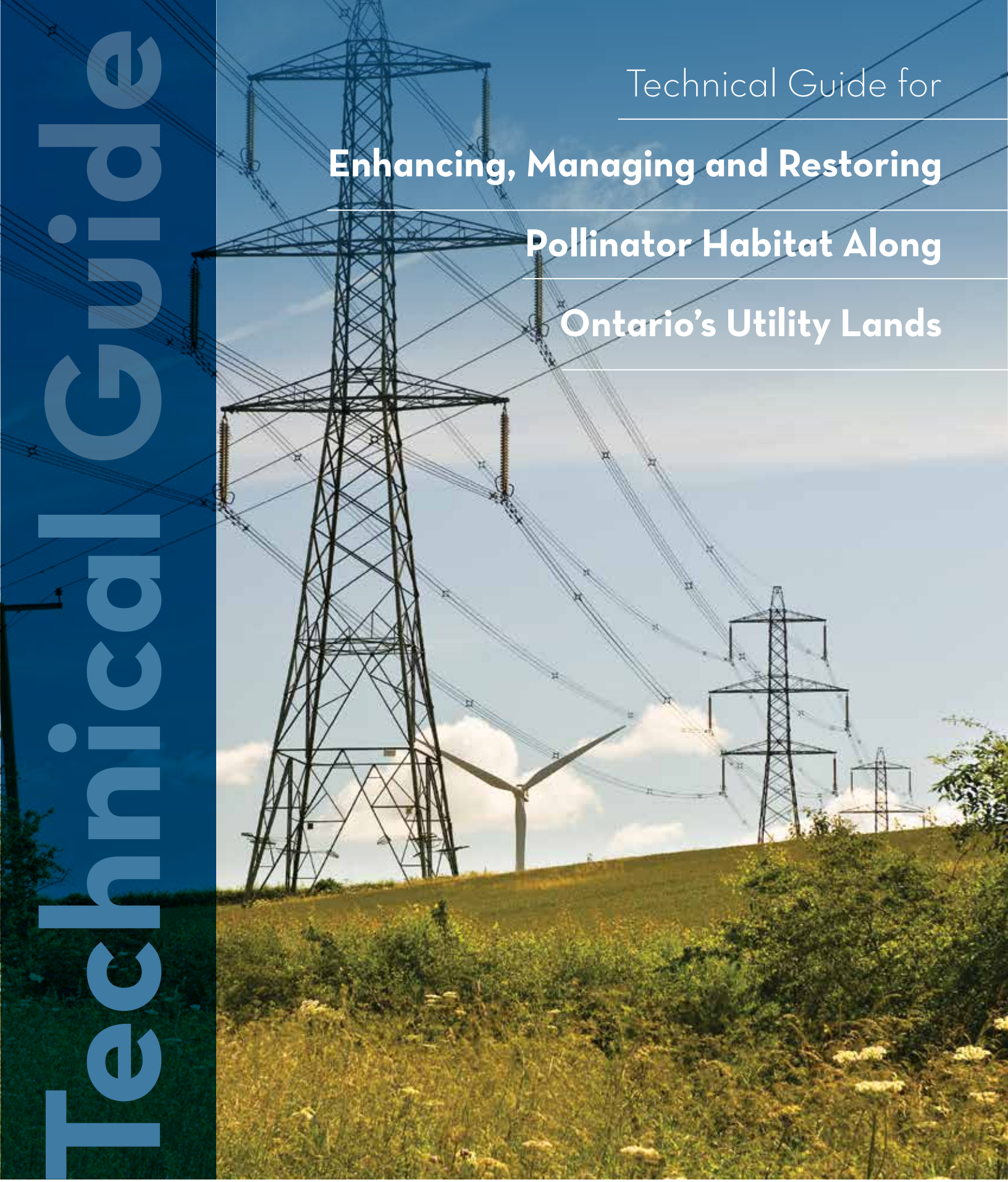
Technical Guide

Technical Guide for

Enhancing, Managing and Restoring Pollinator Habitat Along Ontario's Utility Lands



Growing Forward 2
A federal-provincial-territorial initiative

POLLINATOR PARTNERSHIP CANADA

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Getting Started

In Ontario, right-of-way (ROW) areas and other utility landscapes such as wind and solar constitute vast tracts of land that can be ideal for creating and managing pollinator-friendly landscapes. Managing ROWs for pollinators provides benefits to important wildlife and can also reduce management costs over time. There is well over 36,000 hectares of public land associated with the network of transmission and distribution lines stewarded by various utility companies who provide electrical and hydrocarbon energy transmission and distribution. In addition, large areas have been devoted to solar arrays and wind generating projects. Solar and wind energy continues to grow in Ontario, with hundreds of solar and wind farms currently in operation, and many more in the planning phase. Utility landscapes offer valuable pollinator habitat when they are managed correctly.

This habitat guide has been developed to provide those responsible for maintaining utility corridors, wind and solar farms in Ontario with the most current science, tools, and resources they need to support pollinators. It is part of a series of land management guides for roadside, utility, and agricultural lands that complement local native planting guides for home owners and municipalities. Working together to manage our lands to support pollinators helps to keep our ecosystems productive and resilient for generations to come. This guide provides concrete actions to guide your efforts.

Local, site-specific actions add up to significant change. By considering these three simple actions, you can help to support pollinators along ROWs, wind, and solar farms:

1. Restore natural vegetation and habitats.
2. Maintain habitats using methods that minimize disturbance and harm to pollinators.
3. Enhance habitats using methods that promote pollinator richness and diversity.

Why Support Pollinators?

Pollinators are a diverse group of organisms that visit flowers to feed on pollen and nectar or to collect oils and resins. In the process pollinators transfer pollen grains and assist plants in reproduction, supporting productivity in natural and agricultural landscapes. It is estimated that pollinators provide upwards of $217 billion to the global economy[1,2], and honey bees and bumble bees in Ontario are responsible for $897 million of the roughly $6.7 billion in agricultural revenue in the province each year. This is equivalent to about 13% of the province's total annual crop value. The beekeeping industry has evolved a sophisticated network to facilitate the pollination of key crops such as blueberries in the Algonquin-Nipissing ecoregion and clover, apples, tomatoes, cherries, pears, soybean, squash and pumpkin in the Lake Erie Lowlands, Manitoulin-Lake Simcoe, St. Lawrence Lowlands and Frontenac Axis ecoregions. In addition, Ontario honey production has been growing, nearing $34 million in 2015. About one third of the food that we eat every day is the direct result of pollination. Pollinators also support healthy ecosystems that improve air quality, stabilize soils, and support other wildlife[3]. A decline in pollinator populations can have a large impact given the critical roles that these species play in ecosystem health.

Many pollinator populations and species are in decline due primarily to habitat loss, disease, climate change, and the use of pesticides. Monarch butterflies have seen one of the most dramatic population declines with 90% losses and shrinking overwintering numbers. Honey bee colony losses have significantly impacted commercial beekeepers. Without feeding and nesting habitats, pollinators cannot function to support terrestrial ecosystem productivity. The decline of these pollinators is a serious problem that requires immediate action to ensure that Ontario's food system and natural environment are protected.

Establishing goals to secure habitat for pollinators is an essential strategy. These flower-visiting animals are a truly diverse group with some pollinator species having unique habitat requirements. Understanding the unique biology and needs of each pollinator type allows us to more effectively protect, restore, and enhance habitat. Ontario, through the creation of a Pollinator Health Strategy, is taking action to strengthen pollinator health and ensure healthy agricultural and natural ecosystems. The strategy focuses on regulating the use of neonicotinoid-treated seed, production insurance, and the development of a comprehensive Pollinator Health Action Plan to address multiple stressors on pollinators. To learn more about what the province is doing and how you may contribute: www.ontario.ca/pollinators

Photo: Leif Richardson

Photo courtesy: Monarch Watch

Understanding the Ecology of Utility Landscapes

The habitat requirement of pollinators are quite simple: they need regular access to natural foraging areas – flowers that bloom throughout the season – and nesting areas such as accessible soils and woody vegetation. There is huge potential to create this habitat along the vast networks of ROWs and other utility landscapes in Ontario.

- Natural Gas Pipelines – There are currently 14,000 km of natural gas transmission and distribution ROWs in Ontario that carry about 26 billion cubic metres of fuel per year. These pipelines can be both above and below ground features, and vary in width.
- Electric Transmission Corridors – A major priority for transmission corridors is the safe, reliable transmission of electricity. Approximately 20,000 hectares of electrical transmission are owned by the Ontario government. Additional areas are owned and managed by other private and public entities.
- Solar Arrays - Photovoltaic power stations or solar parks are designed for the supply of power into the electricity grid. These are differentiated from most building-mounted and other decentralized solar power applications because they supply power at the utility level, rather than to a local user or users. In Ontario, there are over 100 solar farm operations, of varying sizes.
- Wind Farms - Ontario is Canada's leader in clean wind energy with 4,361 MW of installed capacity, supplying approximately 5% of the province's electricity demand. There are currently 61 wind sites across the province consisting of about 1,434 turbines. The average footprint of land required for a utility-scale wind turbine is 1 hectare.

Restore, Maintain, Enhance

There are many ways to approach developing and maintaining pollinator habitat along utility corridors, under wind turbines and at solar farms. Simple modifications can make areas ideal habitat for pollinators.

Options available to utility landscape management fall within three categories: actions that will restore, maintain or enhance pollinator habitat at a site. All managers of ROWs and utility landscapes need to understand the role that both small and large actions play in creating benefits at local, regional, and even national scales.

1. **Restore** the natural habitat to its original condition. This includes areas generally associated with Natural Gas Pipelines, Electric Transmission Corridors, Solar Arrays, and Wind Farms. Any areas associated with the utility landscape that is not directly developed with utility infrastructure and gets adequate sunlight and water can generally be restored to contain natural vegetation and flowering plants. Restoring natural vegetation on the landscape is the simplest and one of the most important actions you can take.

2. **Maintain** habitats using methods that minimize disturbance and harm to pollinators where possible. This includes areas generally associated with Natural Gas Pipelines and Electric Transmission Corridors ROWs. Maintenance strategies along ROWs generally include: invasive plant removal, mowing/tree pruning, herbicide and pesticide applications. These practices are targeted at reducing the occurrence of unwanted plant and insect species, and vegetation growth which has the potential to interfere with the function of the service.

3. **Enhance** habitats using methods that promote pollinator richness and diversity.
   This includes areas associated with Natural Gas Pipelines, Electric Transmission Corridors, Solar Arrays, and Wind Farms. For utility landscape managers, there are opportunities to enhance pollinator habitat by planting flowering plants and shrubs and providing nesting and overwinter sites. In some cases stewardship programs can provide cost-share funding and technical support.

Photo: Danelle Hevron Studio

Managing ROWs and Other Utility Lands to Promote Pollinators

Strategy 1: Restore

One of the best things you can do for pollinators is to restore the disturbed landscape with natural native vegetation in as many areas as possible. When restoring an area, it is important to consider food and nesting resources. Pollinators depend on nectar and pollen for nutrients and energy and non-compacted soil and woody vegetation for nesting. In restoration planting projects, it is important that bloom periods coincide with pollinator emergence and activity to sustain both plant and pollinator populations. This can be achieved by planting native flowers and shrubs that are in bloom from early spring through fall, to ensure continuous nectar and pollen sources.

- Maintain seed sources of locally adapted native plant species important to pollinators.
- Cluster plants of the same species together. This makes for more efficient foraging by pollinators.
- Include larval host plants into seeding and planting mixes (i.e., milkweed).
- Remove non-native grasses and non-native plants from seeding mixes.
- Leave patches of bare, undisturbed soil for ground-nesting bees.
- Plant woody shrubs and integrate downed logs for cavity-nesting bees wherever it is practical to do so.

Strategy 2: Maintain

Vegetation managers control woody vegetation for the safety and reliability of the electrical system and to improve accessibility. The removal of this vegetation creates a more open, pollinator-friendly habitat. In Canada, utility companies must selectively remove trees or prune branches that may interfere with or fall on power lines or emergency right-of-way access. In areas where vegetation becomes too dense, land managers must remove the vegetation, often with the application of herbicides or mechanical operations.

CASE STUDIES

While corridor management differs from area to area, the primary goals are safe and reliable power transmission. These examples from Ontario, Canada, and other parts of North America shows various creative approaches to pollinator support around energy infrastructure. There is evidence adding pollinator habitat actually adds value to utility corridors beyond maintenance cost savings. Healthy, functional ecosystems provide ecosystem service benefits which are explored in the following studies.

Integrated Vegetation Management (IVM) is a systematic integrated approach to managing vegetation. It applies the right intervention method at the right place and time to control vegetation. IVM uses a four phase approach to control unwanted vegetation, and is an ideal approach to managing utility landscapes to promote pollinators.

1. Scout the area identifying and/or mapping the location of unwanted plants that are present.
2. Define threshold levels of plant abundances and/or growth heights based upon your management goals, priorities, and abilities. Management thresholds will differ depending on the plant species you encounter, as well as your objectives. For example, determine whether you wish to prevent the plants growth in height, or completely eliminate it from the site (as may be the case for certain invasive plant species).

3. Apply unwanted vegetation control measures. Use as many IVM practices as practical in concert with one another. These will include manual/mechanical, biological, and chemical practices.

4. Evaluate the results. Keep accurate records and modify the unwanted vegetation management program as needed.

Invasive Species Removal and Prevention

The removal of invasive plant material is more often than not one of the first actions needed in developing pollinator habitat. Pollinator-friendly native plants have little opportunity to establish and thrive unless invasive plants are removed. There are several BMPs for making this process as efficient as possible. Successful invasive plant removal takes time, commitment and dedication to the process.

- Identify invasive plants during the planning stages of the removal.
- Set a manageable threshold of tolerance.
- Clean machinery, boots, and other tools used on-site to reduce the spread of invasive plant seeds and other reproductive parts.
- Install desired plant material as quickly as possible after the invasive plants have been removed.
- Monitor the site frequently and have a plan in place for additional removal as needed.
- Do not use non-native grasses in seeding mixes.

Mowing/Pruning

Mowing is the most common management technique used to control or eliminate unwanted vegetation occurrence and growth. Since pollinators visit flowers searching for food in the forms of nectar and pollen, mowing less would increase the natural food supply for bees and other pollinating species. When making the choice to mow and how often, studies show that single-season mowing is better than no mowing. Mowing once a year in late autumn, when pollinators are not flying, may have the least negative impact on pollinators.

- Manage mowing activities to reduce impacts on pollinators. Consider annual or bi-annual mowing regimes.
- Leave patches un-mowed so not all pollinator habitat is mowed down at once.
- Mow when the majority of plants are past bloom. Pollinators collect pollen and nectar from blooming flowers, after the flower is done blooming, pollinator activity rapidly declines.
- If there is a certain pollinator that you are trying to protect, consider it's life cycle when determined mowing schedule.
- Mow at slower speeds and times when pollinators are active. Prioritize mowing during the day when pollinators and other wildlife are active, and at slower speeds so that they have a better chance to escape.

Herbicide Use and Weed Management on ROWs and Other Utility Lands

Direct impacts of herbicides on local pollinator communities generally come from a reduction in their food supply. This has been seen in patterns and trends of milkweed loss throughout the Midwestern United States. Generally, removing any flowering species will impact forage for pollinators, subsequently making populations less viable.

- Carefully diagnose your weed problem. Before applying herbicide(s), make sure the weed population has reached a level where chemical control is necessary.
- Eliminate or at least minimize the use of herbicides. Eliminating herbicide applications will allow the growth of floral resources that pollinators need to survive. If herbicide treatments are necessary, consider completing applications before pollinator forage plants are in bloom.
- Where practical, treat the managed landscape in thirds. Approach weed management decisions by treating the landscape in thirds to avoid the creation of pollinator food deserts.
- Minimize drift and broadcast spraying. Use a back-pack or belt applicator when possible. This will avoid over spraying or killing desired flowering plants. Selective herbicide applications to stumps directly after removal will help to control the re-growth of non-compatible vegetation. If using a motorized spray rig, always shut off the sprayer when making turns at field ends near gardens, ponds, or other areas that may be used by pollinators and other wildlife.

Insecticides

Although unlikely, you may need to use an insecticide in your corridor or utility management program if you are combating invasive pests. When you use insecticides you could unintentionally harm pollinators and other beneficial insects. Proper application and careful and coordinated timing can significantly reduce pollinator mortality.

- Carefully diagnose your pest problem, and, before you apply a pesticide, make sure the pest population has reached a level where chemical control is necessary.
- Complete pesticide application before pollinator foraging plants bloom.
- Time applications to take place when foraging pollinators are least active. This is generally before 9 am and after 5 pm.
- Establish pesticide free buffer zones around important pollinator forage and nesting areas.
- Minimize drift and broadcast spraying.
- Check the weather forecast before pesticide application and be mindful of changing weather conditions during application. Optimal conditions are: mild breeze (< 10 km/h) with considerable mixing of surface air, wind direction away from sensitive areas, cool and humid conditions.
- If available, use equipment to reduce pesticide drift. There are several ways to minimize the potential for spray drift. Contact your local Ontario Ministry of Food, Agriculture and Rural Affairs office for information.

Strategy 3: Enhance

Utility landscapes provide excellent opportunities to enhance the diversity of local native flowering plants, shrubs and trees, which has been shown to increase pollinator occurrence. The capacity of utility corridors and wind and solar farms to support pollinators can be enhanced significantly with native plantings.

Enhance Habitat

For land managers looking to increase biodiversity or the stewardship value of their land, there are opportunities to enhance pollinator habitat in existing utility corridors, and at wind and solar farms. Planting native flowering species and providing nesting materials offers huge benefits to pollinators.

- Provide blooms from April to October. Include at least 3 flowering species per season.
- Choose different flowering shapes to accommodate native species with different tongue lengths.
- Provide hollow twigs and stems; and downed logs at the site for cavity nesting bee species.
- In restoration planting projects, cluster plants of the same species together. This makes for more efficient foraging by pollinators.

Plant Selection

- Flowering plants provide pollen and nectar resources. Provide continuous nectar and pollen sources from early spring through fall with native plants.
- Maintain seed sources of locally adapted native plant species important to pollinators.
- Include larval host plants into seeding and planting mixes (i.e., milkweed).
- Remove non-native grasses from seeding mixes.
- Decide whether seeds, plugs or a combination of the two will be used.

CASE STUDY 1

Pollinator Habitat at Solar Farms

Fresh Energy in Minnesota has been educating the public, policy makers, and developers about the opportunity for biodiverse habitat on solar sites. Photovoltaic (PV) solar uses the sun to generate electricity and is the most common type of solar energy generation. In 2016 Minnesota is poised for a large solar bloom — likely more than 1,600 hectares of ground-mounted solar will be built. For butterflies, bees, and all pollinators this will provide new feeding habitat. Planted with a seed mix reviewed by the Minnesota Department of Natural Resources, 4,000 acres is the equivalent of 2,400,000 homes with 2 x 3 m pollinator gardens. Fresh energy and a group of pollinator experts have been using crowdfunding to gain financial support that will allow them to spread the word about the usefulness of solar farms as a key place to establish pollinator habitat.

Management Recommendations for Specific Pollinator Species

Managing for Butterflies

Butterflies in electrical ROWs responded to similar factors that promoted their occurrence in field boundaries and agricultural landscapes where they were more commonly associated with edge habitats. Management strategies that increased edges (especially ones that created more scalloped edges), favoured trees along sidelines, and increased bare ground provided better butterfly habitat along ROWs. Sunlight is particularly important in species occurrence patterns, as this is important for basking behaviours that warm the body for flight. Clearing larger, taller vegetation common with easement work benefits butterflies.

Having the right host plant is a significant factor in determining species occurrence for butterflies and moths. Because of this, the timing of mowing or herbicide applications is key. Overall, mowing was shown to increase butterfly occurrence. Management regimes that limited and timed mowing were the most successful as they ensured that key host and forage plants were allowed to be present or bloom when they are needed. If efforts to support a particular species are to be successful, the host plants must either be planted or promoted along the ROW. For example, the endangered Karner Blue Butterfly (*Plebejus melissa samuelis*) is largely associated with populations of wild lupine (*Lupinus perennis*). IVM that promotes lupine on ROW within the known range of the Karner Blue has shown increased adult and caterpillar occurrence. Active planting was also successful.

Managing for Monarchs

Like other butterflies, monarchs are intimately tied to their host plants, milkweeds. Because monarch populations migrate across the continent it is not only important to have milkweed in the right place, along their migratory corridor, but also ensure that ample milkweeds are available for caterpillars to feed on at the right time. Timing of mowing or herbicide activities is critical if the goal is to promote monarchs. Milkweed is a commonly occurring plant on many ROWs filling a habitat deficit in many agricultural areas where the plants are virtually absent due to overuse of herbicides. Milkweed can also be planted from plugs or seeds in an effort to increase populations. Site preparation is key, as milkweed plants are not strong competitors in environments dominated by weeds or dense grasses.

Managing for Hummingbirds

Shrubs retained along the edge of utility landscapes can provide food and shelter for songbirds and small mammals, while scattered dead trees can be left as snags for nesting birds, bats and other mammals. Hummingbirds, like many species of specialized pollinators, are dependent on nectar sources from preferred plants, namely native species with long, tubular blossoms. Shrubs and trees at the edges of ROWs and solar farms are ideal sites for roosting. Healthy and diverse landscapes that are maintained through IVM also provide diverse communities of insects which adult hummingbirds feed to developing young.

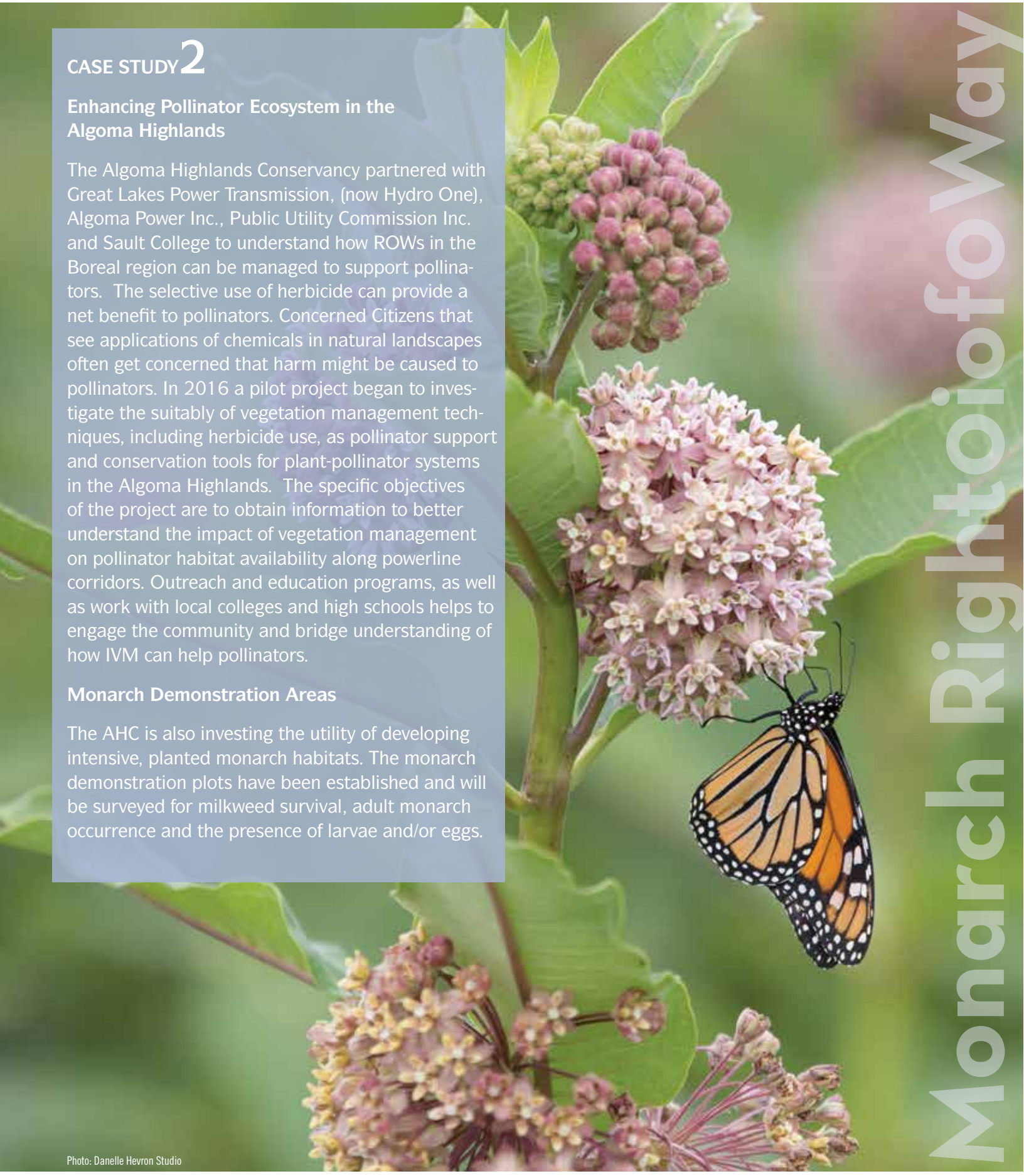
Photo: Steve Fletcher

Managing for Native bees

Unlike honey bees, which live together in hives, most wild bees live solitary lives and nest in the soil, plant stems or wood debris provided by a well-managed utility landscape. Prairie grass and wildflowers growing under electrical conductors or over pipelines ensure safe access for planned and unplanned maintenance, while providing pollinator food and shelter. More diverse and abundant communities of native bees are commonly recorded along managed corridors and this is attributed to a more floristically diverse landscape that was able to develop due to intermediate disturbance from mowing and selective herbicide treatment. Tests monitoring the success of IVM efforts to increase local bee occurrence indicated nearly twice as many species and significantly increased abundance along IVM treated areas of ROWs. Native bee nesting was also noted to be 30% higher in these areas.

Managing for Honey bees

ROW landscapes are abundant and accessible, which makes them ideal sites for beekeepers to pasture their bees during specific seasons or before and after pollination contracts. Many beekeepers have developed land use contracts with local utilities that allow them access and peace of mind to leave their bees as ROWs often have restricted access and are out of the public's view. Correct honey bee hive placement along ROWs is key, as bees should not be placed near towers or other structures that line workers might have to access, or too near utility access roads. It is also vital that ROW managers and beekeepers communicate about the location of bees along ROWs and any planned pesticide applications.



CASE STUDY 2

Enhancing Pollinator Ecosystem in the Algoma Highlands

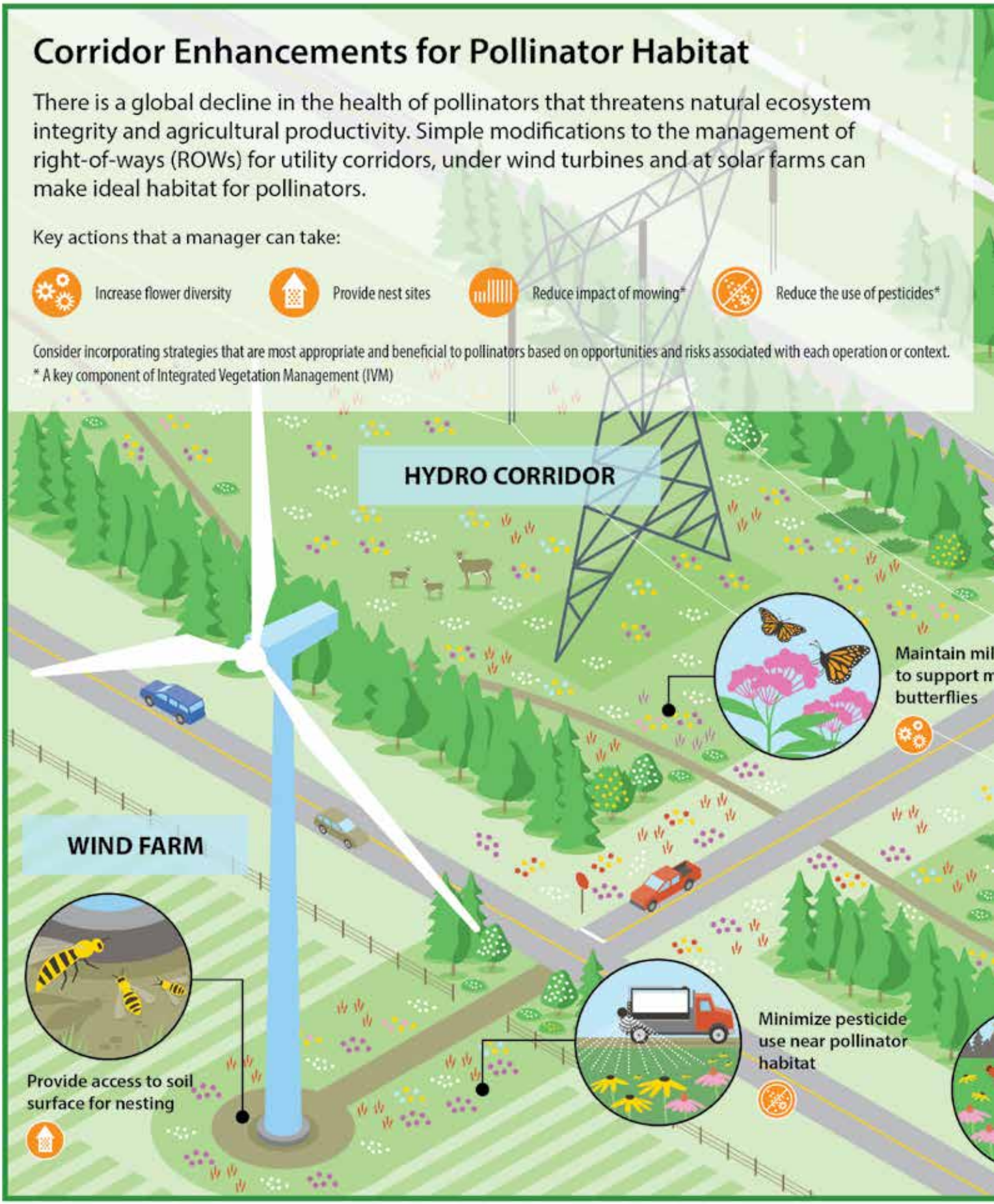
The Algoma Highlands Conservancy partnered with Great Lakes Power Transmission, (now Hydro One), Algoma Power Inc., Public Utility Commission Inc. and Sault College to understand how ROWs in the Boreal region can be managed to support pollinators. The selective use of herbicide can provide a net benefit to pollinators. Concerned Citizens that see applications of chemicals in natural landscapes often get concerned that harm might be caused to pollinators. In 2016 a pilot project began to investigate the suitably of vegetation management techniques, including herbicide use, as pollinator support and conservation tools for plant-pollinator systems in the Algoma Highlands. The specific objectives of the project are to obtain information to better understand the impact of vegetation management on pollinator habitat availability along powerline corridors. Outreach and education programs, as well as work with local colleges and high schools helps to engage the community and bridge understanding of how IVM can help pollinators.

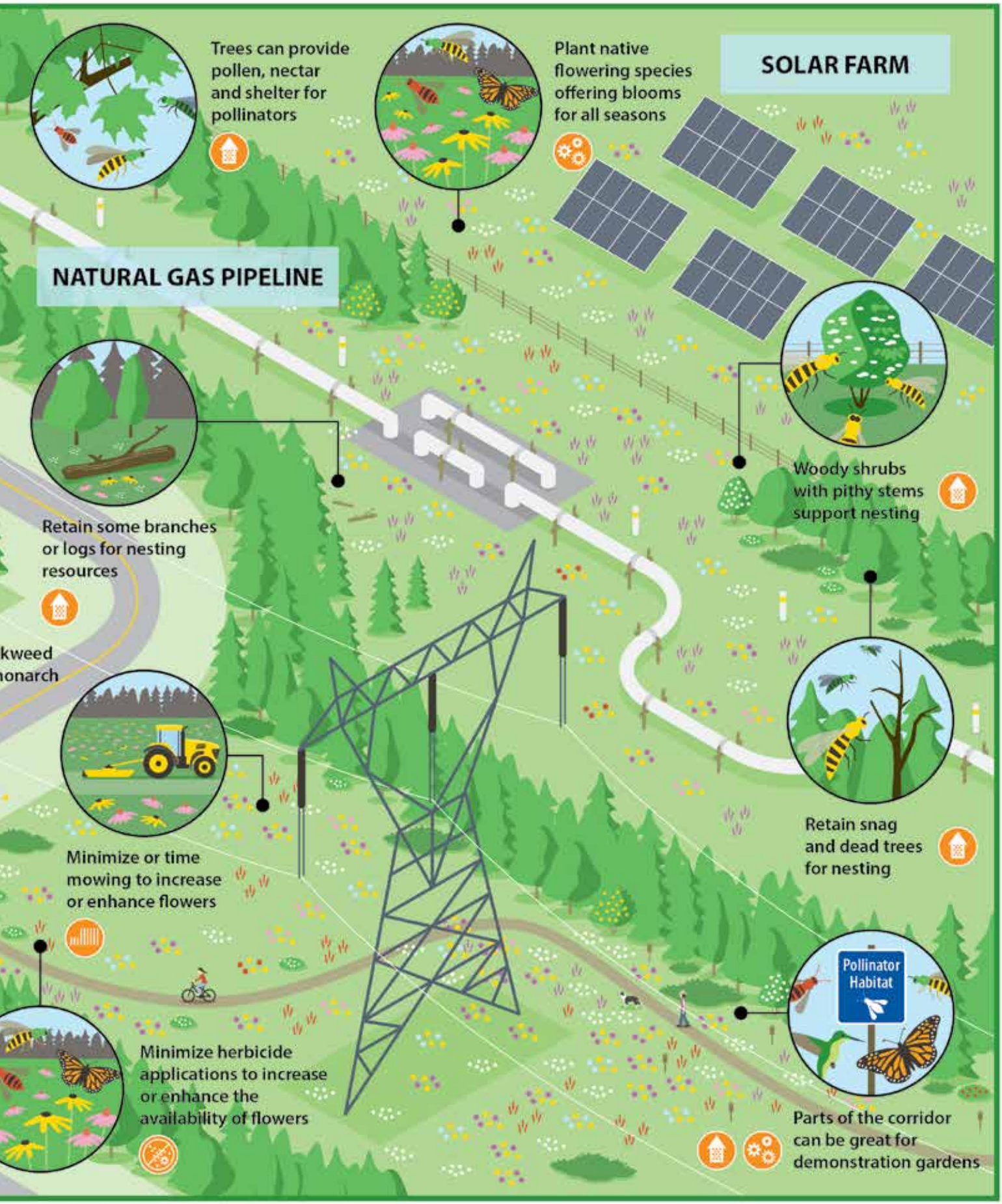
Monarch Demonstration Areas

The AHC is also investing the utility of developing intensive, planted monarch habitats. The monarch demonstration plots have been established and will be surveyed for milkweed survival, adult monarch occurrence and the presence of larvae and/or eggs.

Photo: Danelle Hevron Studio

Monarch Right to Way


Corridor Enhancements for Pollinator Habitat
There is a global decline in the health of pollinators that threatens natural ecosystem integrity and agricultural productivity. Simple modifications to the management of right-of-ways (ROWs) for utility corridors, under wind turbines and at solar farms can make ideal habitat for pollinators.
Key actions that a manager can take:
Increase flower diversity
Provide nest sites
Reduce impact of mowing*
Reduce the use of pesticides*
Consider incorporating strategies that are most appropriate and beneficial to pollinators based on opportunities and risks associated with each operation or context.
* A key component of Integrated Vegetation Management (IVM)
HYDRO CORRIDOR
Maintain mil
to support m
butterflies
WIND FARM
Provide access to soil
surface for nesting
Minimize pesticide
use near pollinator
habitat


Trees can provide pollen, nectar and shelter for pollinators
Plant native flowering species offering blooms for all seasons
SOLAR FARM
NATURAL GAS PIPELINE
Retain some branches or logs for nesting resources
Woody shrubs with pithy stems support nesting
kweed
nonarch
Minimize or time mowing to increase or enhance flowers
Retain snag and dead trees for nesting
Pollinator Habitat
Minimize herbicide applications to increase or enhance the availability of flowers
Parts of the corridor can be great for demonstration gardens

Opportunities to Share the Success

Let the community know what your organization and partners are doing for pollinators!

- Create a website, Facebook page, or a Twitter account to keep the public informed and engaged.
- Take before and after pictures.
- Post pictures of planting activities and the pollinators being attracted to the utility landscape.
- Provide planting lists so members of the public can also plant for pollinators.
- Hold public meetings to communicate the status of the pollinator habitat throughout the course of the project. Make sure to invite various partners and contributors to speak and be available for questions.
- Request outreach materials from the Pollinator Partnership.
- Register this site with the S.H.A.R.E. (Simply Have Areas Reserved for the Environment) program at: http://www.pollinator.org/SHARE.htm.
- Hold a Pollinator Week event and add it to the Pollinator Week Event Calendar at www.pollinator.org.

Photo: Derrick Ditchburn

CASE STUDY 3

A Collaborative project between The Ohio State University Mansfield, First Energy, Arnold Landscaping and Davey Tree lead to the creation of Monarch ROW Demonstration plots.

The site on the OSU Mansfield campus consists six sections under First Energy electrical utility lines; four are pollinator plots and two are pollinator hedges. These demonstration plots house native plants, attract pollinators and show landowners alternative management options for utility right-of-ways on their properties. The intention is that in about 3 years, the plot will be filled with native grasses and flowers, and will provide a feeding ground for important pollinators, including honey bees and Monarch butterflies. First Energy became involved with the pollinator project through interactions with other pollinator project partners about 2 years ago. The company has to trim trees that interfere with the electrical lines to provide customers with good electrical service and their hope is that the creation of the demonstration plots will be a first step could lead to more research and other projects. The demonstration plot won't only educate landowners, it will also educate students and the community. OSU Mansfield students will be able to use the area to study the vegetation, and the pollinators that feed there. The utility company using this particular right-of-way because the area is central to campus, visible and close to the classroom.

Education, Outreach, and Certification

Your newly created pollinator habitat will provide an excellent learning opportunity for everyone, from school children to university students and other land management professionals. It can also engage existing employees and attract new hires. Educational visits are also a great way to showcase your commitment to the community and connect with others.

Outreach

There are many ways to reach out to the community. Consider installing interpretive signage at the planting site so that any visitor to the site becomes informed about pollinators and learns about the managers commitment to the environment and community. Additionally, providing information via the web in the form of background, project summary, and future plans will reach beyond the local community to others that have interest in similar projects or learning more about the organization. The Pollinator Partnership (P2) has completed a wide variety of projects utilizing outreach materials, and case studies, which are available at www.pollinator.org.

Certification and Recognition

Contact organizations such as the Canadian Wildlife Federation or the Wildlife Habitat Council (WHC) to take part in the Habitat Certification process. Certification ensures that your habitat sustains pollinators and also puts sustainability and habitat projects completed by your organization in the national spotlight. In addition, Pollinator Partnership's signature initiative, the North American Pollinator Protection Campaign (NAPPC) offers recognition to the best roadside pollinator habitat. Information can be found at www.pollinator.org/awards.

Monitoring and Research

Information about the success of pollinator habitats and local pollinator populations is essential for conservation and land management. Adding data to new and ongoing monitoring efforts is valuable. Consider a partnering with a local citizen science program or a regional monitoring program such as as Bumblebee Watch (bumblebeewatch.org), the Monarch Larva Monitoring Project (www.mlmp.org), or eButterfly (www.e-butterfly.org). Partnerships with local conservation groups or universities are also great ways to support pollinators. Contact Pollinator Partnership if you are interested in including your utility pollinator habitat in a scientific study that can aid in pollinator conservation.

Regulatory Considerations

If the site is known habitat for a sensitive species, review all laws, regulations, and guidelines. Consult with your regional Ministry of Natural Resources and Forestry, or Environment Canada office for additional guidance. Even the slightest change in sensitive habitat can have negative effects on the rare, threatened, and endangered species it supports. However, with careful planning, a habitat enhancement project could benefit both species at risk AND other pollinators.

Ecoregional Habitats

The information contained in this utility management guide applies to five ecoregions in Southern and South-central Ontario including: St. Lawrence Lowlands, Frontenac Axis, Lake Erie Lowlands, Manitoulin-Lake Simcoe and Algonquin-Lake Nippissing. These ecoregions are based on delineations set out in the National Ecological Framework of Canada[12], and are characterized by ecological factors such as: climate, physiography, vegetation, soil, water, and fauna. The area is represented by site regions 7E, 6E, and 5E and extends from the Ontario-Quebec border in the east, along the north shores of Lake Ontario and Lake Erie, up the eastern shoreline of Lake Huron to Manitoulin Island, around the north side of Lake Nipissing, and eastward to Ottawa.

Lake Erie Lowlands, Manitoulin-Lake Simcoe, St. Lawrence Lowlands, and the Frontenac Axis lie within the Mixedwood Plains ecozone. The geographic location, waterways and combination of gentle topography, fertile soils, warm growing season and abundant rainfall have made this the most intensely used and populated area in Canada. The region is dissected by farms, roads and urbanized areas. Algonquin-Lake Nipissing lies within the Boreal Shield ecozone and is characterized by large tracts of forests, flashing waters, and bedrock. Despite the fact that highways, railroads, and airports have made much of this ecozone accessible, there is still much that remains as wilderness.

To find out which bioregion you live or work in go to www.pollinator.org and click on Ecoregion Locator for help.

Greater Toronto Area and Golden Horseshoe, Windsor, London, Sarnia and the Niagara Region

Lake Erie Lowlands - LEL

Lake Erie Lowlands spans 24,000 square kilometres and is located along the shorelines of three of the Great Lakes. The region is home to the majority of Ontario's population. Most of the deciduous forest has been cleared away for farms, orchards, highways, and cities. Agriculture is the predominant land use occupying 65% of the ecoregion, and major crops include corn, soybeans, and tender fruit. The area contains the most productive agricultural soils in Canada and is the main fruit growing region of Ontario. The Lake Erie Lowlands ecoregion is often referred to as the Carolinian zone and is the northern extent o the Carolinian forest with the highest pollinator diversity. The climate is marked by warm summers (mean summer temperature is 18°C) and cool winters (mean winter temperature is -2.5°C) with an annual growing season ranges from 175 growing days in the north to 250 in the south, near Lake Erie.

Manitoulin–Lake Simcoe - MLS

The Manitoulin–Lake Simcoe ecoregion covers an area of 46,600 square kilometres within Ontario. More than 60% of the ecoregion is classified as dependable agricultural land. The rich soils and favourable climate (mean summer temperature is 16.5°C and the mean winter temperature is -4.5°C) support a strong agricultural economy which account for the majority of the land use (56%) in the ecoregion. Mixed, dairy, and cash crop are the dominant farming systems. Major crops include grains, corn, soybeans, hay, and some fruit. There are some significant areas of mixed forest where vegetation is characterized by sugar maple, beech, eastern hemlock, red oak, and basswood.

Peterborough, Oshawa, Guelph, Kitchener, Barrie, Owen Sound, and Stratford

Sault Ste. Marie, Elliot Lake, Sudbury, North Bay, Mattawa, Parry Sound, Bracebridge, Gravenhurst, Huntsville, Deep River, Elliot Lake, Minden, Bancroft and Barry's Bay

Algonquin-Lake Nipissing - ALN

The Algonquin-Lake Nipissing ecoregion encompasses 74,479 square kilometres. The topography is mostly forested and exposed bedrock is common. Cottages have been constructed on the shoreline of many rivers and lakes. Commercial forestry and associated processing are important economic activities along with mining, hydropower, commercial and subsistence hunting, trapping, fishing and tourism. The majority (60%) of population live in urban centres and Sudbury is the major mining centre. Agriculture is limited to the few areas where the soil quality and microclimate are suitable. This ecoregion is classified as having a humid cool temperate climate marked by warm summers (mean summer temperature is 15.5°C) and cold winters (mean winter temperature is -8.5°C). The land cover in this ecoregion is dominated by mixed forest (32.0%), deciduous forest (22.2%) and coniferous forest (12.1%).

Kingston and Brockville

Frontenac Axis - FA

The Frontenac Axis is the smallest ecoregion in Ontario. The region is characterized by temperate summers (16°C) and cold winters (-7°C) with moderate precipitation (700-800 mm) distributed evenly throughout the year. The landscape is dominated by forest cover with bedrock outcrops. Forest vegetation is characterized by sugar maple, eastern hemlock, red oak, white pine, paper birch, and white cedar – species common to the Mixedwood Plans and Boreal Shield ecozones. Mixed farming and dairy are the leading farming systems, with major crop types including grains, corn, and hay.

St. Lawrence Lowlands - SLL

The St. Lawrence Lowlands encompass 46,000 square kilometres. The region is characterized by warm summers (16.5°C) and cold winters (-7°C) with moderate precipitation (800-1000 mm). Mixed forests of sugar maple, yellow birch, eastern hemlock and eastern white pine form the dominant forest types in the region, with beech occurring at warmer sites. Species characteristic of dry sites include red pine, eastern white cedar, and red oak. Wet sites support red maple, back ash, white spruce, tamarack, and eastern white cedar. Most of the region is intensely farmed (60%) with corn being the dominant crop type grown, and dairy and mixed farming systems also present.

Cornwall, Brockville, Ottawa, and Pembroke

A Diverse Pollinator Community

Bees

Bees are the best known and also the most important pollinators of wild and agricultural plants. While all pollinators visit flowers, bees are the only pollinators that actively collect pollen. For bees, pollen is an essential protein source that they collect and store to feed their developing young. The behaviour of bees on flowers and their hairy bodies make them efficient at moving pollen from one plant to another.

There are more than 800 native species of bees in Canada, and more than 400 in Ontario, making the province a hot spot for bee diversity. Wild bees are an incredibly diverse group of organisms with an estimated 20,000 species globally[5]. The diversity of lifestyles in the wild bee community is large and includes varied nesting habitats as well as different levels of social interactions. Most bees live solitary lives and do not interact with one another, nor do they make honey. Some bees, like carpenter bees or sweat bees will live in aggregations nesting side-by-side. Very few bees are truly social, living in colonies with multiple generations.

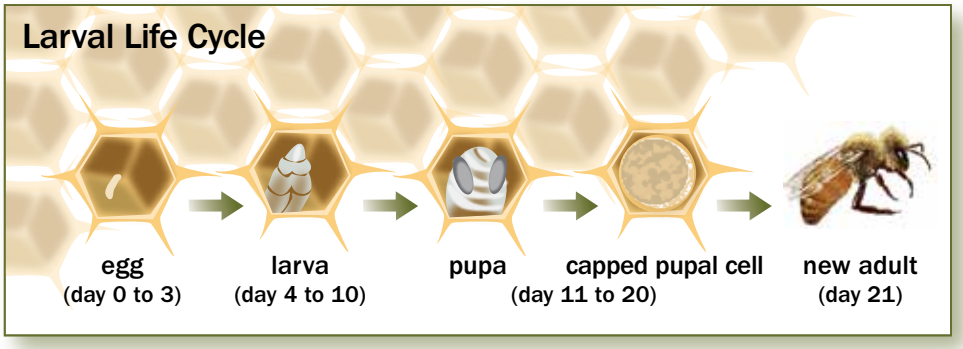
Photo: Leif Richardson

Bumble bees (*Bombus* spp.) are large social bees that live in colonies and produce honey, much like honey bees. Bumble bees look for nests in abandoned mouse nests, other rodent burrows, upside down flower pots, under boards, and other human-made cavities. Colonies are founded by a queen in the spring. The number of workers in a colony can grow to 300 at the peak of summer bloom. Bumble bee colonies die out in the fall after producing new queens. New queens mate and then overwinter, hiding in cracks or small crevices until the next spring. Bumble bees are usually active during the morning hours and can forage at colder temperatures than honey bees, even flying in light rain. There are 26 recorded species of bumble bees in Southern Ontario[6] and they are some of the most easily identifiable and observable native bee species. The majority of wild bees in Ontario nest in the ground, including digger bees (*Anthophora* spp.), sweat bees (*Halictus* spp., *Agapostemon* spp. and others), squash and gourd bees (*Peponapis pruinosia*), plasterer or cellophane bees (*Nomia* spp. and *Colletes* spp.) and mining bees (*Andrena* spp.). Ground nesting bees generally require sunny, bare ground, and less compacted soil. Large carpenter bees (*Xylocopa virginica*) nest in soft dead wood, poplar, cottonwood or willow trunks and limbs, and structural timbers. . Small carpenter bees (*Ceratina* spp.) chew out nests in pithy stems including the stems of roses and blackberry canes. Other wild bees make use of pre-existing holes and tunnels, often made by beetles. These bees include leaf-cutter bees (*Megachile* spp.), mason bees (*Osmia* spp.) and small masked bees (*Hylaeus* spp.).

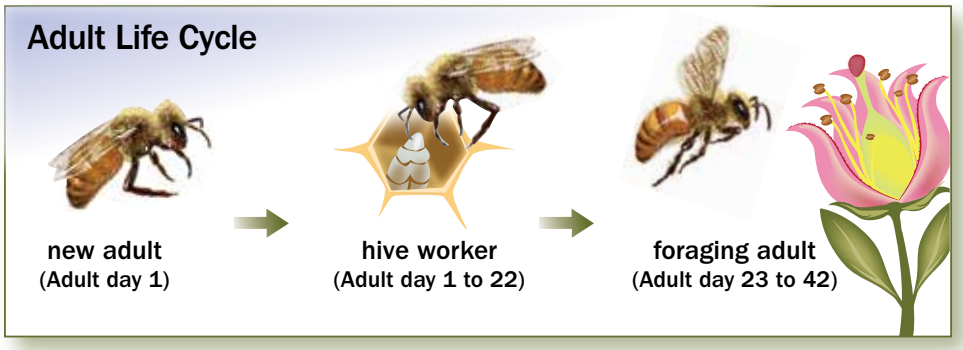
Wild bee life cycle

Most solitary wild bees have short life cycles ranging from 2 to 4 weeks. Different species occur throughout the spring, summer, and early fall, and they all have unique preferences for floral resources. Some solitary bees such as carpenter bees can live for extended periods of time, over 2 months in some cases, but they are seasonal and do not live from year-to-year. Because of this varied set of lifestyle and occurrence times (also

known as phenology) floral habitats must be diverse and must provide blooming flowers from early spring through to the fall. Estimates of the number of flower visits required to support native bee populations range from 500 to 1100 a day – meaning that abundant floral landscapes are key to keeping bee populations healthy and stable. Floral resources also have to be highly localized as foraging distances for wild bees range on average between 100 to 300 metres from their nests. Generally bees spend a few days as an egg, a week or two as larvae, and another week or two as a pupa, but they can overwinter or hibernate in any of these stages. For bees that nest in wood or dry plant stems it is important to leave vegetative material undisturbed through the fall and winter seasons as they may contain individuals of varying life stages.



Illustrations: Marguerite Meyer



Wild bees are faced with significant challenges from habitat loss that is a result of land conversion for agricultural, urban, or industrial uses. As natural areas shrink so does their carrying capacity, and populations of wild bees see reduced forage and nesting resources. In highly fragmented landscapes food resources may be beyond foraging ranges, which results in lower nest success and fewer bees. Wild bees existing in or near agricultural areas also face non-target impacts from chronic exposure to pesticides, similar to what honey bees do. Current research indicates that impaired foraging and reduced reproductive abilities can be correlated with chronic pesticide exposure, in particular products that have extended residual toxicities and longer lifetimes in the environment[7]. Overall, wild bees that are exposed to pesticides are not as healthy and productive.

Honey bees (*Apis mellifera)*are managed for pollination services and honey production throughout the world. They represent one species of the estimated 20,000 species of bees globally[5]. Honey bees are not native to Ontario, but rather were imported from Europe and northern Africa in the late 1700's. Managing honey bees for agricultural pollination services is a newer phenomenon that has grown throughout the 20th century[8]. Today managed honey bees are essential partners in the pollination of row crops including alfalfa, fruit and nut trees, berries, and field vegetables to name a few. Other common managed bees include bumble bees, leafcutter bees, mason bees, and mining bees. The managed non-Apis bee industry is growing in size but is nowhere near that of the honey beekeeping industry.

A year in the life of a honey bee colony

Honey bees are unique in that they are truly social bees that live in a colony where they divide tasks and roles between workers, have a queen, and persist in the colony over multiple seasons and years. This lifestyle is very uncommon in the pollinator community but it has made honey bees successful in many landscapes.

Winter

A honey bee hive has a seasonal cycle that repeats from year to year. During the winter a hive is dormant. The bees in the colony surround the queen and keep her warm. The colony survives the winter by feeding on honey stores that were collected the previous year.

Spring

When the weather gets warmer and spring flowers start to bloom the colony becomes more active. Overwintering foragers leave the hive to collect pollen and nectar; the queen has been laying eggs (between 1000 to 1500 each day) and the colony is ready for spring. Most beekeepers manage bee colonies to avoid swarming.

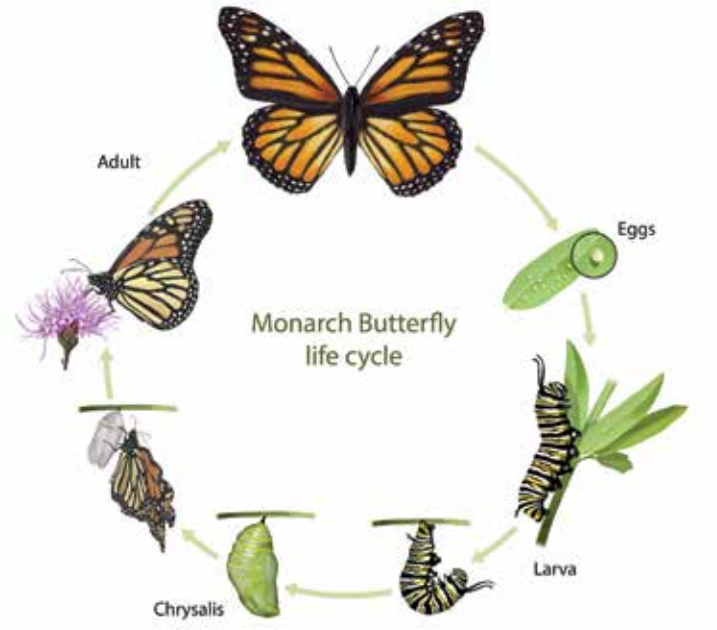
Summer

In early summer the colony is very active. Foragers leave daily to collect pollen and nectar and many new worker bees emerge. By late summer the colony has grown very large and strong. Workers start to produce new queen cells that will produce new queen bees (in warmer climates this can occur earlier in the spring as well). After the new queens hatch, they leave the colony, each taking some worker bees with them. This is called swarming.

Fall

By the fall, flowers have stopped blooming and are producing fruit. The colony works on storing food and foraging for nectar slows. The worker bees and the queen will spend the winter feeding on stored honey, waiting for the spring bloom of flowers.

While a honey bee colony can live through multiple years, worker bees have limited lifespans of approximately 40 days. As a honey bee ages, it cycles through various tasks inside and outside the hive. Right after emerging from their pupa, worker bees work to build combs and take care of other developing larvae. When they get older they leave the hive and become foragers, bringing back pollen, nectar, and other plant products to the hive. Queens live longer, ranging from 2 to 10 years. When a colony has a weak or older queen, or loses a queen unexpectedly due to illness, new queens are produced to replace the old queen.



Butterflies and Moths

Butterflies and moths also visit and pollinate wildflowers. Many moth species are particularly active in the evening and morning hours, visiting flowers that bloom at these times as well. Butterflies on the other hand are attracted to open sunny areas where they can bask and warm themselves. Meadows, grasslands, and other open spaces are ideal habitats for butterflies.

Butterfly and Moth Life Cycle

Young butterflies and moth (caterpillars) have very different habitat needs than adults. Moth and butterfly eggs are laid on leaves of host

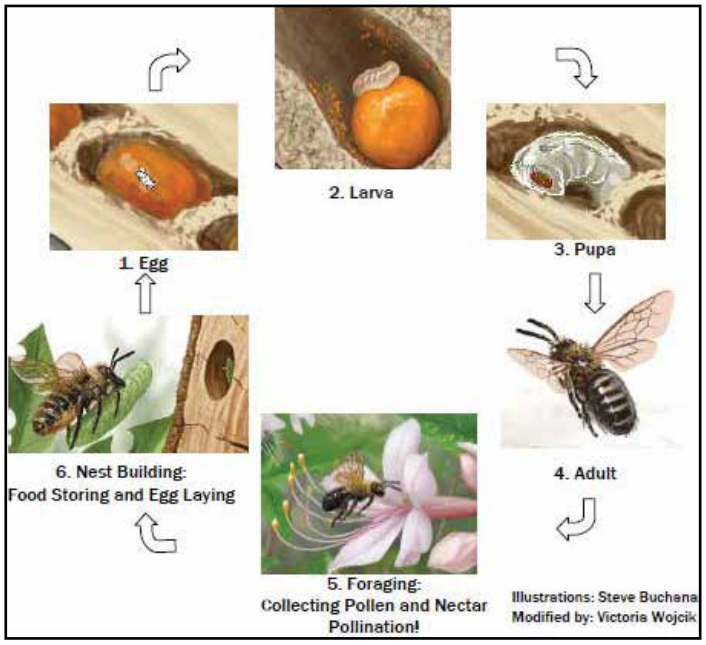

Photo: Leah Lewis

plants. After a few days these eggs hatch into caterpillars that feed off of the host plant leaves, growing, molting (shedding their skin), and growing again. Caterpillars develop over a 2 week period during which they can molt up to five times. After their final molt, caterpillars settle into a spot where they develop into a chrysalis and metamorphose into an adult. Metamorphosis usually takes between 1 to 2 weeks. When they mature into adults, butterflies and moths feed on nectar from flowers. In some cases host plants and nectar plants are the same species, but not always. Butterfly and moth life spans range from just a few days to over a year depending on the species and region.

Flies

Flies (including mosquitoes) pollinate a range of wild and cultivated plants. One of the most important of all fly pollinator groups are flower flies or hoverflies, in the family Syrphidae. Flower flies are dominant floral visitors and important pollinators wherever they occur. Many flies mimic bees in pattern and colouration in an effort to gain protection from predators that avoid bees due to their ability to sting. Unfortunately less is known about landscape management for flies, which have a complex life cycle where the maggot and the adult often require very different habitats.

Solitary Bee Life Cycle



Beetles

Beetles are the most ancient pollinators of plants and are considered to be associated with the widest range of species. Their role as functional and significant pollinators is debatable as many are pollen feeding and destroy pollen without significant transfer between plants. Generally, beetle pollinators (including scarabs, staphylinids and sap beetles) are somewhat indiscriminate in which flowers they visit, foraging for pollen and sometimes nectar on open bowl-shaped blossoms that offer easy access. Beetles are attracted to "primitive" blossoms including magnolia and tulip trees. As with other wild pollinators, threats from habitat loss, climate change, invasive species, and non-target exposure to pesticides can reduce populations. Management and conservation strategies for beetles are not well developed.

Bats

Pollinating bats have a limited range in North America, existing only in the far southern portion of the United States and throughout Mexico. These pollinating bats, however, are keystone pollinators of desert plant species and some commercial crops like agave and mezcal. Bats feed on large, nectar-producing flowers in the evening. Many species of bats are also migratory, tracking patterns of food availability as they move throughout their range. Expanding rural and agricultural development, and cultural challenges to conservation, have impacted species throughout Mexico and the southwest. The lesser long-nose bat (*Leptonycteris yerbabuenae*) is a keystone pollinator for saguaro cactus (*Carnegiea gigantean*) in the desert southwest. This species of bat is listed as a threatened species in the United States as much of its feeding and nesting habitat has been fragmented. White nose syndrome, a disease currently restricted to the eastern part of the United States and South-eastern Canada, could significantly threaten populations of pollinating bats if it continues to spread. Climate change and its impacts on plant bloom and food availability are also key concerns for bat conservation. Bats generally do not interface with agricultural landscapes where pesticides are used, but there is the potential of harm to bats from the use of rodenticides.

Hummingbirds

Hummingbirds are resident and migratory throughout North America. In their adult form they are nectar feeders, visiting flowers and acting as pollinators of many wild species. Juvenile hummingbirds require insects as a protein-rich food source. Most often hummingbirds are associated with naturalized or urbanized landscapes where their preferred food plants grow or are cultivated. The Ruby-throated Hummingbird (*Archilochus colubris*) is the only hummingbird specie in Ontario. As with bats, they are seldom in areas where they experience a direct interaction with agricultural pesticide use, but can be impacted by chemical use in garden settings. Climate change, and shifts in bloom period are expected to impact migratory species disproportionately meaning that hummingbirds may face future challenges.

Pollinator Species at Risk

Species at Risk (SAR) are those species that are in danger of disappearing from the wild. SAR species include endangered, threatened, and special concern species. Some pollinator species, such as the Karner Blue butterfly have been extirpated from Ontario, meaning that they used to occur here, but their ranges are now restricted to other geographic areas. Other species are of conservation concern because of their rarity in Ontario, but their formal conservation status has yet to be determined. The survival of a species can be put at risk by a variety or combination of factors, and determining the cause and solution is often a complex one.

Monarch Butterfly

Monarch butterflies (*Danaus plexippus*) are a unique migratory species that make a 5000 km journey across North America. This journey can take four generations of butterflies to complete. The monarch migration takes these butterflies across three countries and all four seasons of which they encounter many different landscapes and challenges along the way. The monarch butterfly life cycle is similar to that of other butterflies and moths, only monarchs have a unique host plant – milkweed. A monarch egg is laid on a milkweed leaf. This egg hatches into a caterpillar within 3 to 6 days. The caterpillar feeds and grows over a 2-week period. Once fully grown, it chooses a safe location to form its chrysalis, and after about 10 days an adult emerges.

The Monarch's range extends from Central America to southern Canada. In Canada, Monarchs are most abundant in southern Ontario and Quebec where milkweed plants and breeding habitat are widespread. During late summer and fall, Monarchs from Ontario migrate to central Mexico where they spend the winter months. During migration, groups of Monarchs numbering in the thousands can be seen along the north shores of Lake Ontario and Lake Erie.

Milkweed is critical for monarchs as their caterpillars will not survive and thrive on any other plant. Land conversion throughout their migratory range, and in particular the proliferation of herbicide resistant crops and attitudes toward milkweed have created food deserts, in which monarchs cannot survive as their caterpillars are entirely dependent on milkweed. The milkweed deficit that has been created in these agricultural lands will have to be substituted for in other landscapes that are a better fit for ongoing persistent milkweed populations.

Rusty-Patched Bumble Bee

- The rusty-patched bumble bee (*Bombus affinis*) is yellow and black, but males and workers have a distinctive rusty-coloured patch on the second segment of their abdomen
- the Rusty-patched bumble bee was once widespread and common throughout eastern North America, but has suffered rapid and severe declines throughout their entire range since the 1970s
- Despite extensive survey efforts every year, the last known occurrence of Rusty-patched bumble bee in Canada was at Pinery Provincial Park in 2009.

Karner Blue Butterfly

- The Karner Blue (*Plebejus melissa samuelis*) has a lifespan of about five days as an adult butterfly
- Karner Blue caterpillars feed exclusively on wild lupine leaves; as an adult butterfly they feed on a variety of flowering plants

Declines of wild lupine populations and oak savannah habitats are responsible for the extirpation of Karner Blue and are also likely responsible for the extirpation of two other butterfly species in Ontario, the Frosted Elfin and the Eastern Persius Duskywing.

Photo: Danielle Heyon Studio

Planting List

Botanical Name	Common Name	Ecoregion					Height	Flower Season	Sun	Soil Moisture	Pollinators
		MLS	ALN	LEL	SLL	FA					
Trees and Shrubs											
Arctostaphylos uva-ursi	kinnikinnick	X	X	X	X	X	less than 1m	May - July	sun to partial shade	well drained to dry	hummingbirds, bees
Aronia melanocarpa	black chokeberry		X	X	X	X	2m	May - June	sun to partial sun	dry to moist	bees, beetles, flies
Ceanothus americanus	New Jersey tea	X					0.5-1m	June - August	sun to partial sun	dry	bees, flies, beetles, butterflies
Diervilla lonicera	northern bush-honeysuckle		X				up to 1m	June - July	sun to shade	dry to moist	bees, moths
Gaultheria procumbens	eastern teaberry	X	X				less than 1m	April - May	partial shade	well drained, dry to moist	birds
Symphoricarpos albus	snow berry		X				0.5-1.5m	June - July	sun to partial sun	dry	bees
Vaccinium macrocarpon	cranberry		X	X	X	X	less than 1m	April - June	sun to partial shade	dry to moist, well drained	bees
Forbs											
Achillea millefolium	common yarrow		X				less than 1m	June - August	sun	dry to well drained	butterflies
Anemone canadensis	Canada anemone	X	X	X	X	X	up to 1m	April-August	sun to shade	moist, well drained	bees
Aquilegia canadensis	wild columbine	X	X	X	X	X	up to 1m	April-July	sun to partial shade	dry to moist, well drained	hummingbirds, butterflies, bees
Arisaema triphyllum	Jack in the pulpit	X		X	X	X	up to 1m	April-June	deciduous shade (spring sun)	moist to wet, well drained	gnats, thrips
Asclepias incarnata	swamp milkweed	X	X	X	X	X	0.5-1.5m	June-August	sun	moist to wet	butterflies, bees
Ascelpias syriaca	*common milkweed*	X		X	X	X	less than 1m	June-September	sun to partial shade	dry, well drained	hummingbirds, butterflies, bees
Asclepias tuberosa	butterfly weed	X		X	X	X	less than 1m	June-September	sun to partial shade	dry, well drained	hummingbirds, butterflies, bees
Campanula gieseckeana	harebell	X	X	X	X	X	less than 1m	June-September	sun to partial shade	dry, well drained	hummingbirds
Chamerion angustifolium	fireweed		X				0.5-2m	July-September	sun	dry to moist, well drained	hummingbirds, butterflies, bees
Chelone glabra	white turtlehead	X	X	X	X	X	less than 1m	July - September	sun to shade	moist to wet	butterflies, bees
Cirsium discolor	field thistle	X	X	X	X	X	up to 2m	June - September	sun	dry, well drained	butterflies
Coreopsis lanceolata	laceleaf tickseed	X	X	X	X	X	up to 1m	May - August	sun to partial sun	moist to dry	bees, butterflies
Dasiphora fruticosa	shrubby cinquefoil	X	X	X	X	X	0.5-1.5m	June-September	sun	dry, well drained	butterflies, bees
Desmodium canadense	showy tick trefoil	X		X	X	X	up to 2m	July - August	sun to partial shade	dry to moist, well drained	hummingbirds, bees
Erythronium americanum	yellow trout lily			X	X	X	less than 1m	April - June	shade	moist	bees
Eupatorium maculatum	spotted Joe pye weed	X		X	X	X	up to 2m	July - September	sun to partial shade	moist to wet, well drained	butterflies, bees
Eupatorium perfoliatum	common boneset	X	X	X	X	X	1-1.5 m	July - Septepmber	sun	well drained to moist	bees, butterflies, flies
Euthamia graminifolia	flat-top goldentop	X					1-1.5 m	July - October	sun	moist to well drained	butterflies, bees
Fragaria virginiana	wild strawberry		X				less than 1m	April - June	sun to partial shade	well drained to moist	bees, flies
Gentiana andrewsii	closed gentian	X		X	X	X	less than 1m	August-September	sun to partial shade	moist to wet, well drained	bees
Gentiana crinita	fringed gentian			X	X	X	less than 1m	August-October	sun to partial shade	wet to moist	bees
Geranium maculatum	wild geranium	X		X	X	X	less than 1m	April-June	sun to partial shade	dry, well drained	butterflies, bees
Helenium autumnale	sneezeweed	X		X	X	X	1-1.5m	July - September	sun to partial shade	moist to wet	bees, wasps, flies, butterflies
Helianthus divaricatus	woodland sunflower	X		X	X	X	0.5-1.5m	July-September	sun to partial shade	dry, well drained	butterflies, bees
Heliopsis helianthoides	false sunflower	X					1m	July - October	sun	dry to moderately moist	bees, butterflies

Planting List

Botanical Name	Common Name	Ecoregion					Height	Flower Season	Sun	Soil Moisture	Pollinators
		MLS	ALN	LEL	SLL	FA					
Impatiens capensis	jewelweed		X	X	X	X	0.5-1.5m	July-October	partial shade to shade	moist to wet	hummingbirds, butterflies, bees
Iris versicolor	wild blue iris	X	X	X	X	X	less than 1m	May-August	sun to partial shade	moist to wet	hummingbirds, bees
Lespedeza capitata	roundhead lespedeza	X					0.5-1.5m	August - October	sun to partial shade	dry to well drained	bees
Lilium philadelphicum	wood lily	X	X	X	X	X	less than 1m	June-August	sun to partial shade	dry	hummingbirds
Lobelia cardinalis	cardinal flower	X		X	X	X	0.5-1.5m	July-September	sun to partial shade	moist to wet, well drained	hummingbirds, butterflies, bees
Lobelia siphilitica	great blue lobelia	X	X	X	X	X	0.5-1.5m	August-September	sun to partial shade	moist to wet, well drained	hummingbirds, butterflies, bees
Lysimachia ciliata	fringed loosestrife	X	X	X	X	X	0.5-1.5m	June-August	partial shade to shade	moist	bees
Lysimachia terrestris	swamp candles	X		X	X	X	up to 1m	June-August	sun to partial shade	moist	bees
Mentha canadensis	Canada mint	X	X	X	X	X	less than 1m	July-October	partial shade	moist to wet	bees
Monarda didyma	beebalm	X	X	X	X	X	1-2m	July - September	sun to partial shade	moist to wet	hummingbirds, butterflies, bees
Monarda fistulosa	wild bergamot	X		X	X	X	0.5-1.5m	June-August	sun	dry to moist, well drained	hummingbirds, butterflies, bees
Oenothera biennis	common evening primrose		X	X	X	X	up to 2m	July - October	sun to partial shade	well drained, dry to moist	butterflies, bees
Packera paupercula	balsam ragwort	X	X	X	X	X	less than 1m	May-August	partial shade	moist	bees
Penstemon hirsutus	hairy beardtongue	X		X	X	X	up to 1m	May-July	sun to partial shade	dry, well drained	hummingbirds, bees
Phlox divaricata	wild blue phlox	X		X	X	X	less than 1m	April-June	partial shade to shade, deciduous shade (spring sun)	moist, well drained	butterflies
Phystostegia virginiana	obedient plant	X		X	X	X	1-1.5m	August-November	sun to shade	moist	hummingbirds, butterflies
Podophyllum peltatum	mayapple		X				less than 1m	March - May	shade	moist to well drained	bees, beetles
Potentilla arguta	tall cinquefoil	X	X	X	X	X	less than 1m	June - September	sun	dry to well drained	
Rudbeckia hirta	black-eyed Susan	X	X	X	X	X	0.5-1.5m	June - September	sun to partial sun	moist to dry	bees, butterflies, beetles, wasps
Sisyrinchium montanum	strict blue-eyed grass	X	X				less than 1m	May - July	sun to shade	dry to wet, well drained	
Solidago altissima	Canada goldenrod	X	X	X	X	X	1-2m	August - November	partial shade	moist	butterflies, bees
Solidago canadensis	Canada goldenrod	X	X	X	X	X	0.5-1.5m	July-October	sun to partial shade	dry, well drained	butterflies, bees
Solidago juncea	early goldenrod	X	X	X	X	X	0.5-1.5m	July-September	sun to partial shade	dry, well drained	butterflies, bees
Solidago nemoralis	grey goldenrod	X	X	X	X	X	1m	August-October	sun to partial shade	dry	butterflies, bees
Solidago ptarmicoices	prairie goldenrod	X					up to 1m	July - September	sun	dry to well drained	bees, flies, butterflies
Spiraea tomentosa	steeplebush	X	X	X	X	X	0.5-1.5m	July-September	sun to partial shade	moist	butterflies
Symphyotrichum ciliolatum	fringed blue aster	X	X	X	X	X	0.5-1m	July-October	sun	dry, well drained	butterflies
Symphyotrichum cordifolium	heart-leaf aster	X	X	X	X	X	1-2m	June - August	sun	moist	bees, butterflies, flies
Symphyotrichum ericoides	heath aster	X	X	X	X	X	less than 1m	August-October	sun	dry to moist, well drained	butterflies, bees
Symphyotrichum laeve	smooth blue aster	X	X	X	X	X	0.5-1.5m	August - November	sun	dry	butterflies
Symphyotrichum lanceolatum	lance-leaved aster		X	X	X	X	up to 1m	September-October	sun	moist to wet	butterflies

Planting List

Botanical Name	Common Name	Ecoregion					Height	Flower Season	Sun	Soil Moisture	Pollinators
		MLS	ALN	LEL	SLL	FA					
Symphyotrichum oolentangiense	azure aster	X	X	X	X	X	up to 1m	September - November	sun to partial shade	dry to well drained	bees, butterflies, flies
Symphyotrichum pilosum	hairy white oldfield aster	X					up to 2m	July - August	sun	moist	bees, butterflies, flies
Symphyotrichum puniceum	purple-stemmed aster		X	X	X	X	up to 2m	August-September	sun	moist to wet, well drained	butterflies, bees
Symphyotrichum novae-angliae	New England aster	X	X	X	X	X	up to 1m	September - October	sun to partial shade	moist, well-drained	bees, butterflies, flies
Symplocarpus foetidus	eastern skunk-cabbage	X	X	X	X	X	up to 1m	April - May	sun to shade	wet to flooded	beetles, flies
Tiarella cordifolia	foamflower		X	X	X	X	less than 1m	April - May	sun to shade	moist	bees, flies, moths
Trillium grandiflorum	white trillium	X	X	X	X	X	less than 1m	May - June	partial sun	moist	beetles, flies, bees
Verbena hastata	swamp verbena	X	X	X	X	X	up to 2m	June - September	sun to partial shade	moist to wet, well drained	butterflies, bees
Verbena stricta	hoary vervain	X	X	X	X	X	less than 1m	July - September	sun	dry, drained to sandy	bees, butterflies
Zizia aurea	golden Alexanders	X	X	X	X	X	up to 1m	May - July	sun to partial sun	moist to wet	flies, bees
Shelter Plants											
Bromus kalmii	arctic brome	X	X				up to 1m	June - August	sun to partial shade	dry, moist	butterflies
Calamagrostis canadensis	bluejoint			X	X	X	up to 2m	June - August	sun to shade	moist to wet	
Carex comosa	longhair sedge	X	X				0.5-1.5m	May - July	sun to partial shade	moist to wet	
Carex crinita	fringed sedge	X					0.5-1.5m	May - July	partial shade to shade	moist to wet	
Carex granularis	limestone meadow sedge		X				less than 1m	May - June	sun to partial shade	dry to moist	
Carex retrorsa	knotsheath sedge			X	X	X	0.5-1.5m	May - June	partial shade to shade	moist to wet	
Carex stipata	awlfruit sedge	X	X				0.5-1m	May - June	sun to partial shade	moist to wet	
Carex stricta	upright sedge		X				0.5-1.5m	May - June	sun to partial shade	moist to wet	
Carex vulpinoidea	fox sedge	X		X	X	X	less than 1m	May - June	sun	moist to wet	
Elymus canadensis	Canada wildrye	X	X	X	X	X	up to 1.5m	March - June	sun to partial shade	moist	
Elymus trachycaulus	slender wheatgrass						0.5-1m	April - May	sun to partial shade	moist, well drained	
Elymus virginicus	Virginia wildrye						0.5-1m	May - June	partial shade to shade	moist, well drained	
Juncus effusus	common rush		X				0.5-1.5m	July - September	sun	moist to wet	
Juncus tenuis	poverty rush	X	X				less than 1m	May - September	sun to partial shade	moist to wet, well drained	
Juncus torreyi	Torrey's rush	X	X				0.5-1m	August - October	sun	moist	
Panicum virgatum	switchgrass		X	X	X	X	up to 2m	July - September	sun	dry to moist, well drained	
Schizachyrium scoparium	little bluestem			X	X	X	0.5-1.5m	June - December	sun to partial shade	dry	
Scirpus atrovirens	green bulrush	X					0.5-1.5m	June - July	sun to partial shade	moist to wet	
Scirpus cyperinus	woolgrass		X				1-1.5m	July - September	sun to partial shade	wet	
Sporobolus cryptandrus	sand dropseed	X	X	X	X	X	less than 1m	May - November	sun to partial shade	dry	

Pollinator Resources

BeeSmart™ Gardener APP for iPhone and Droid, available at iTunes and the Google Play Marketplace.

Many books, websites, and people were consulted to gather information for this guide. Use this list as a starting point to learn more about pollinators and plants in your area.

Monarch Joint Venture at http://www.monarchjointventure.org/

Pollinator Week: http://www.pollinator.org/pollinator_week

Monarch Waystation Program: http://www.monarchwatch.org/waystations/

Monarch Net: http://monarchnet.uga.edu/

Wildlife Habitat Council: http://www.wildlifehc.org/about-whc/

Monarch Watch: www.monarchwatch.org/

Milkweed Market for Milkweed plugs at http://monarchwatch.org/milkweed/market/

Pollinator Partnership - www.pollinator.org

North American Pollinator Protection Campaign - www.nappc.org

The Xerces Society - www.xerces.org

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Committee on the Status of Pollinators in North America. 2007. Status of Pollinators in North America The National Academies. Press: Washington, DC.

Native Plants

There are many native plant nurseries and growers of local plant variety in Ontario. This list presents just a few. Visit findnativeplants.com/canada/ontario-native-plants/ to find more sources of local plant materials and current providers.

Wildflower farm
10195 Hwy 12 West, R.R.#2
Coldwater, ON L0K 1E0
1 866 476 9453, info@wildflowerfarm.com

Connon Nurseries Ltd.
Box 1218, 383 Dundas St. E., Waterdown, ON. L0R 2H0
P: (905) 689-4631
F: (905) 689-5481 sales@connon.ca www.connon.ca
carries wide variety of Carolinian Canada species

Grow Wild
Mail: 22 Birchcliff Ave. Box 12 Dunsford, ON K0M 1L0 4735 Durham/York 30 Claremont, ON L1Y 1A
Phone: (705) 793-3136 Cell: (416) 735-7490
By appointment only

Humber Nurseries Ltd. 8386 Hwy 50,
Brampton, ON. L6T 0A5 P: (905) 794-0555
(416) 798-8733 (Toronto), F: (905) 794-1311
humber@gardencentre.com www.gardencentre.com

Keith Somers Trees Limited
Office: 10 Tillson Ave, Tillsonburg, (519) 842-5148

Farm Centre: Concession #8, off Elgin Rd. 44, Eden, ON
carries full range of native Carolinian Canada species

Limestone Creek Restoration Nursery RR 1, Campbellville, ON. L0P 1B0, P: (905) 854-2914, F: (905) 854-3363

Native Plant Source
Jeff Thompson, President, E-mail:info@nativeplantsource.com
Tel (519) 748-2298, Fax (519) 748-2788
Nursery Address: 1098 Wurster Place, Breslau
Mailing Address: 318 Misty Crescent, Kitchener, ON N2B 3V5

Nith River Native Plants
4265 Wilmot-Easthope Rd.,
New Hamburg, ON N3A 3S7
(519) 662-2529 or contact Graham Buck at (519) 780-1816
buckgraham@hotmail.com
A great many native plants at reasonable prices.

Ontario Tallgrass Prairie Nursery PO Box 1168
Chatham, Ont. N7M 5L8, P: (519) 354-7340

Otter Valley Native Plants Box 31, RR 1
Eden, Ont. N0J 1H0 P/F: (519) 866-5639

Pterophylla Native Plants & Seeds #316 Regional Road 60
R.R.#1, Walsingham
Ph: 519-586-3985, Email: gartcar@kwic.com

St. Williams Nursery and Ecology Centre 885 Hwy 24
P.O. Box 150, St. Williams, ON NOE 1P0
Phone: 519-586-9116
Toll Free: 1-866-640-TREE (1-866-640-8733)
Fax: 519-586-9118, Email: info@stwilliamsnursery.com

Sweet Grass Gardens
RR 6, 470 Second Line Rd,
6 Nations of the Grand River, Hagersville, ON. N0A 1H0
P: (519) 445-4828, F: (519) 445-4826
info@sweetgrassgardens.com
www.sweetgrassgardens.com

Not So Hollow Farm
838369 4th Line E Mulmur Twp Glencairn, ON L0M 1K0
fax:705-466-6341
ph: 705-466-6290 idpayne@enviroscape.on.ca

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Photo: Steve Fletcher

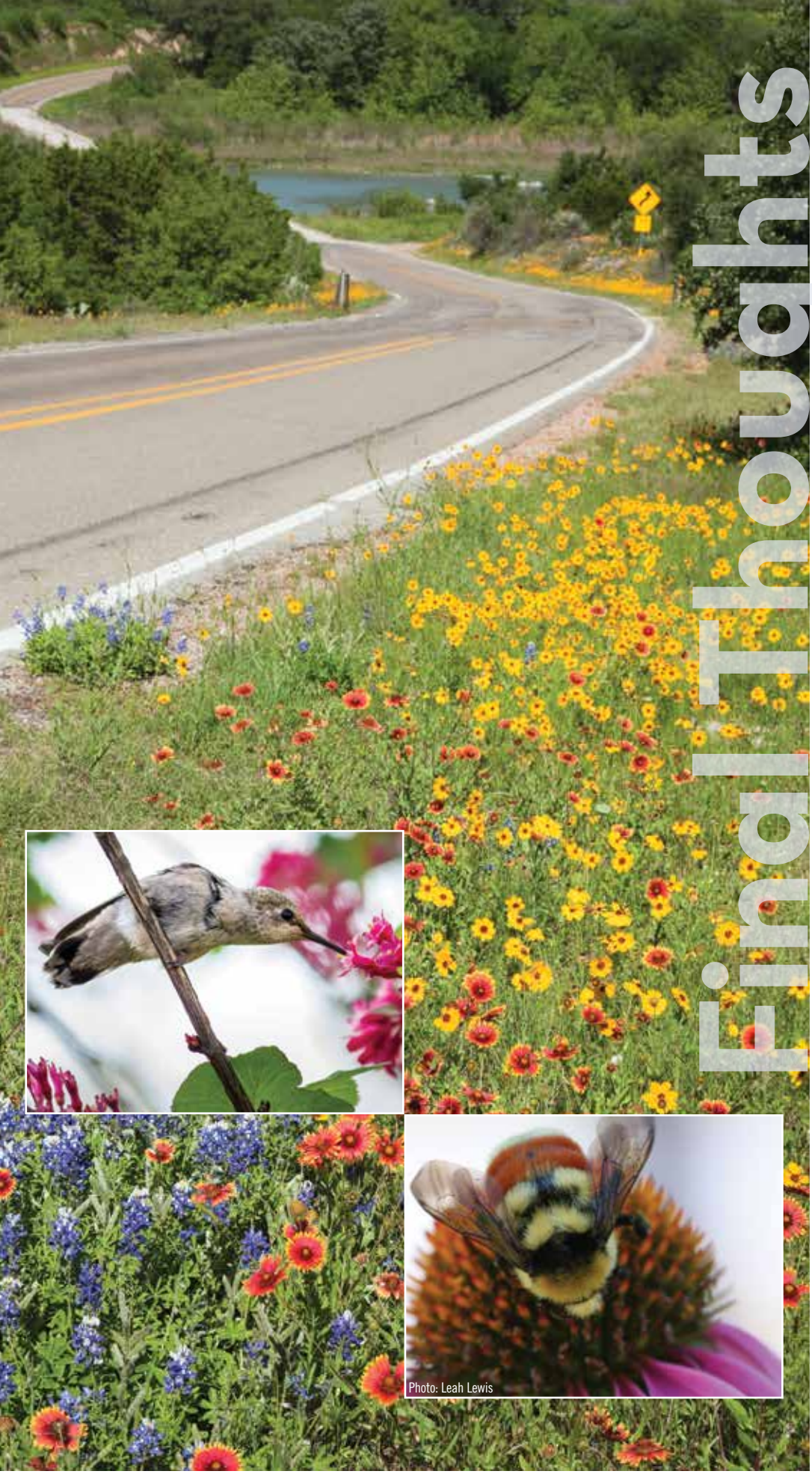

Photo: Leah Lewis

Final Thoughts

A successful pollinator habitat project on a roadside or transportation corridor holds the promise of supporting the buzz of bees, the hum of birds, and the wondrous migration of monarch butterflies while bringing your community great satisfaction. You will support nature in your own backyard while connecting fragmented habitats across the continent. Other regional planting lists are available for parts of Canada and the United States if you need assistance in other locations. These are available at www.pollinator.org.

Feedback

We need your help to create better guides for other parts of North America. Please e-mail your input to feedback@pollinator.org.

- How will you use this guide?
- Do you find the directions clear? If not, please tell us what is unclear.
- Is there any information you feel is missing from the guide?
- Any other comments?

We welcome stories and pictures of your successes and are here to help you meet your challenges. E-mail your success stories to feedback@pollinator.org. Thank you for supporting ecosystems through habitat management and providing resources for pollinators across Ontario.

Notes

Notes

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