Technical Guide

# Technical Guide for

# Enhancing, Managing and Restoring Pollinator Habitat Along Ontario's Roadsides

Growing Forward 2
A federal-provincial-territorial initiative

POLLINATOR PARTNERSHIP CANADA

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# Contents



# Getting Started

**With over 270,000 km of roads in Ontario, marginal habitats such as roadsides are a significant, yet often overlooked resource for pollinator conservation.** In landscapes fragmented by urbanization and agriculture, roadsides are an increasingly important component of regional habitat networks and connectivity. They can support native vegetation, create important habitat for wildlife, and may support the pollination needs of neighbouring farms.

This habitat restoration, management, and enhancement guide has been developed to provide those responsible for maintaining roads 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 resource 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 roadsides:

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

Supporting Pollinators

# Why Support Pollinators Along Roadsides?

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 alone are responsible for $897 million of the roughly $6.7 billion in sales for agricultural crops grown 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. In addition to the food we eat, pollinators also support healthy ecosystems that improve air quality, stabilize soils, and support other wildlife[3]. Pollinator declines can have large impacts given the critical roles that pollinators 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 productive and resilient.

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

# Understanding the Ecology of Roadsides



The habitat requirement of pollinators is 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. Determining how to create this habitat along the vast networks of roadways is currently an untapped opportunity in pollinator conservation and involves participation and action at numerous levels. In Ontario there are over 270,000 km of roadways organized into various classifications, which traverse the province and provide access to rural and urban population centers. Road classifications vary regionally, but are broadly characterized into three classifications:

1. Primary/Freeway: Large freeways such as the 400 series highways
2. Secondary/Rural: Arterial roads that connect regions together
3. Tertiary/Local: Roads which serve primarily to provide access to properties

Roadways come in many forms, ranging from dirt roads, paved city streets, to provincial highways. Each of these road types have both negative and positive impact on landscapes, wildlife, and people. Roads are known to fragment natural, urban, and agricultural landscapes into ever-smaller areas and irregular polygons, often referred to as habitat islands[4,5]. Dividing landscapes into smaller parcels has consequences on the plants and animals of those regions and neighboring areas. Fewer species can live and reproduce on smaller habitat islands[6]. Increased distances between critical habitats can isolate populations, or prevent species from moving naturally through a landscape. For bees, their daily foraging distances are limited whereby small bees generally travel 200 metres or less to find food and large bodied bees (such as bumble bees) travel up to 500 metres. If abundant quality habitat is not located within this distance, bees aren't able to sustain themselves or their young, resulting in population declines.

Conversely, roadways can function as natural conduits both facilitating and causing the long-distance dispersal and establishment of plants and animals[7] creating long, interconnected tracts of habitat that pollinators inhabit. In some cases this can mean the spread of weeds and invasive species. Weedy and invasive plants have unique interactions with pollinators as they can provide food and resources. Pollinators can favour weeds and in some cases they can assist in their proliferation, making weed management more challenging.

Roadways are managed with chemical and mechanical disturbances that have the potential to cause negative impacts on pollinators. In winter, roads are salted or sometimes treated with sand. This can also impact the characteristics of the adjacent habitat, especially after spring rains wash salt onto roadsides. The specifics of pollinator interactions with roadway pollution, salt, and run-off are not well known.

Plant growth along roadsides during the growing season is often exuberant, resulting in thick and tall vegetation due to increased concentrations of water that results from runoff. Pollinating insects such as butterflies, moths, beetles, wasps, ants, and bees visit roadside flowers frequently. Beekeepers have utilized flowering roadsides as transient bee pastures to capture honey flows in many areas. Roadways could also possibly create new areas, strips or patches of open compacted, silty ground and may enhance nesting of certain native ground-nesting bees. While habitat fragmentation is a concern caused by roadways, the habitat created along roadways and their associated verges can in some circumstances, play significant roles in habitat connectivity, perhaps compensating for some of the negative impacts.

# Restore, Maintain, Enhance

There are many ways to approach developing pollinator habitat along roadsides. The key aspects of creating roadside habitat is that pollinators have access to flowers throughout the growing season, can find nesting sites and that the landscape is linked together so that pollinators can move throughout it.

The budget, size of the project area, and timeline all factor into how your project will progress and take shape. The steps provided in this manual are for your convenience and reference and refer to large scale projects such as the maintenance of roadsides on a major highway right down to creating pollinator patches on a boulevard adjacent to a residential street. Use the information that is applicable to your specific project.

Photo: Danelle Hevron Studio

The options that are available for a land manager fall within three categories: actions that will restore, maintain or enhance the pollinator habitat at the site. All managers of roadsides 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 pre-construction conditions and manage weedy and invasive species. Any areas adjacent to the roadside that receive 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. Consider modification to standard activities such as: reducing or timing mowing; avoiding and limiting the use of herbicide in key areas beside pollinator habitat; leaving old branches and woody shrubs with pithy stems for nesting; allowing trees and other woody vegetation to grow further from the roadway in areas where they are not an impediment to visibility or the clear zone.

3. **Enhance** habitats using methods that promote pollinator richness and diversity. Consider enhancing a roadside through activities such as: increasing the diversity of native flowering plants, forbs, and shrubs to offer blooms all season; providing nesting spaces in logs, nest block or bee hotels or by planting milkweed. Sometimes a roadside land manager is dealing with a relatively small area such as a boulevard, interchanges, or roundabout. These are perfect places to create Pollinator Patches. Boulevards are excellent roadside habitats to plant flowers for pollinators.

# Managing Roadsides to Promote Pollinators

Roads require continuous management for accessibility, visibility, and user safety. This can result in the maintenance of an early successionary stage habitat that can have positive impacts for pollinators. The approaches and techniques used to create and maintain a safe roadway or to ensure that weeds and other invasive species do not persist include actions such as mowing, burning, grazing, herbicide and pesticide use.

Roadsides that are managed and restored to mimic natural prairie grasslands have increased richness and diversity and are used by more pollinators. In some cases, roadsides are actively seeded with wildflower seeds as part of highway or municipal beautification projects. In other cases, road building requires the stabilization and restoration of landscapes that are seeded with plant mixes. Both of these cases provide opportunities to enhance the diversity of local native flowering plants, which has been shown to increase pollinator occurrence. The pollinator support capacity of roadsides can be enhanced significantly with native plant seeding.

Managing roadsides for pollinators is easier when you follow tried and tested Best Management Practices (BMPs). The following BMPs have proven to be beneficial to many projects, however like any land management initiative; use what is applicable to your site and disregard what is not helpful.

## *Integrated Vegetation Management*

Integrated Vegetation Management (IVM) is a systematic integrated approach to managing vegetation. It applies the right intervention method at the right place and the right time to control vegetation. IVM makes use of manual, cultural, mechanical, and chemical methods to target undesirable species in the landscape while minimizing environmental impacts and risks.

### CASE STUDIES

While roadside management differs from area to area, the primary goals are: motorist safety, noxious weed prevention, and soil stabilization. These examples from Ontario, Canada, and other parts of North America shows various creative approaches to pollinator support around transportation infrastructure. There is evidence that adding pollinator habitat actually adds value to roadsides beyond maintenance cost savings. Healthy, functional ecosystems provide ecosystem service benefits which are explored in the following studies.

Photo: Diane Porter

Managing Roadsides

## *Mowing*

There are several BMPs that can be applied to mowing regimes to reduce the amount of insect mortality. Not only can pollinators be harmed by mower blades, but they are also adversely impacted when large swaths of habitat are removed. Manage mowing activities to reduce impacts on pollinators.

- Restrict mowing activities to the immediate roadside edge. Maintain the clear zone for safety and visibly, retain the remainder of the roadside for pollinators.
- Consider annual or bi-annual mowing regimes. Ideally mow in the late fall when the pollinator habitat has finished blooming.
- Schedule mowing around pollinator activity. Certain times of the year are more active than others. 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.
- Mow at a slower speed and during the day when pollinators and other wildlife are active, and have a better chance to escape.
- Set mower at 5 cm to encourage perennial flowers to make good root development. It is important to mow meadow plantings in the first year after sowing,

### CASE STUDY 1

**Creating a Prairie on a Parkway**

Tallgrass prairie is one of the most unique, diverse, and productive ecosystem types in Ontario. Characterized by 1-2 metre tall grasses and wildflowers tallgrass prairies are teaming with wildlife. Many species of pollinators, including those that are threatened or at risk, are found in this habitat visiting flowering species including Showy Tick Trefoil (*Desmodium canadense*), Black-eyed Susan (*Rudbeckia hirta*), and Common Evening Primrose (*Oenothera biennis*). Although it once covered most of southeastern Ontario, today only isolated fragments remain. In addition to landuse change, succession and the spread of invasive species threaten these ecosystems. Recently, Ministry of Transportation lands along the Rt. Hon. Herb Grey Parkway in Windsor have been restored to tallgrass prairie and Oak Savannah using techniques that mimic the natural ecological processes in these landscapes. A vigorous program of brush cutting, herbicide application, and prescribed burns are being used to keep the landscape. Prescribed burns are the most effective method to control invasive species in a tallgrass prairie as they mimic the natural disturbance prairies depend on. Twenty hectares of prairie have been burned since the spring of 2012. The total area includes 120 hectares of green space associated with the Parkway and 74 hectares are constructed ecological landscapes nearby.

Visit www.hgparkway.ca/sustainability to find out more about the project.

## *Herbicide Use and Weed Management Along Roadsides*

Direct impacts of herbicides on local pollinator communities generally comes from a reduction in their food supply. 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 after pollinator forage plants have bloomed.
- Avoid creating pollinator food deserts. If possible, treat the managed landscape in thirds.
- Minimize drift and broadcast spraying. Use a back-pack or belt applicator when possible. This will avoid over spraying or killing desired flowering plants.
- 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.
- Do not spray when wind is blowing toward known pollinator habitats or areas where hives are placed.
- When doing hand removal of persistent multi-stemmed woody plants, consider carrying a spray bottle of herbicide on your belt and directly spray the cuts as you work through the site. This will avoid over spraying or killing desired plants, and spraying the cuts immediately will prevent the cut from healing over and allowing the undesired plant to persist and thrive.

## *Insecticide Applications*

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

- Use an Integrated Pest Management (IPM) approach to address potential pest issues.
- Carefully diagnose your pest problem through monitoring, and, before you apply an insecticide, make sure the pest population has reached a level where chemical control is necessary.
- Complete insecticide application before pollinator foraging plants bloom. Most pollinator poisoning occurs when bee-toxic insecticides are applied to crops during the bloom period. This is the time when pollinators are most likely to be attracted to the crop while actively searching for pollen and nectar.
- Time applications to take place when foraging pollinators are least active. This is commonly before 9am and after 3pm.
- Minimize insecticide drift and avoid broadcast spraying, instead opt for very targeted spray techniques. Use a back-pack applicator if possible.
- Plan buffer zones around known pollinator habitat to create an area to intercept possible drift from insecticide sprayed sites.
- 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.
- Do not spray when wind is blowing toward known pollinator habitats or areas where hives are placed.
- Always shut off the sprayer when making turns at field ends, near gardens, ponds, or other sources of water that may be used by pollinators.

## *Beautification and Restoration*

The removal of invasive plant material is more often than not one of the first actions needed in developing pollinator habitat. Pollinator-friendly 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.
- Schedule and plan removal activities to reduce the spread of the invasive plants.
- Clean machinery, boots, and other tools used on-site to reduce the spread of invasive plant's seeds and other reproductive parts.
- Install desired plan material as quickly as possible after the invasive plant material removal.
- Monitor the site frequently and have a plan in place for additional removal as needed.

Photo: Steve Fletcher

## *Plant Selection*

- Pollinators depend on nectar and pollen for nutrients and energy. Flowering plants provide pollen and nectar resources; it is important that bloom periods coincide with pollinator emergence and activity to sustain both plant and pollinator populations.
- Provide continuous nectar and pollen sources from early spring through fall with native plants.
- Include larval host plants for butterflies into seeding and planting mixes (i.e., milkweed).
- In restoration planting projects,cluster plants together. This makes for more efficient foraging by pollinators.
- Maintain seed sources of locally adapted native plant species important to pollinators.
- Do not include non-native grasses in seed mixes.
- Decide whether seeds, plugs, potted plants, or a combination of plant sources will be used.

### Road Salt and Plants

The local native plants that support pollinators in Ontario's landscapes are generally not tolerant of salt. Efforts to seed or plant native pollinator plants near roadsides should focus on areas that are away from or upslope of zones of salt accumulation. Consider the hydrology of the region and make sure run-off will not carry salt into areas of pollinator planting or seeding projects.

# Are Roads Barriers?

## *Mortality along roadsides, as cause for concern?*

Accounts of the potentially negative impacts of roadsides, focus on pollinator mortality. However, most studies show that while mortality does occur it is not a significant factor in overall pollinator mortality. Some pollinators, including bees, are indeed killed by traffic,[8] but the positive benefits of creating roadside habitat outweigh the loses. A study in Iowa examined butterfly mortality trends associated with roadsides that were restored to prairie habitat and compared it to mortality on roadsides with non-native grasses. They found that butterfly mortality was highest in non-native grassy areas and lowest in prairie habitat, even though there were significantly more butterflies using prairie habitat[9]. Roadsides planted or restored to support pollinators have not shown to be pollinator sinks. Instead, pollinators tend to stay in the highly rich floral landscape, and are less inclined to search for food elsewhere.

## *Are roads barriers to pollinator movement?*

There is conflicting evidence regarding the movement of pollinators across roads. Roads were not found to be barriers to the movement of butterflies, nor were populations of butterflies separated by even busy roadways genetically isolated from each other, again indicating fluid species movement[10]. There are contrasting findings regarding whether bees do or do not cross roads: one study found that bees do not cross roads in suburban landscapes[11]; whereas another study observed bumble bees crossing roads when foraging along roadsides[12]. While pollinators likely can cross roadways, questions exist as to whether they do so easily, often, and safely.

Photo: Diane Porter

## CASE STUDY 2

### Milkweeds Along Roadsides: Reconnecting Monarch Corridors

Common milkweed (*Asclepias syriaca*) has traditionally been viewed as a noxious weed in Ontario. Because milkweed is poisonous to grazing livestock, it was on the list of noxious plants in the Ontario's Weed Control Act, administered by the Ministry of Agriculture and Food. The Ontario government delisted it as a noxious weed in May 2014, recognizing that milkweed provides an important habitat and a larval food source for the monarch butterfly. Milkweed can be planted along roadsides to create corridors that support monarch populations.

At the Tallgrass Prairie Center associated with the University of Northern Iowa, the staff propagated milkweeds and collected nine pounds of seed from them in 2013 for out planting along Iowa highway roadsides. The Center provides seed, technical assistance, training and education to county and state department of transportation staff. Since 1998, 78 counties in Iowa and adjacent states have received Transportation Enhancement seed that has helped restore 10,000 acres of roadside to natural vegetation, which includes milkweeds in many places. This model state program has fostered the kind of collaborations to implement tangible solutions on the ground.

See more at: www.makewayformonarchs.org

In Ontario the Monarch Manifesto is part of a growing movement to bring back monarch butterflies and help other important pollinators, like honeybees and wild bees. If all goes well, we'll see thousands of participants, hundreds of new butterfly gardens and more local milkweed sources. The campaign complements a research project the David Suzuki Foundation and University of Guelph researchers have launched to determine best practices for cultivating milkweed and encouraging monarch populations along rail and hydro lines, roadways and trails.

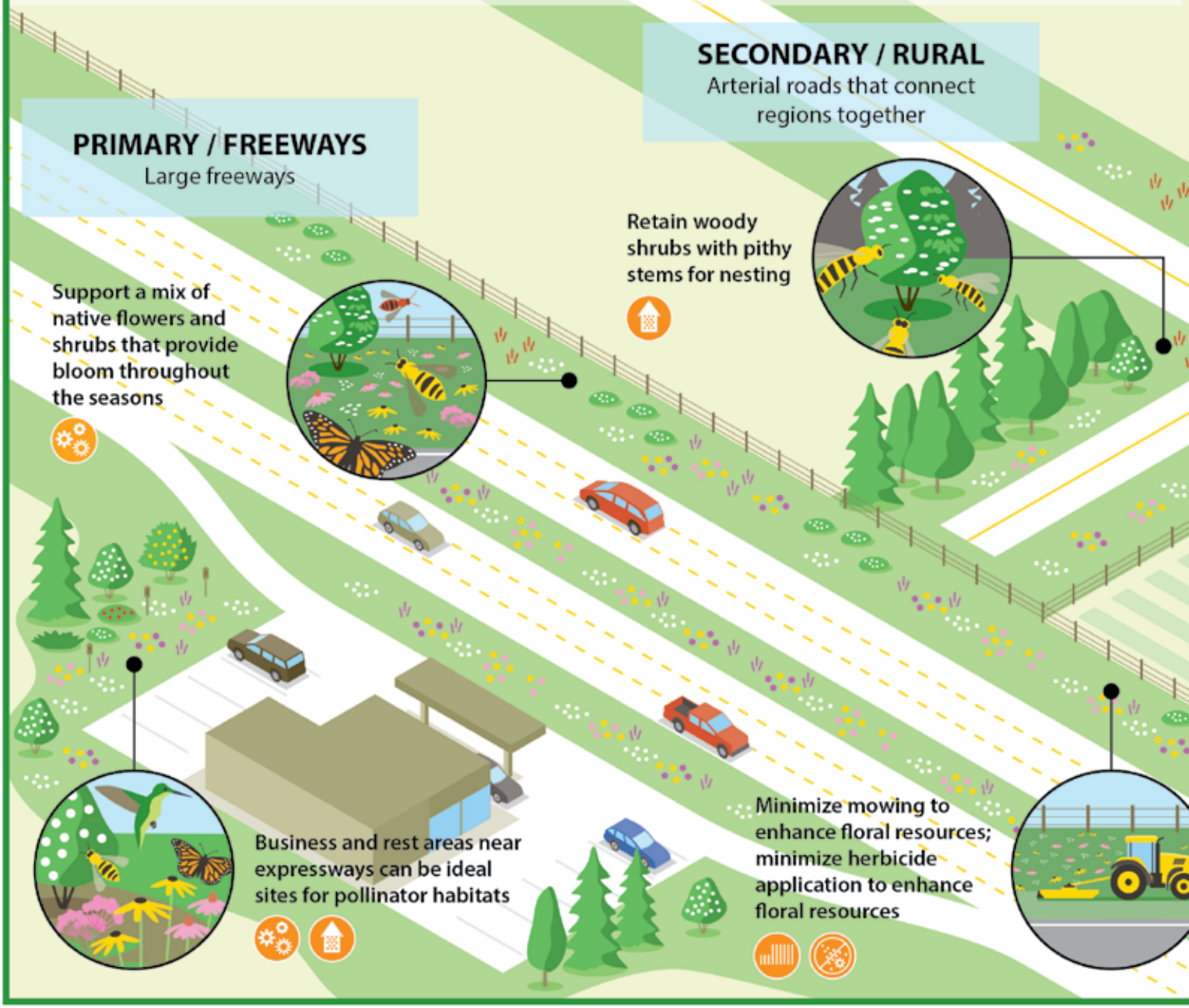
Photo: Danelle Hevron Studio

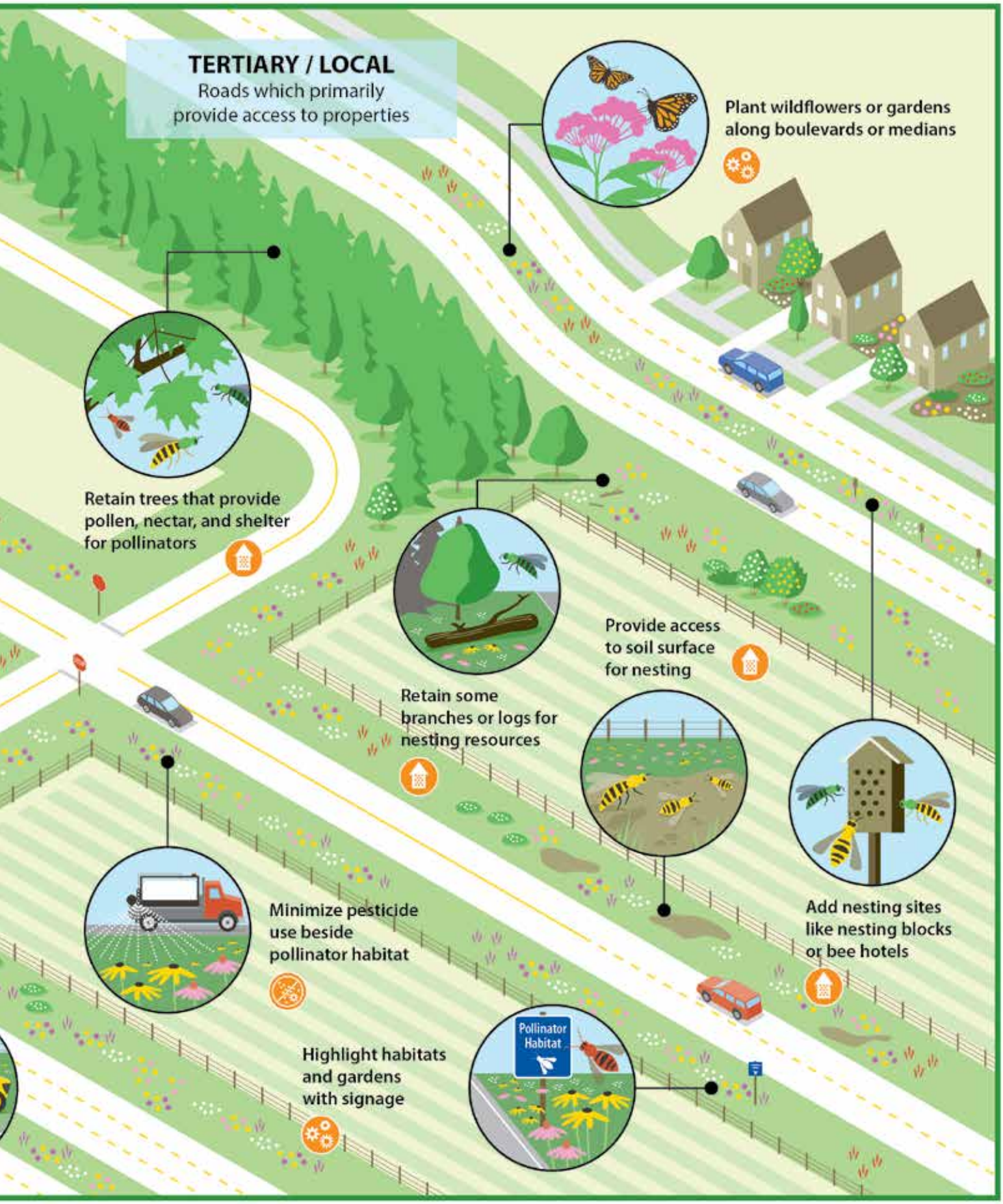
# Roadside Enhancements for Pollinator Habitat

There is a global decline in the health of pollinators that threatens natural ecosystem integrity and agricultural productivity. With over 270,000 km of roads in Ontario, roadsides are a significant resource for pollinator conservation. Here are the key actions that roadside managers can take to maintain, restore, and enhance pollinator habitat:

- Increase flower diversity
- Provide nest sites
- Reduce impact of mowing
- Avoid herbicides and insecticides

Use an Integrated Vegetation Management (IVM) approach to treat landscapes. Consider incorporating strategies that are most appropriate and beneficial to pollinators based on opportunities and risks associated with each operation or context.




TERTIARY / LOCAL
Roads which primarily provide access to properties
Plant wildflowers or gardens along boulevards or medians
Retain trees that provide pollen, nectar, and shelter for pollinators
Retain some branches or logs for nesting resources
Provide access to soil surface for nesting
Add nesting sites like nesting blocks or bee hotels
Minimize pesticide use beside pollinator habitat
Highlight habitats and gardens with signage
Pollinator Habitat

## 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 roadsides.
- 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.

### CASE STUDY 3

**Empowering Citizens: One Pollinator Patch at a Time**

Roadsides is a project started in Barrie, Ontario, with the aim to help provide habitat for native pollinators and restore the natural biodiversity to the land one patch at a time. The program provides information, connection and inspiration for citizens to create habitat for native bees and other pollinators along roadsides, on boulevards, on unused urban land. The little habitats created by volunteers are called Pollinator Patches. By planting small Pollinator Patches along roads and in unused land, citizens provide spaces for native pollinators to live and breed. Roadsides provides citizens with information about how to plan the areas. The planting areas range from very small areas that have stemmed from seed balls to larger planted habitats. Seed balls are little clay balls impregnated with compost and wild flower seeds. The idea behind the seed ball is that it contains all that is needed for germination and first growth. The seed ball can be placed or thrown wherever we want native plants to grow. The vision is to plant hundreds and even thousands of patches across our province to create interconnected corridors and high impact. The initiative advocates both small and large actions.

http://roadsides.caroldunk.com/about.html

Photo: Derrick Ditchburn



## Education, Outreach, and Certification

Your newly created roadside 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 your 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. 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 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 partnering with a local citizen science program or a regional monitoring program such 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 roadside 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 roadside 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 Carolinain 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 ranging 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, 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. 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.

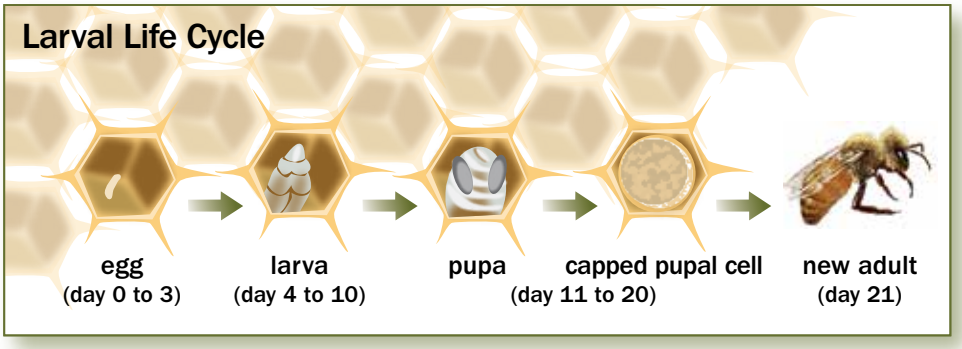
Photo: Leif Richardson

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.).

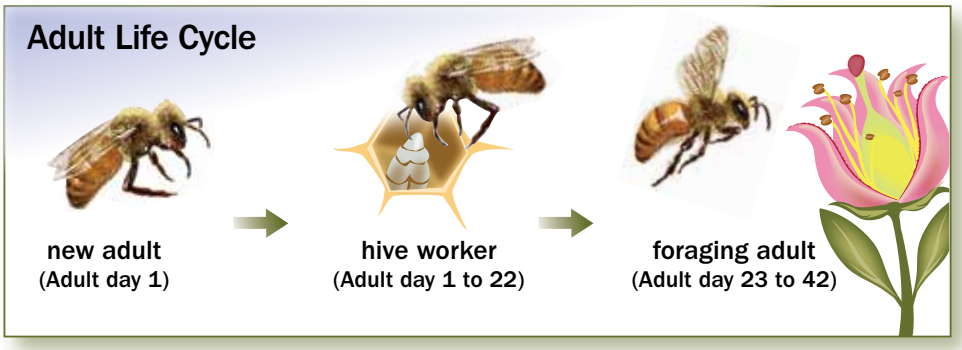
## Wild bee life cycle

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 two 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 in the late 1700s. 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.

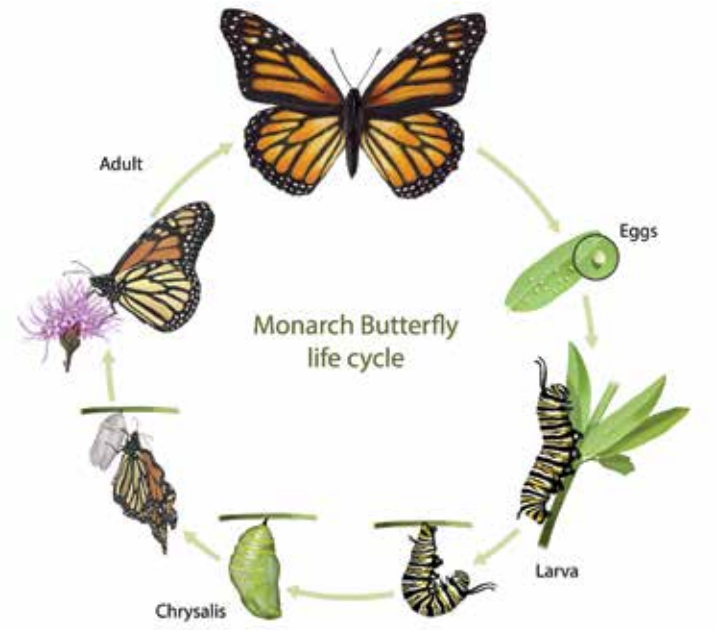
## Summer

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. Most beekeepers manage bee colonies to avoid swarming.

## Fall

By the fall, most 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

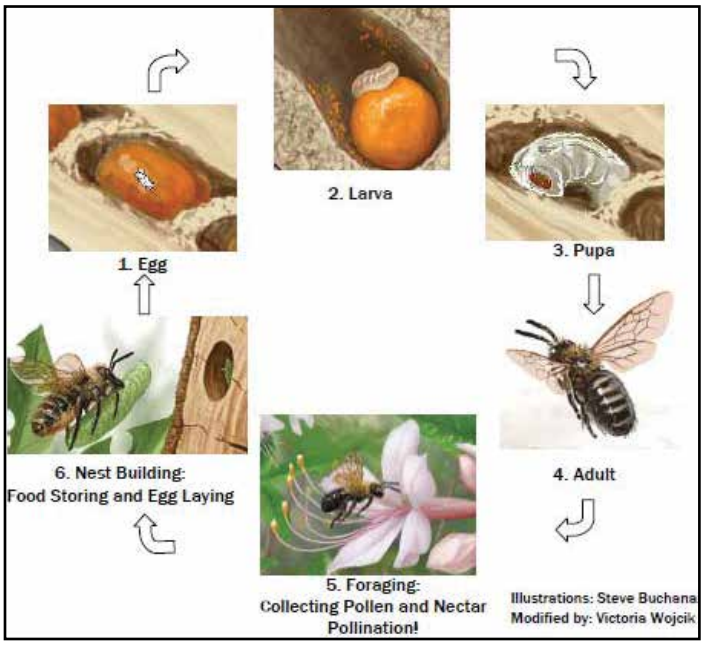
Young butterflies and moth (caterpillars) have very different habitat needs than adults. Moth and butterfly eggs are laid on leaves of host


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 southern 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.

## Species at Risk

Species at Risk (SAR) are plants and animals 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. 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 Hewson 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* | red columbine | X | X | X | X | X | 0.5-1m | April - July | partial shade to sun | moist, well drained | hummingbirds, bees, moths |
| *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 |
| *Asclepias syriaca* | common milkweed | 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 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 |
| *Eutrochium maculatum* | spotted Joe Pye weed | X | X | X | X | X | 1-2m | July-September | sun to partial shade | wet to moist | bees, butterflies |
| *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 |

# Planting List

| Botanical Name | Common Name | Ecoregion | | | | | Height | Flower Season | Sun | Soil Moisture | Pollinators |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MLS | ALN | LEL | SLL | FA | | | | | |
| *Heliopsis helianthoides* | false sunflower | X | | | | | 1m | July - October | sun | dry to moderately moist | bees, butterflies |
| *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 |
| *Physostegia 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* | tall 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 |

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|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MLS | ALN | LEL | SLL | FA | | | | | |
| *Symphyotrichum lanceolatum* | lance-leaved aster | | X | X | X | X | up to 1m | September-October | sun | moist to wet | butterflies |
| *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 Android, 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 N0E 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

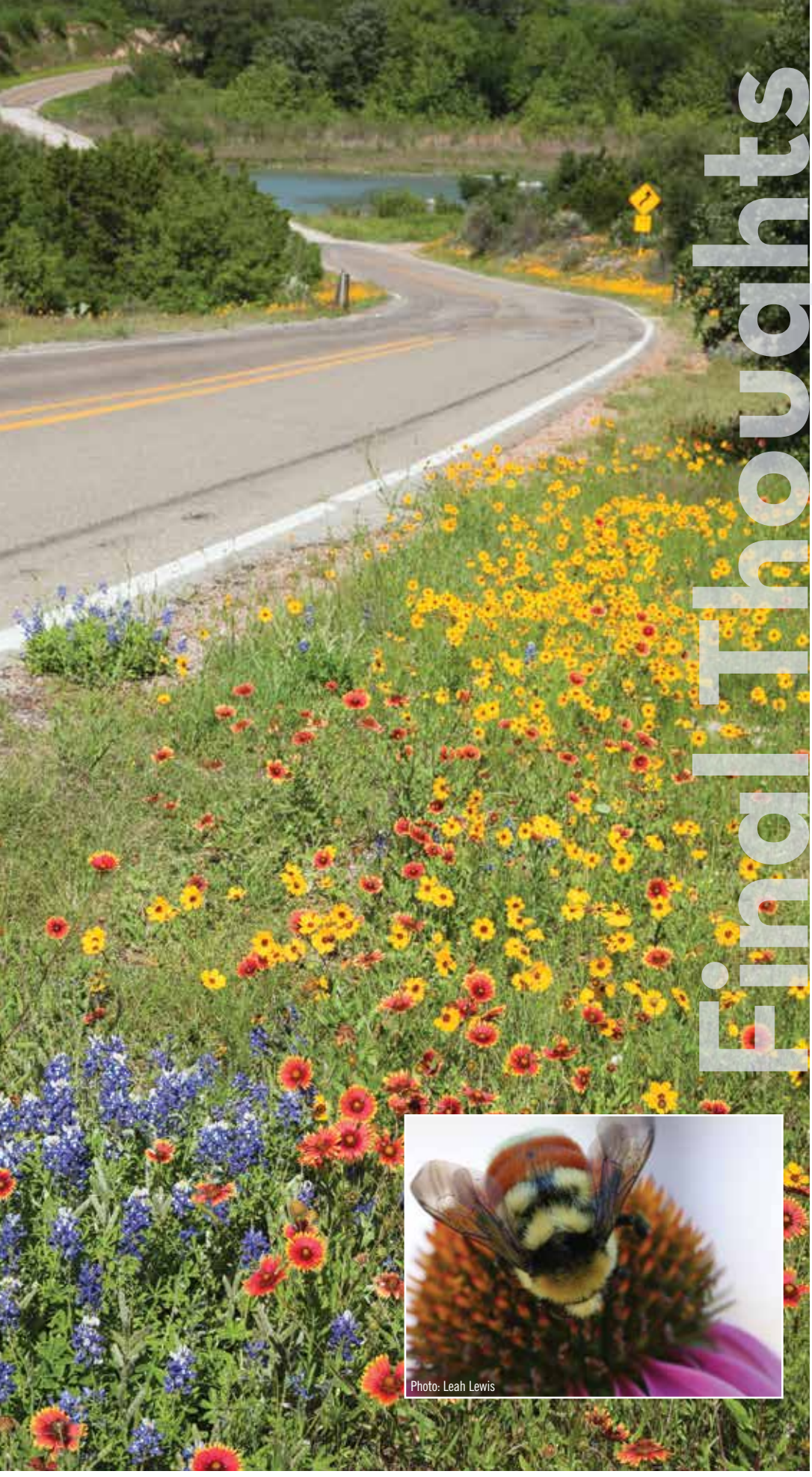


Photo: Leah Lewis

## 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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