



# MONARCH WINGS ACROSS OHIO

## Guide to *Monarch Habitat* on **FARMS**



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## Introduction

Monarchs used to number in the billions, but over the course of the last 20 years, their populations have decreased by nearly 90%. This is largely due to habitat loss, and a loss of milkweed, the host plant for their larva. To help monarchs recover, millions of native plants, especially milkweed, will need to be planted. With generous support from The Kelvin and Eleanor Smith Foundation and The J.M. Smucker Company, the Pollinator Partnership (P2) joined with a number of Northeast Ohio institutions to form Monarch Wings Across Ohio (MWAO). The goal of this exciting project was to find out how best to create new habitat for this iconic but imperiled butterfly.

Through the leadership of MWAO's partner organizations, monarch habitat research plots were installed on 18 sites in four different types of land: farm, gardens, rights-of-way, and corporate. Over the course of three years, P2 scientists observed and analyzed how monarchs used these sites to gain an understanding of how best to create much needed new habitat on these land types. The guide you are reading is the culmination of these efforts. In it you will find strategies that will help transform marginal areas on your farm into monarch habitat, while achieving other stewardship goals like preventing nutrient runoff and reducing the use of pesticides.

Unlike many of the environmental issues we are faced with on a daily basis, you can have a direct, positive impact on monarchs by creating habitat. You will know you are successful once you start seeing the caterpillars eating the milkweed leaves and the adult butterflies feeding on nectar from the wildflowers. Not only will you have helped the monarchs, you will have helped bees, birds, and other Ohio wildlife.

### *Benefits of Managing for Monarchs*

Fostering monarch habitat on a farm can be as simple as mowing less, which saves you time and money. Similarly, using integrated pest management (IPM) to reduce the use of pesticides can also lower operational costs and increase the health of your crops. In addition to these financial benefits, the promotion of native flowers and grasses improves water filtration, prevents erosion, and reduces pollution runoff into waterways. Monarch habitat also sustains populations of beneficial insects that prey on crop pests, which helps sustain a healthy crop. For farms that grow pollinator dependent crops like apples and squash, monarch habitat also sustains wild bee pollinators, whose free ecological services increase crop yield. The benefits to farmers of helping monarchs go beyond the farm gate; by doing your part for this iconic butterfly, you are showing your community how agriculture can be part of the solution. This is a win-win-win proposition!



Photo: Amber Barnes

## Monarch Habitat

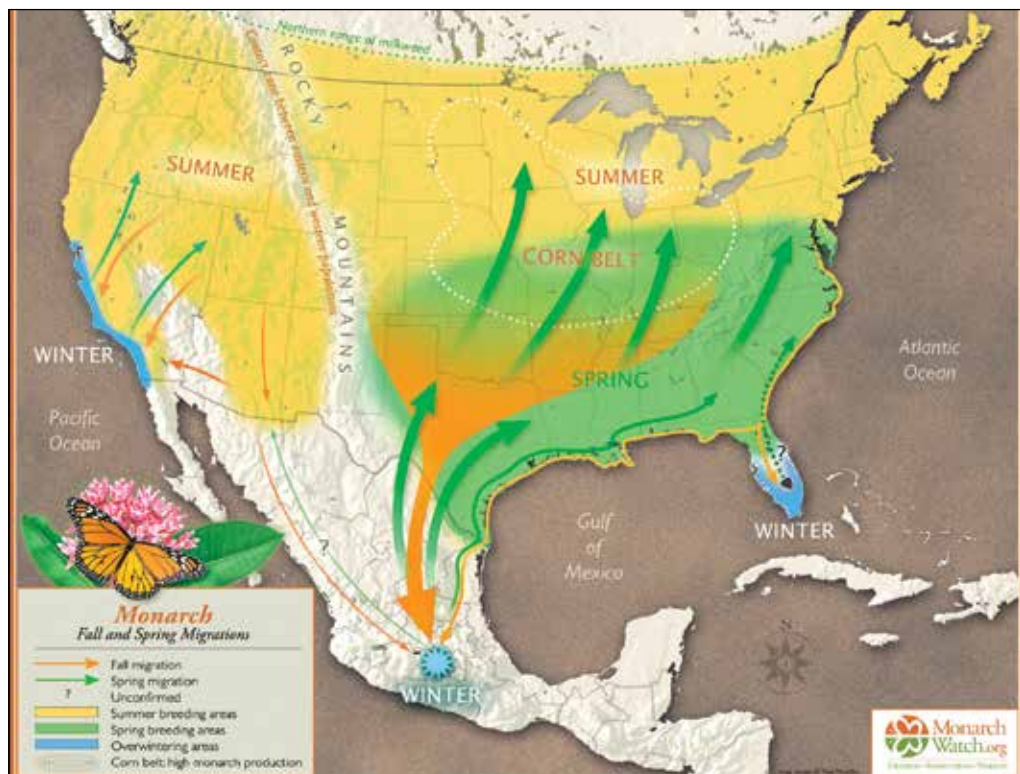
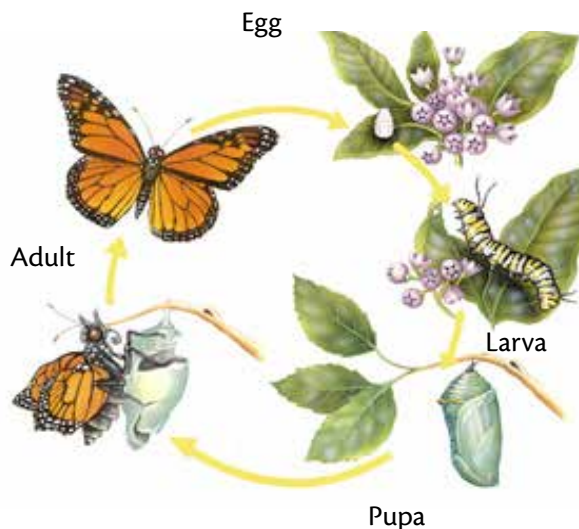
Monarchs have a few basic habitat requirements: milkweed leaves for caterpillars, and nectar and water for butterflies. Monarch habitat on agricultural lands can take many forms; it can be a designed garden with native perennials, a naturalized meadow that includes native grasses and flowers, or it can be included in a number of working lands conservation practices such as buffer strips, filter strips, and riparian vegetation cover. Whether garden, meadow, or conservation area, providing milkweed is essential, since it is the only food monarch caterpillars can eat. Once the caterpillars have become butterflies, they need the nectar of many different wildflowers, blooming during the spring, summer, and fall, to fuel their spectacular migration across the North American continent.

## Monarch Life Cycle

A monarch egg is laid on a milkweed leaf and the egg hatches into a caterpillar within 3 to 6 days. The caterpillar feeds and grows, eating only milkweed leaves over a 2-week period. Once fully grown, the caterpillar forms a chrysalis and, after about 10 days, emerges as an adult and begins feeding on nectar.

## Monarch Migration

The monarch is probably the most recognizable butterfly in the United States, yet this beautiful creature is experiencing a massive decline.



The number of monarchs making the annual migration has plummeted; in the 1990s, close to 700 million monarchs made the journey each fall, now this population has experienced a decline of nearly 90%. This alarming decline is due in large part to the loss of milkweed, on which monarchs lay their eggs, and other native plants that provide nectar to fuel their migration. According to Monarch Watch (<https://www.monarchwatch.org/>), approximately 2.2 million acres of milkweed habitat is lost each year in the United States due to land conversion and agricultural pesticide use.

There are two populations of monarchs, one that migrates east of the Rocky Mountains, and the other that migrates west of the Rockies. This guide will focus on the eastern monarch population, which includes the monarchs we see in Ohio. The eastern monarch migration starts in March as the butterflies overwintering in Mexico start traveling north. Two, three, and sometimes even four generations are produced as they move from Texas into southern Canada. It is the great grandchildren, or great-great grandchildren of the overwintering monarchs that we see in Ohio.

In mid-August, the last generation of the year begins migrating south on an epic journey of over 3,000 miles to central Mexico, thus beginning the migratory generation. Summer generations typically live for two to six weeks as adults; however, adults in the migratory generation can live for up to nine months! Butterflies from Canada will migrate over Lake Erie and into Ohio. As monarchs from the eastern U.S. and southern Canada migrate toward Mexico, they need areas of refuge (high quality nectar sources and shelter from harsh weather) along the way, making Ohio an essential part of the monarch migration.

# Creating Monarch Habitat on Farms

Though there are challenges to monarch conservation on farms, there are also opportunities. Ideally, actions you take to benefit monarchs will also have positive business, production, and stewardship implications.

Two of the main cash crops in Ohio, corn and wheat, do not directly benefit from pollinators; however, soy, tomato, cucurbit crops, and orchard fruit have seen yield benefits from wild pollinator visits from field edges. Whether your farm directly benefits from pollinators or not, the actions you take to support monarchs can provide multiple advantages.

- Creating and protecting quality habitat also benefits wild bees and other pollinators which can ensure, and even increase, your crop yield and quality.
- Monarch habitat can be combined with other Best Management Practices (BMPs). By including flowering plants in projects for erosion control, nutrient loss mitigation, and water quality support, you can get more than one benefit with a single action. Pursuing monarch conservation through these practices can grant you access to financial assistance and technical expertise.
- Even if your crops don't need insect pollination, they may be contributing to the pollinator habitat on your farm.
- Monarch habitat can play an important role in pest reduction by hosting beneficial insects that prey on insect crop pests. This may result in reduced costs for insecticides.
- Enhancing monarch habitat on your farm can help you 'brand' your business and demonstrate your stewardship values to your business partners and clients, as well as to the general public:
  - Increasingly, consumers are influenced by environmental branding in the food purchasing choices they make;
  - You can certify your farm as 'bee-friendly', giving you access to a logo that can be used on your website and on signage (Refer to page 22).
- Monarch habitat also makes your farm more attractive and increases the quality of life for your family.



Photo: Brooks Bolyard

# Three Strategies for Monarch Conservation on Farms

*Monarchs need:*

- **Milkweed to lay their eggs on**
- **Wildflowers for nectar to feed on**
- **Protection from pesticides**

Fortunately, three relatively simple strategies can result in substantial positive impacts on monarchs and other pollinators. The first, and easiest, strategy proposed in this guide fits almost any farm. It involves keeping the sources of food and shelter for pollinators that you already have on the farm. The other two strategies, enhancing monarch habitat, and maintaining habitats using methods that minimize disturbance and harm to monarchs, including reducing pesticide exposure, can be more involved. For farmers who want to take these extra steps, there are government-funded stewardship programs and other organizations that can provide cost-share funding and technical support. Farmers seeking to enhance crop pollination by native bees utilizing the monarch habitat can see a return on their investment within four to five years.



*To help monarchs on your farm, follow these three strategies:*

- 1. PRESERVE EXISTING NATURAL HABITAT**
- 2. ENHANCE HABITAT, ESPECIALLY IN COMBINATION WITH OTHER BEST MANAGEMENT PRACTICES**
- 3. MAINTAIN HABITAT USING METHODS THAT MINIMIZE DISTURBANCE AND HARM TO MONARCHS, INCLUDING REDUCING PESTICIDE USE**

Photo: Amber Barnes

# 1 STRATEGY 1: PRESERVE EXISTING NATURAL HABITAT

One of the best things you can do for monarchs is to keep the habitat that is already on your farm. These are the semi-natural and natural areas on the farm and in the broader landscape. Conservation areas, wetlands, and woodlots are examples of natural areas; fence lines, riparian buffers, pastures, and roadsides are considered semi-natural because they are often mowed or sprayed and contain mixes of native and non-native vegetation.

Although monarchs are not the most effective pollinators, semi-natural and natural areas on your farm can also attract wild bees and other efficient pollinators. Several studies indicate that farms in landscapes with at least 23% of these types of cover can meet their crop pollination requirements from wild pollinators. Removing a feature like a perimeter hedgerow on a 100 acre farm represents the loss of an asset worth approximately \$12,000 (which is only the cost of re-establishment and does not take into account the financial benefits it provides to crops or cattle). Keeping these kinds of features on your farm is a simple action that can benefit you and monarchs.

While it may seem as if managing semi-natural and natural areas on your farm for monarchs and beneficial insects may distract the more efficient pollinators from visiting your crops while in flower, this habitat can actually result in increased crop pollination over time. When more forage is available for bees to utilize, this can result in greater reproduction. The outcome of which can be more offspring visiting the farm the next year.

## A Note on Milkweed & Farms

Many farmers have unhappy memories of pulling up persistent milkweed plants by hand, or of finding some particularly stubborn ones popping up above their crop, come the fall. The introduction of glyphosate and glyphosate-resistant crops in the mid 1990s was a significant advancement in weed management. Yet, it is this very same agricultural innovation that has spelled trouble for monarchs, as their only larval host—milkweed—has disappeared from the landscape. Fortunately, farmers can help monarchs without having to tolerate weedy crop fields. As it turns out, female monarchs prefer small patches of milkweed on farmland, as compared to roadsides and parks. Farmers can allow milkweed on their marginal lands, like in ditches, fencerows and riparian buffers. This provides important habitat for monarchs and other wildlife without compromising production. Agrochemical companies have also embraced this approach and are helping farmers to plant milkweed and other native flowers and grasses for monarchs on their marginal lands.

## Key Tips for Preserving Existing Natural Habitat on Your Farm:

- Keep farm features like hedgerows, ponds, windbreaks, riparian buffers, grassy areas, and woodlots.
- Limit mowing of ditches, roadsides, and grassy areas to once a year or less to provide nesting habitat for bees and places for butterflies to lay their eggs and forage.
- If there is concern about seeds from the monarch habitat spreading to your fields, wait to mow until late fall; or, after plants have bloomed, but before they go to seed. This helps provide valuable food sources for adult monarchs and their larvae, while preventing undesired plants from spreading to your fields.
- If seed dispersal isn't a worry, consider a spring mowing before May 1 for northern Ohio and April 1 for southern Ohio.
- Avoid mowing the entire habitat at once. Consider leaving a refuge area for wildlife using the site at the time of mowing.
- Tolerate non-invasive native plants on marginal land or field edges and corners.
- Keep dead trees, downed logs, and shrub and flower stems for cavity-nesting bees and overwintering butterfly chrysalides wherever it is practical to do so.
- Leave patches of bare, undisturbed soil for ground-nesting bees.



Photo: Amber Barnes



## 2 STRATEGY 2: ENHANCE HABITAT

Whether your goal is to ensure crop pollination or simply increase the stewardship value of your land, enhancing habitat for monarchs and other wildlife is simple: Provide sources of food and shelter in the form of native grasses, wildflowers, trees, and shrubs, and protect these sites from pesticides. Habitat enhancement involves costs both in land and in plant material. To minimize expense and effort, combine monarch habitat with other farm stewardship projects. For example, include native flowering shrubs and flowers in a riparian buffer. Not only will the buffer help cut sediment runoff, but the long root systems of native flowers and grasses will also take up excess nutrients while providing food and shelter to pollinators.

Choose a mix of plants that provide a variety of benefits to the system you are creating. Remember to include at least three flowering species for each season (spring, summer, and fall), resulting in overlapping bloom periods, while also providing a variety of shapes and colors. Make sure to include a few different species of native milkweeds in your planting as well! We field-tested four varieties, but there are 13 species native to Ohio from which to choose, though some are more readily available for purchase than others. These species will thrive in different conditions, so make sure to choose the right plant for your farm's conditions. Refer to the Ohio Monarch Habitat Planting list for planting recommendations and suggestions (p. 28).

Once established, this native vegetation can displace many of the sources of undesirable weed seeds that were once growing in that location. Over time, the removal of that weed seed bank will result in a decrease of time, resources, and chemicals used to maintain these areas. Leaving trees and snags along field edges can not only provide valuable habitat for monarchs and tunnel-nesting bees, they can also serve as perches and nesting sites for owls and other raptors. These residents can then help control rodent populations in crop fields.



Photo: Amber Barnes

## Basic Considerations for Monarch Habitat

- ✓ Provide blooms from April to October:
  - Include at least three flowering species per season (spring, summer, and fall).
  - Include or tolerate milkweed in habitat and outside of productive fields.
  - Include clumping native grasses in the flower mix.
  - Choose a variety of flower shapes and colors to attract a diversity of pollinators to your monarch habitat.
- ✓ Include perching, nesting, overwintering, roosting, and chrysalis sites:
  - Leave areas of bare soil and minimize soil disturbances to protect and provide habitat for ground nesting bees.
  - Include hollow twigs and stems; tall and bunching grasses; and fallen logs.
  - Allow or plant other native plants near milkweeds to provide protection and cover for caterpillars that are molting or forming their chrysalis.
  - Incorporate trees into your landscape where possible to provide protected roosting sites for migrating monarchs and tolerate dead trees where they are not a safety hazard.
- ✓ Protect habitat from pesticide exposure:
  - Locate new habitat at least 150m from where pesticides are used or;
  - Use a non-flowering buffer like a windbreak between the habitat and cropped land to keep residues from the habitat.
  - Reduce pesticide use and practice Integrated Pest Management.
  - Be especially mindful of pesticide labels that identify toxicity to bees and butterflies.
  - Avoid tank mixes or mixing products as interaction with inactive ingredients can also have negative impacts.
  - Do not buy plants for your monarch habitat that have been treated with systemic pesticides.
- ✓ For crop pollination, locate habitat within bees' flying range
  - Locate habitat within 820 yards or less of crop field edges to attract larger-bodied species like bumblebees.
  - Note: many solitary bees have flying ranges of less than 380 yds.
- ✓ Avoid disturbing habitat
  - To protect butterflies, bees, and other beneficial insects, do not mow more than 20% of habitat per year, focusing on a different section each year.
  - Mow at a height of 8-12 inches or more, to allow plants to recover more quickly and to provide more cover for wildlife
  - Use a flushing bar and cut at reduced speeds on warm days to allow wildlife to escape the mower.
  - Time mowing to avoid peak insect activity, including times of high monarch reproduction and migration (from May until October for northern Ohio, and from April until October for southern Ohio).

## Monarch Habitat Enhancement Features on the Farm

**Buffers:** are strips of vegetation used along waterways, drainage ditches, around ponds, and along the edges of cropland to mitigate erosion and nutrient loss from cultivated fields.

- Include native and non-native flowering shrubs, trees, broadleaf plants and grasses, depending on the location and long-term goals.
- Establish seedlings or bare root cuttings in spring and seed native perennial forbs in the fall.

**Windbreaks:** are strips of shrubs and trees used on field or property perimeters to reduce wind speed and erosion.

- Include native flowering shrubs and trees.
- Farm business benefits: reduces feed consumption of cattle, increases yield in dry conditions, increases beneficial insects, and reduces mortality in lambs.
- Avoid plants that may be alternative hosts for diseases or pests of your crop.
- Establish seedlings or bare root cuttings in early spring or early fall.
- It takes 5-10 years to maximize the benefit of a hedgerow.

**Cover Crops:** are plantings used within cropland to improve soil health and prevent erosion.

- Include non-native legume, and native grass and broadleaf species (single species or mix).
- Use in no-till, strip-till, or conventional till systems in annual or perennial crops.
- Seed at various times during the season to match fallow periods between crops.
- Learn which cover crops are best in your area by asking other farmers.
- Avoid letting cover crops flower if used in the same field as treated seed because cover crops will take up pesticide which will then be poisonous to foraging butterflies and bees.

**Bee Pastures on Marginal Lands:** are annual or perennial plantings used in parcels of land 0.5 acre or more that are marginal to crop production because of their slope, lack of fertility, stoniness, wetness, fragility, or inaccessibility to large machinery.

- Include a combination of native grasses and flowering plants that do not interfere with surrounding cropland (see p. 28).
- Seed in fall if you are using native species that benefit from cold exposure for germination.

**Wildflower Strips:** are strips of flowering annuals used primarily in and around crop fields to increase pollination of crops.

- Include a combination of native and non-invasive flowering plants that flower when your crop is not in flower (see p. 28).
- Seed in spring if using annuals or seed in fall if you are using native species that benefit from cold exposure for germination.

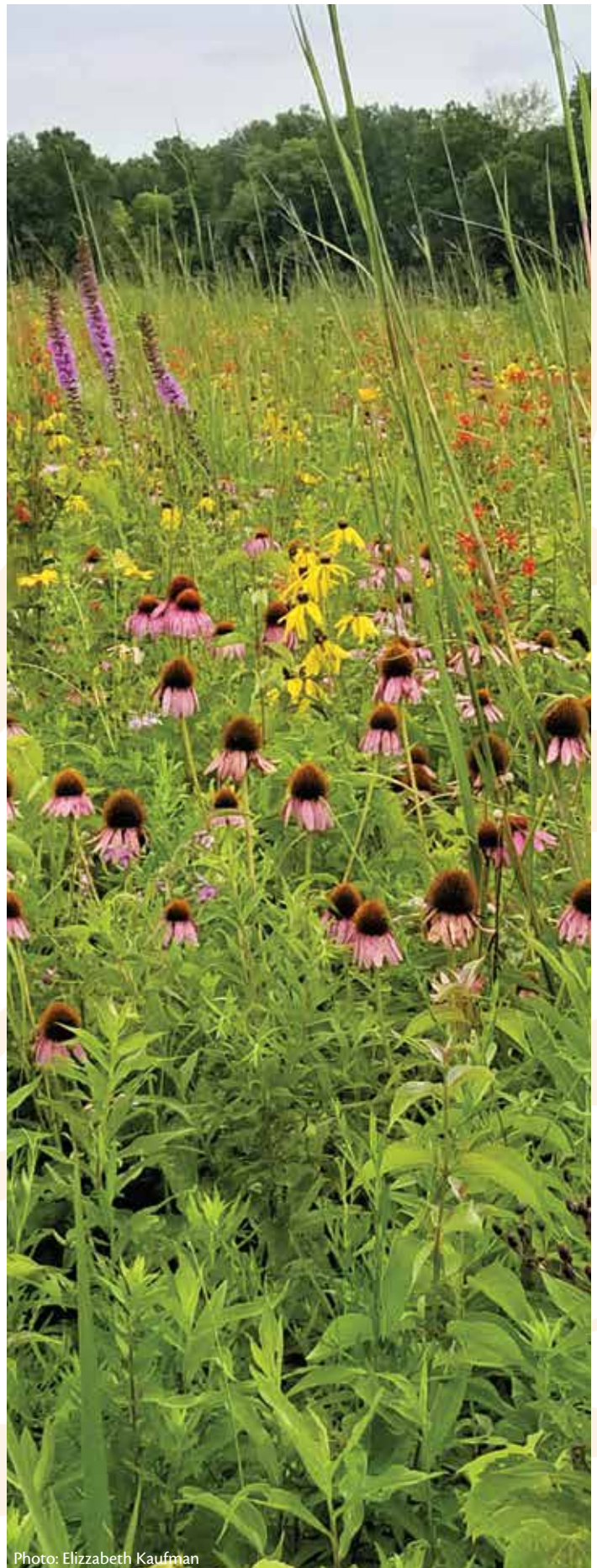


Photo: Elizabeth Kaufman

# 3 STRATEGY 3: MAINTAIN HABITAT BY REDUCING PESTICIDE USE

Controlling pests is an important part of farming that may involve the use of pesticides. However, conventional farm practices may have unwanted effects on monarchs and other wildlife. The loss of milkweed in the American Midwest due to glyphosate use has been linked to the dwindling numbers of monarchs. In 2014, their population was less than 90% of what it had been in 1994. Farmers certainly are not expected to let weeds back into their fields, but tolerating milkweed and other wildflowers in those non-productive areas of the farm is a simple and important action that makes a big difference to monarchs.

Herbicides eliminate some plants that pollinators use for foraging or laying eggs, while insecticides can impact bees, monarchs, and other pollinators either through direct exposure from crop visitation, or indirect exposure when residues are present in wild vegetation, soil, and/or water. Importantly, not all insecticides are equally harmful to all species of pollinators. In some cases, even if pollinators exposed to insecticides do not die immediately, they may experience negative effects on their foraging, learning, and mating behavior. With thoughtful management, such as the use of Integrated Pest Management (IPM), these unwanted effects can be reduced. In fact, many farmers are proactively using dust deflectors and fluency agents on their vacuum planters to help bees, butterflies, and other beneficial insects.

- ✓ Labels are legal documents. Read and follow all label directions for all pesticides you use on the farm.
- ✓ Notify local beekeepers when planning insecticide treatments. This allows beekeepers to plan and protect their hives from unnecessary exposure.
- ✓ Time applications to minimize exposure:
  - Never apply when flowering crops are in bloom.
  - Follow weather and wind speed application guidelines to reduce the risk of drift to monarch habitat.
  - Apply in the evenings, after dark if possible, since the majority of pollinators are least active during this period.
- ✓ Use a fluency agent and deflector equipment to reduce the insecticide-contaminated dust from treated seed that is exhausted from planters.
- ✓ Minimize herbicide treatments:
  - Choose treatments that target your specific weed problem rather than tank mixes.
  - Use spot treatments where possible.
  - Apply IPM tools such as crop rotation to weed management.
  - Tolerate milkweeds and other native wildflowers in places where they do not interfere directly with production or serve as a host to pest insects or disease.



Photo: Danielle Hevron

## Integrated Pest Management (IPM)

IPM uses a combination of methods to manage weeds and pests on the farm. These include using cultural (crop rotation), biological (beneficial insects), genetic (pest resistant varieties), mechanical (i.e., chopping corn stalk with flail mower to destroy overwintering larvae), and chemical (insecticides, herbicides, fungicides, etc.) techniques. The strength of IPM lies in the intelligent combination of all these methods. In the long run, this helps farmers save money, grow healthy crops with large yields, and maintain a healthy farm environment for themselves and their communities.

Instead of seeking to completely eliminate any and all undesirable species, IPM uses economic thresholds to determine which method to apply at what time. For example, there are times where tolerating the small presence of a crop pest is less expensive than treating it with insecticides.

An increasing number of farmers are experimenting with cover crops and crop rotations, and are finding that they need fewer pesticide applications when using these techniques. Cover crops increase soil health, which increases a crops' resistance to pests and diseases. Crop rotations also help interrupt pest life cycles as well as help maintain long-term soil health.

Monarchs and other pollinators benefit from the same IPM practices that encourage natural enemies of many crop pests. Natural enemies are predatory and parasitoid insects that feed on insect pests. For example, lady beetles and a parasitoid wasp can be found in soybean fields preying on aphids. All farms can benefit from applying the principles of IPM to their operations.



IPM strategies that are effective across all operations include:

- ✓ Promoting soil health through no-till, cover crops, controlling erosion, and reducing fungicide applications that can interfere with beneficial soil fungi and other organisms. This supports healthy crops that can better resist pests.
- ✓ Using crop rotations on annual crops to break pest life cycles.
- ✓ Encouraging natural enemies of crop pests by providing habitat and reducing pesticide use.
- ✓ Tolerating pest populations below economic damage thresholds.
- ✓ Using chemical controls at the right time, and in the right way, in response to specific pest monitoring trends on your farm. This saves money, reduces the risk of resistance, and reduces exposure risk to all beneficial insects.

### A Note on Systemic Insecticides

Seeds treated with insecticides have become standard in the cash crop industry. While these treatments help prevent pest damage in pest-prone fields, their prophylactic use means millions of acres across North America are treated with insecticides that may not be necessary. Most of the treatment is not taken up by the plant, but remains in the soil where it moves into the water or into nearby vegetation. This has detrimental effects on the environment, where pollinators feed on the pollen and nectar of wild plants or the tissues of larval host plants, like milkweed, that are contaminated with pesticides leaching from nearby farm fields. By only buying treated seed where there is a proven need for it, and by buying untreated seed when there are no soil-borne pests, farmers can save money, improve their soil health, and help monarchs and other wildlife.

# Planning and Creating Your Monarch Habitat

## *Incorporating Native Plants into Agricultural Landscapes*

Creating monarch habitat features in an agricultural landscape is a key strategy for monarch recovery. Typical monoculture farm fields offer little to pollinators and other wildlife by way of food and habitat resources. Whether you manage a vegetable farm, grow field tomatoes or cucurbit crops, manage an orchard or berry farm, or grow forage crops, all farm types can provide habitat for monarchs and other pollinators. Turning underutilized areas of the farm over to native species of grasses, flowers, and shrubs is an effective strategy to increase crop productivity through enhanced biodiversity, and reduce maintenance costs in the long-term. Consult the plant list (p. 28), as well as local experts and native plant producers to develop seed mixes that provide benefits to monarchs.

Flowering trees and shrubs can also benefit pollinators by providing places to nest and shelter in addition to pollen and nectar food sources. Consider incorporating these into living snow fences as well as into ornamental plantings.

## *Benefits of Diverse Plantings of Native Plants*

Though using native plants involves higher up-front costs, in the long-term there are savings when compared to using conventional, non-native grass mixes, mostly due to reduced maintenance costs. There are many other benefits to native plants as well, and their use in agricultural landscapes can serve multiple goals: financial, environmental, agricultural, and aesthetic.

### Benefits include:

- Reduced mowing and herbicide costs from established, diverse communities that prevent erosion and weed encroachment
- Native plants are more tolerant of drought than non-native plants
- Deep root systems of native plants increase water filtration, and reduce run-off, erosion, and water pollution
- Native plant communities foster local identity and beautify landscapes
- Native plants support more wildlife than non-native, hybrid, and exotic plant species
- Native plants can be used in landscape elements like windbreaks
- Native plants sustain populations of native pollinators which can increase crop pollination in nearby agricultural lands



Photo: Amber Barnes

## Selecting Native Plants

Diversity is a key element of successful monarch habitat. Choosing a variety of bloom times, colors, and shapes will ensure there is a constant source of food for pollinators between early spring and late fall. Milkweed is an essential part of monarch habitat, as it is the host plant for this butterfly. There are several milkweed species to choose from in Ohio to fit your farm's needs. Make sure to also include nectar sources to fuel their migration such as coneflower, beebalm, goldenrod, and asters, to name a few. Consult the Ohio Monarch Habitat Planting List for recommendations and suggestions (p. 28).

Native grasses and sedges form the backbone of meadow and prairie habitats; their long roots sequester carbon, allow water infiltration, reduce erosion, provide shelter for bumble bees and other wildlife, and are larval hosts for various butterfly species. They are important to include in any naturalized planting, and in ornamental plantings, bunching grasses like little and big bluestem can also be effectively included. Native grasses tend to be less expensive than native wildflowers, so a strategy for keeping costs down while keeping diversity high is to increase the proportion of grasses in the mix while maintaining a large number of flowering species.

### Creating Habitat:

When creating pollinator habitat, one should employ a mix ratio of 75% native forb (flower) seed to 25% native grass seed. If cost is a defining factor, one could employ a 70/30 or even a 65/35 forb to grass mix, but never less than a 60/40 ratio. Grasses will quickly overtake forbs in a matter of just a few years, so using the higher grass ratio will ultimately incur costs such as needing to use prescribed fire sooner (or targeted herbicide if fire is prohibited to decrease the grasses). However, in order to lower the cost of the mix, it is recommended to maintain the 75/25 ratio, but use a higher percentage of annual forbs (as opposed to perennial forbs). Employing annuals will also help secure and fill the space quickly (preventing weed establishment) while deep-rooted perennials establish more slowly. Using a higher percentage of perennial species that are more commonly available on the market and a lower percentage of high-value forbs will also help to keep costs down.

### Choosing seeds and plants:

When choosing seed mixes and native plant species for agricultural landscapes and re-vegetation projects, the following criteria will ensure you are providing high quality habitat for monarchs and other pollinators:

- Include at least 1-2 locally native milkweed species as a host plant for monarchs.
- Choose at least three flowering species for each season (spring, summer and fall).
- Include as many species of flowering plants as possible.
- Look to local plant communities to inform species selection.
- Select a variety of bloom colors and shapes.
- Include native grasses and sedges.
- In ornamental plantings, clumping plants of a single species together in patches increases the visual aesthetic and facilitates pollinator foraging.



Photo: Amber Barnes

## Site Preparation and Techniques

Before preparing the site for planting, use the Site Evaluation Rubric (p. 28) to review key components to habitat development success.

Proper site and seedbed preparation is a crucial step that is often overlooked, but is necessary to create successful pollinator habitat. Before any site preparation, it is essential to recognize the specific needs of your site. Common sites will be pasture, idle or brushy fields, lawn grass, and soybean or corn stubble. Sites with existing vegetation (especially cool season perennial grasses, such as fescue) should have a minimum of two growing seasons of site preparation.

Weed removal is one of the most important steps to successful habitat creation. Whether there is heavy weed pressure on your farm or simply turf grass, removing this vegetation is key to preparing your site for planting. Choose the method below that best suits your needs.

### Solarization

Solarization is a great method for sites one acre in size or smaller. Solarization reduces beneficial microbes in soil, so consider using a mycorrhizal inoculant before planting. Begin by mowing and tilling the site. Then wait for rainfall or irrigate the area so that the moisture

causes the dormant weed seeds to germinate. Dig a canal around the site, then place a clear, UV-stabilized plastic sheet over the site, and bury the edges of the plastic in the canal to ensure the heat is sealed in. The heat generated from the sun will become trapped under the plastic sheet, and the high temperatures will kill the vegetation and dormant weed seeds. This should be done in the spring or early summer and left until the fall, just before seeding or planting. If the soil dries out, add moisture; the steam produced will help eradicate unwanted vegetation. Do not till between solarizing and planting as this can cause any remaining dormant weed seeds to germinate.



Photo: Amber Barnes

Photo: Amber Barnes



### *Hand Weeding and Clearing*

On small sites, a combination of mowing and hand weeding can be very effective, but usually requires more working hours. On such sites, the careful and selective application of herbicide to individual weed plants can also be appropriate, especially if there are shrubby plants, such as the invasive Japanese Knotweed, Autumn-olive, and Buckthorn. This method is effective for preparing relatively small sites in spring and early summer when transplants (plugs and potted plants) are used.

### *Herbicide Application*

This is an option for sites too large for solarization and where mechanical removal is not feasible. Carefully time and repeat herbicide applications over the summer in preparation for a fall seeding and planting. Begin by mowing the site. Hire a certified pesticide applicator and use a broad-spectrum herbicide to kill turf grass. When targeting woody plants, apply herbicide immediately and directly to freshly cut stumps. Though herbicides are generally less likely to be harmful to bees than other pesticides, some are known to be toxic to bees. Refer to our Pesticide Applicator Training course (<https://www.pollinator.org/pesticide-education>) for more information on safeguarding habitat from pesticide use, and other ways of minimizing

the effects of pesticides on pollinators. To be effective, herbicide usually needs to be applied a few times throughout the growing season as dormant seeds germinate. A fall application will be necessary if there is an abundance of cool season grasses and other, more aggressive, noxious weeds. To ensure adequate seed-to-soil contact, brown and dead vegetation should be removed by burning, mowing, or raking. Wait at least two weeks after the last herbicide treatment before planting or seeding.

### *Tilling*

Tilling the site is a good option when weed pressure is low or multiple tills are possible to eliminate the seedbed. Conduct a survey of existing plant material and consider past weed problems before tilling. Often times, a till will work well in the short term but can bring weed seeds to the surface from the soil bed, creating a long-term weed problem. If you want to till, consider combining it with herbicide application. When tilling to exhaust the seedbed, first till, then irrigate to germinate the weed seeds, till to eliminate the plants, and repeat until the seedbed is exhausted.

## **Preparation Methods:**

Each site is different, and preparation methods should be carefully thought-through prior to project initiation. Often, a combination of methods will be needed to prepare a site. No matter which method you use, if planting plugs, make sure to coordinate the plant delivery so live plants can be planted after the area has been cleared of weeds (wait at least two weeks after herbicide application). If seeding, ensure your preparations are complete by the time of the first frost, to accommodate a fall dormant or an early spring seeding. If the site goes unplanted for an extended length of time, weeds will return to fill the ecological void.



## Planting and Seeding

A successful pollinator mix can be planted in either spring or fall. The time of year that works best often varies with site conditions and latitude. A fall planting is sometimes considered the best time to establish a diverse native forb community that is attractive to monarch butterflies, bees, and other pollinating species, since many of these native plant species need to go through a period of cold (stratification) before they will germinate. That said, if your site and seedbed aren't fully prepared by fall, or if your site is located in an area that has warmer winter temperatures, a spring planting might be ideal.

If herbicides have been used, schedule the planting or seeding at least two weeks after the last herbicide application. Before dispersing seeds, a site must have a clean seedbed and adequate bare soil. Make sure water will be available on the day of planting (not needed for seeding).



Photo: Amber Barnes



Photo: Elizabeth Kaufman

## Broadcast Seeding

Broadcast seeding is when seed is scattered either by hand or machine. For sites under an acre in size, broadcast seeding by hand is very cost effective. Scatter the seed across the site by walking the length of it, and then scatter the seed again by walking the width of the site. Sawdust, kitty litter, no-nitrogen fertilizer, or pelletized lime may be mixed with seed to ensure a more even distribution. Special machines such as fertilizer buggies can also be used to make sowing light, fluffy seeds easier.

If seeding with native perennials, late November to early January is a good time to plant the native seed, when there is relatively bare soil, a light dusting of snow, and temperatures are below freezing. Broadcasting the seed over the area followed by lightly raking, harrowing, or rolling the area with a cultipacker works well to achieve desired seed-to-soil contact. Many of the native plant species produce very small seeds and it is imperative they are not planted too deep (greater than 1/8"), or they will not grow. Additionally, a broadcast seeding on top of existing snow works well, because the freeze-thaw action in the following spring naturally works the seed into the soil. Broadcasting over snow allows the applicator the ability to see where the seed has been applied and achieve an adequate coverage of the area. If broadcasting onto bare soil, the technique of mixing sand or other carrier with the seed can be used to the same effect.

## Drill Seeding

Drill seeding uses mechanical equipment, a drill seeder, to cut into the soil and drop in the seed. This method is great for large meadow restoration sites, but renting specialized equipment and hiring labor can be expensive. If no-till drilling is preferred, make sure the drill is designed for native seed, to ensure that the seed isn't buried too deep. Seeds should be covered by no more than 1/8 inch of soil. One can also combine drill and broadcast methods by unhooking some seed tubes so some seed falls to the ground.

## Plugs and Mature Plants

Plants are better than seed for more formally designed hedgerows and wildflower strips. If you are planting something more formal, design the layout so that taller plants are at the back, and shorter ones are at the front. Plant flowers of the same species in groups for a more beautiful visual effect and to make foraging by pollinators easier.

On planting day, develop a planting strategy and communicate it to your farm hands. Holes for plug plants can be dug with a basic trowel. You can prep for the planting by placing the potted plants on the soil where they will be planted. This allows you to fine tune the layout before planting and minimizes confusion about where the plants should be installed. To save time, you can also dig the holes in advance. A good rule of thumb is to place one plant per square foot if you want a dense planting that will reduce weed pressure during early establishment.

For your plants to survive, plug plants will need to be watered immediately after planting, and once a week for the first 6-8 weeks. Planting early in the morning, late in the afternoon or on an overcast day also helps reduce heat stress on the plants.

## Mulch

While not sensible when establishing larger-scale monarch habitat, mulch can be a good addition to a garden or demonstration area because it helps retain moisture in the soil and helps prevent weeds from establishing.

## Maintenance

It is important to remain patient with your planting as native perennial forbs and grasses will usually not appear or be noticeable on your planting site the first year. When seeded some species, like partridge pea and bee balm, may germinate and become visible in the first year, but in most cases, forbs and grasses won't begin appearing until the second and third year of the planting. It is helpful to remember the phrase "Sleep, creep, and leap!" when monitoring the growth and success of your planting. The process appears slow because native grass and forb species allocate the majority of their resources to below ground biomass and very little to above ground growth during establishment. This is why one is not likely to see much more than "weedy" species the first year (hence, "Sleep"). During the second growing season, one may see more native grass and forb species, but the area will likely continue to be dominated by annual grasses and weedy species (hence, "Creep"). It is not until the 3rd or 4th growing season that, given good establishment, the native grasses and forb species will become apparent at the site and dominate (hence, "Leap").

Proper care and maintenance is a vital part of any pollinator habitat project. While native plants require less maintenance over time, some 'TLC' will help them establish and thrive.

## Post-Meadow/Wildflower Strip Seeding

In most cases, meadows are seeded in the fall, which allows the seeds to overwinter and start the germination process in the spring. In these cases, nature is left to take its course and one hopes that the right amount of rain falls at the right time. However, if there is a water source nearby, you can water the site to help seedlings survive. In this case, water the seeds once a week, until the seedlings are about 4-6 inches tall. After that, the seedlings will survive on rain water, unless there is a particularly dry period. Though many native plants are adapted to drought, watering during dry periods will increase plant survival, the attractiveness of the habitat, and the amount of pollen and nectar available for butterflies and other pollinators.



Photo: Niches Landtrust

In the first year of your planting, it is advisable to mow your site twice to set back any annual grasses or broadleaf weeds that may appear. Mow at a height of about 6-8 inches whenever weeds reach 10-12 inches in height for the first growing season, and ensure that the last mow of the season in late summer or early fall maintains at least 6-8 inches of vegetation height during winter. Mowing to control weeds during this establishment period should occur even if some of the planted species are beginning to bloom. Mowing high during this early stage will not damage the planted vegetation, and long-term will result in a much more diverse and vigorous stand. Do not mow with a riding lawn mower because they cut too close to the ground. Use a tractor-mounted mower or something that can mow at 6-10 inches in height. Pull weeds like mare's tail by hand or by mowing to stop those from going to seed and re-populating your site and spot spray invasive species such as Canada thistle or teasel. If cool season weed growth is heavy in the spring of the second growing season, mow to 6-8 inches once in late May, and if necessary, again in late June.

Weed competition and invasive species should be continually monitored for the first several years. Spot mowing or spot spraying should be conducted to control seed production and spread. Organize a team of farm hand employees or partner with a local non-profit to organize interested community volunteers to hand pull weeds or target spray herbicides once a week or once a month during the first two years. Perfection is not necessary, but prioritizing weeding of the most aggressive species is essential.

In the fall, after plants have browned from frost, we recommend an annual mowing of the habitat with the blades 6 inches from the ground. This will distribute the flower seed throughout the site and keep any woody plants from growing up in the planting area, and is particularly beneficial in the first couple of years. In seeded meadows, always keep one section un-mowed to serve as a refuge to wildlife and stem-nesting wild bees; rotate this section from year to year.

When appropriate and desired, a controlled or prescribed burn can be utilized as a management technique to improve and maintain your monarch and other pollinator habitat. Usually by the third or fourth year of a planting, enough dead vegetation has built up to conduct a controlled burn. A spring burn will favor prairie grasses where a late summer or fall burn will favor the forbs.

### *Post-Plug/Potted Planting*

Water the plants thoroughly the day of planting and as needed during the following days.

Water the plants at least once a week for 4-6 weeks post-planting. If conditions are particularly dry, water more often.

Have a team of farm staff or volunteers spend time weeding the habitat weekly or monthly.

## **Mowing:**

Mowing once a year helps stimulate plant growth and will allow your meadow to thrive. Once your monarch habitat is established, timing of your maintenance should be planned to avoid mowing during peak monarch migration periods.

If you want to utilize a spring or early summer mowing to help keep some weeds down, it is recommended this take place prior to May 1 for northern Ohio and prior to April 1 for southern Ohio.

If an early season mowing isn't possible, this management should be held off until late fall (after October 31) in Ohio to avoid damage to monarchs and other pollinators.

The timing of monarchs' arrival in Ohio, and the emergence of their caterpillars a few weeks later, changes from year to year depending on the weather. Before mowing, scout for butterfly eggs and caterpillars; if they are present, delay mowing.

Leave the old stems in place over the winter. These can be trimmed back in late spring or left in place. The seed heads provide a winter food source for birds while the stems can provide cover for birds and nesting habitat for bees.

### *Long-Term Habitat Maintenance*

As noted above, it's important to have a maintenance plan in place to monitor for weeds annually, focusing efforts on aggressive and invasive species (targeting them before they go to seed). As the native pollinator plants establish, the pressure from the weeds will reduce, but some weeding or targeted herbicide spraying will be required each spring/summer. Your habitat type, whether it is a small wildflower strip or a large riparian buffer, will determine the type and level of maintenance required.

In seeded meadows, remember to always keep one section un-mowed to serve as a refuge to wildlife and rotate this section from year to year.

Seeded habitat can take multiple years to establish and may look different from year to year as the perennial species form a healthy root system and begin to produce flowers. Be patient as your wildflower habitat invests in its below ground growth. Once the roots are well established, flowers will follow.

# Farmer and Farm Contractor Training

Getting all farm staff, pesticide applicators, and other contractors familiar and on board with these three strategies to preserve and enhance monarch habitat is crucial to their success. All too often, a lack of communication between farmers and farm contractors, can lead to setbacks when monarch habitat is accidentally sprayed or mowed. Including all stakeholders in integrating monarch conservation strategies ensures that their benefits, financial and otherwise, are fully realized.



Photo: Elizabeth Kaufman

## Summary:

- Attend workshops and training sessions on monarch and pollinator ecology as well as the important role farmers and agricultural land can play in monarch conservation
- Communicate the benefits of reduced mowing, selective herbicide applications, and native plants to other farmers and the public through market and farmer-2-farmer networks
- Attend training sessions on native plant identification
- Take Pollinator Partnership's course, "Protecting Pollinators: A training module for certified pesticide applicators, pesticide and crop advisors, and agricultural producers". Access to the course can be found on our website: <https://www.pollinator.org/pesticide-education>
- Read Pollinator Partnership's Corn Dust Research Consortium paper for recommendations on protecting honey bees during corn planting



Photo: Amber Barnes

# Raise Public Awareness of Monarch-Friendly Farm Practices

The creation of monarch habitat on farmland through these three strategies is an excellent opportunity to engage with other farmers and the public on how you have implemented these practices, sharing challenges and opportunities to enhance future success. Changes in a landscape, however, can sometimes be met with misunderstanding or resistance. Communicating with stakeholders, whether they are the general public, or adjacent farmers or landowners, can help mitigate negative reactions.

For example, while most people find wildflowers and meadows aesthetically pleasing, some do not. Communicating the benefits to wildlife, soil, water quality, and overall crop production that these areas provide can help increase acceptance. Explaining the benefits of selective and targeted herbicide use on invasive species, as compared to indiscriminate usage, can help other farmers and the public to better understand the value to monarchs and other wildlife. Communicating with adjacent landowners, farmers and the public throughout the planning, planting, and establishment of a new site can also mitigate concerns when new plantings appear scraggly before they are fully

established, or when previously mowed areas are allowed to grow in.

Simple actions like creating signage to indicate monarch habitat and wildflower plantings can help raise the profile of your farm and farming practices within the community. This signage also provides context and indicates intention when formerly mowed or highly managed areas are allowed to return to a more naturalized look. Engaging with other farmers and the public through community meetings in advance of plantings can help gain local support for monarch habitat.

Partnering with local groups and other organizations (state, private, or non-profit) has multiple benefits. Volunteers can be recruited to help with plantings and funds can be leveraged to support the costs of diverse native seed mixes or signage. Hosting monarch monitoring and tagging events with local naturalists clubs or schools can take place in naturalized or other areas on your farm, further engaging community partners on environmental and agricultural education. These types of community events are an excellent way to showcase your farming practices and commitment to the environment.



Photos: Amber Barnes

## Outreach

- Install signage to indicate the presence of monarch habitat on your farm and your commitment to the environment
- Organize a monarch monitoring or tagging event on your farm to engage local citizens, community groups, and other farmers
- Provide information about how you are supporting monarchs on your website or other publication
- Use farm markets as an opportunity to showcase your commitment to the environment and monarch conservation to members of the public

Pollinator Partnership (P2) has a wide variety of outreach materials available at [www.pollinator.org](http://www.pollinator.org). Many of the materials can be customized with your farm's logo.

## Certification and Recognition

Contact organizations such as P2 if you are interested in taking part in habitat certification programs. Certification ensures that your habitat sustains pollinators and monarchs and also puts your farm and your project in the national spotlight. Being part of this network will connect you to other agricultural land management professionals that can share in your successes and offer guidance for future projects.

## Bee Friendly Farming

Become a Bee Friendly Farmer! Bee Friendly Farming (BFF) is a program that provides guidelines for farmers and growers interested in promoting pollinator health on their lands. This is an excellent opportunity to rally community support and communicate the benefits of creating monarch and pollinator habitat on your farm and join a thriving network of other farms, orchards, vineyards, and ranches which share the same goal. <https://www.pollinator.org/bff>



## Pollinator Partnership Pollinator Steward Certification

This unique certification program is offered only by P2. P2 has been at the forefront of pollinator research, education, and habitat improvement for over 20 years. Certification as a Pollinator Steward demonstrates that you have a science-based understanding of pollinators and gives you the practical know-how to help them. Certification also shows that you have used your knowledge to create habitat and educate others. Visit <https://pollinator.org/pollinator-steward-certification> for more information on this unique certification opportunity.

## North American Pollinator Protection Campaign

P2's signature initiative, the North American Pollinator Protection Campaign (NAPPC) offers recognition to pollinator advocates, farmers and ranchers, and roadside managers. Nominate a local farmer or farm you know that is working for pollinators, for one of these prestigious awards. Information can be found at [www.pollinator.org/awards](http://www.pollinator.org/awards)

Photo: Amber Barnes





Photo: Gail Vanersteen



Photo: Amber Barnes



Photo: Amber Barnes

## *Monitor and Research*

Pollinator Partnership (P2) has partnered with many farmers to conduct monitoring and research. Contact P2 if you are interested in including your farm in a scientific study that can aid in pollinator conservation.

Your newly created monarch habitat will provide an excellent learning opportunity for everyone, from school children to other farmers and land management professionals. Educational visits are a great way to showcase your commitment to your community and environmentally-friendly agricultural practices, as well as provide a rich connection experience to others who may have lost touch with their local agricultural community and their traditions. Registering your site as a S.H.A.R.E. (Simply Have Areas Reserved for the Environment) site and holding an event during National Pollinator Week (both at P2's website: [www.pollinator.org](http://www.pollinator.org)) will ensure that others outside of your community will learn about the work you are doing on your farm to promote pollinators.


## *Insight Citizen Science App*


The Insight Citizen Science App is a simple tool that empowers citizens to learn about North America's essential pollinators and participate in observation-based research. This user-friendly app provides a guide to walk you through the observation process and help you learn how to identify pollinators within the 7 featured pollinator categories. It also provides a platform where you can follow the observations of other citizen scientists across the United States, Canada, and Mexico. The free iOS app was launched in North America in 2019. Visit <https://insightcitizenscience.com/> to download this app for free!

# Monarch Habitat Actions


The monarch migration is in peril but you can help! Here are key actions you can take on your land to support the iconic butterfly and keep the migration a natural wonder for generations to come.

Key actions:


 Increase nectar species

 Increase milkweed

 Ensure bloom during key migratory periods

 Reduce pesticides

 Reduce impact of mowing

 Communicate with neighboring landowners about pesticide application

Plant or seed nectar  
milkweed and



Plant milkweed and nectar plant flowering strips around crops



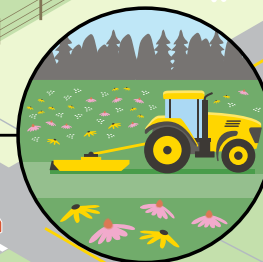
Reduce wind speed by planting windbreaks



Plant or seed utility rights-of-way with milkweed and nectar species



Minimize mowing roadsides, margins and lawns to maintain bloom and ensure of caterpillars and



Adjust mow utility right minimize in eggs and ca



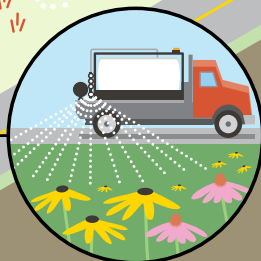


Roadsides with nectar species

Plant milkweed and nectar species on marginal lands



of marginal lands to maintain safety eggs



Minimize pesticide use near pollinator habitat



Planting schedule in roadside-of-way to impact to monarch caterpillars

Plant a monarch garden at home or school



# Monarch Habitat Site Evaluation Rubric

Use this rubric as a starting point to evaluate each site being considered for monarch habitat development, and adjust as per your project specific goals and priorities. Circle the description that best represents the site. If a site receives a zero in any category consider choosing a different site, if there is another option. If a site is in between scores use the blank boxes or modify the rubric as you see fit.

**SITE NAME:** \_\_\_\_\_ **EVALUATOR:** \_\_\_\_\_

**TOTAL SCORE:** \_\_\_\_\_ **DATE:** \_\_\_\_\_

SCORE	0 (choose another site, if possible)	1	2	3	4
<b>EXISTING HABITAT/VEGETATION</b>					
Existing Beneficial Vegetation (if not planning on removing all existing vegetation prior to habitat planting) (includes existing hedgerows, windbreaks, and other flowering shrubs and trees)		1-2 identifiable beneficial plants blooming in 1 season		2-4 identifiable beneficial plants blooming in 2 season	4+ identifiable beneficial plants blooming in 3 seasons (spring, summer, fall)
Ability to Procure Additional Plants or Seeds	No ability	Ability to procure seed of a few species, not able to maintain bloom during migration periods.		Ability to procure seed to maintain continuous bloom, including peak migration periods.	Ability to procure plugs and seeds to maintain a continuous bloom, including peak migration periods.
<b>SITE ATTRIBUTES</b>					
Value as Crop Land		Site has high economic value as crop land.	Site has moderate economic value as crop land.		Site has little to no economic value as crop land.
Sun Exposure	Full Shade	Partial Shade (50% shade/50% sun)	Partial Sun (75% sun/25% shade)		Full Sun
Water Availability (needed for establishment of plugs/potted plants, not applicable if using only seed)	Not available for plug planting		No water on site, but ability to bring it on site post-plug planting	Can water weekly for 6 weeks post-planting	Constant, accessible water source (e.g. Irrigation)
Slope	46-90 degrees (extreme slope)	16-45 degrees (steep slope)		6-15 degrees (moderate slope)	0-5 degrees (gentle slope)
Soil Texture		Gravel	Compacted	Clay, Sandy	Well-drained Loam
Soil pH	Alkaline soil, pH above 7.5 or Acidic soil, pH below 4	Acidic soil, pH between 4 and 5.5	Slightly acidic soil, pH between 5.5-6.5		Neutral pH between 6.5-7
Accessibility (if desired)	The site is inaccessible.		The site is difficult access	The site is moderately accessible	The site is easily accessible

# Monarch Habitat Site Evaluation Rubric continued

SCORE	0 (choose another site, if possible)	1	2	3	4
<b>ADJACENT LAND USE</b>					
	Commercial Ag (Pesticide Use)	Overgrown & weedy or high herbicide usage	Developed, ROW, Roadside, Residential w/o IVM, IPM or BMPs	Organic Ag, Open Space, ROW, Roadside, Residential w/ IVM, IPM or BMPs	Diverse natural or restored habitat
<b>HABITAT MANAGEMENT AND MAINTENANCE</b>					
How long will the site be maintained as native habitat?	<3 years	<5 years	5 years	5+ years	Idefinitely secured as conservation area
Ability to Reduce Undesirable Plant Species	No ability to reduce undesirable plant species (make note if no invasive species on site)	Initial removal, no additional removal planned	Initial removal, would like to do more	Seasonally Removed	Aggressive and sustained removal of undesirable species can be incorporated into the management of the site
Ability to add more plant material after initial planting		No ability	As needed, seed only		As needed, seed and plants
Prescribed Fire (evaluate based on either prescribed fire, or mowing)		Infrequently	Occasionally (Rotating w/in 8-10 year cycle)	Annually (Rotating as needed = 5 to 10 years)	Annually (Rotating as Needed = 5 to 10 years)
<b>OR</b>					
Mowing	Monthly	Seasonally	1 to 2 times per year	1 time only when timed with prescribed window*	Only when outside of monarch reproduction and migration periods
<b>TOTAL SCORE:</b>					
<b>ADDITIONAL COMMENTS:</b>					
<p><b>* Key to mowing (recommended only if necessary):</b>            Ohio: South - July 1st - July 20th; North - June 30th to July 10th</p>					

# Ohio Monarch Habitat Planting List

From 2015 through 2017 P2 monitored adult monarch butterfly use of candidate nectar plants in Ohio to develop practical monarch habitat plant lists supported by data. Three years of data collection have been analyzed and provide insight into adult monarch feeding and preference patterns. The monarch recommendations below are based on data collected from 18 native Ohio plant species planted at 18 sites throughout Ohio. The early blooming pollinator species will help maintain floral resources through most of the growing season.

## Nectar Recommendations

Botanical Name	Common Name	Light	Water	Height	Bloom Time	Flower Color
<b>MONARCH NECTAR ALL-STARS</b>						
<i>Asclepias incarnata</i>	Swamp Milkweed	Full Sun	Medium Wet to Medium	4 feet	June-August	Pink/Rose
<i>Eutrochium purpureum</i>	Joe Pye Weed	Partial Shade	Medium Wet to Medium Dry	Up to 7 feet	July-September	Pink
<i>Symphytotrichum novae-angliae</i>	New England Aster	Full Sun	Moist to Medium Dry	5 feet	August-October	Purple
<b>GOOD MONARCH NECTAR PLANTS</b>						
<i>Asclepias tuberosa</i>	Butterfly Weed	Full Sun to Partial Shade	Medium to Medium Dry	2 feet	June-August	Orange
<i>Echinacea purpurea</i>	Purple Coneflower	Full Sun to Partial Shade	Medium	Up to 4 feet	July-September	Pink/Purple
<i>Liatrix aspera</i>	Rough Blazing Star	Full Sun	Medium	3 feet	July-October	Pink/Purple
<i>Lythrum alatum</i>	Winged Loosestrife	Full Sun	Moist to Medium Wet	3 feet	June-September	Pink/Purple
<i>Parthenium integrifolium</i>	Wild Quinine	Full Sun	Medium to Medium Dry	4 feet	June-September	White
<i>Pycnanthemum tenuifolium</i>	Narrowleaf Mountain Mint	Full to Partial Sun	Moist to Medium Dry	2 feet	June-September	White
<i>Solidago rigida</i>	Stiff Goldenrod	Full to Partial Sun	Moist to Medium Dry	4 feet	August-October	Yellow
<i>Symphytotrichum laeve</i>	Smooth Aster	Full Sun	Dry to Medium	Up to 4 feet	September-October	Purple
<b>EARLY BLOOMING POLLINATOR FRIENDLY PLANTS</b>						
<i>Penstemon digitalis</i>	Foxglove Beardtongue	Full to Partial Sun	Medium to Medium Dry	5 feet	May-July	White
<i>Tradescantia ohioensis</i>	Ohio Spiderwort	Full to Partial Sun	Medium	3 feet	April-July	Purple
<i>Zizia aurea</i>	Golden Alexanders	Full to Partial Sun	Medium	3 feet	April-June	Yellow

## Milkweed Recommendations

Ohio has 13 native milkweed species (*Asclepias* spp.). P2 tested these four milkweed species for their nectar attractiveness, but not for larval preference: *Asclepias incarnata*, *A. syriaca*, *A. tuberosa*, and *A. exaltata*. *Asclepias incarnata* (swamp milkweed) proved to be the most attractive of the four milkweeds to adults seeking nectar. However proved, it is highly encouraged that you plant the right milkweed species for your site, all are beneficial to monarchs. Below are the most commonly available milkweed species and their growing conditions. *Asclepias incarnata* can tolerate regular watering, making it easy to incorporate into display gardens that are watered frequently.

Botanical Name	Common Name	Light	Water	Height	Bloom Period	Flower Color
<i>Asclepias exaltata</i>	Poke Milkweed	Partial Shade, Shade	Medium to Medium Dry	5 feet	June-July	White
<i>Asclepias incarnata</i>	Swamp Milkweed	Full Sun	Medium Wet to Medium	4 feet	June-August	Pink/Rose
<i>Asclepias syriaca</i>	Common Milkweed	Full Sun	Medium to Medium Dry	3 feet	June-August	Pink/Rose
<i>Asclepias tuberosa</i>	Butterfly Weed	Full Sun	Medium to Medium Dry	2 feet	June-August	Orange

## Basic Monarch Habitat Checklist

Monarchs have a few basic requirements which are needed for good health and reproductive success. Below is a checklist for you to use to make sure these needs are being met by your monarch habitat project.

### Food

- ✓ Milkweed: Female monarchs lay eggs on milkweed plants because the caterpillars (that hatch from the eggs) only eat milkweed leaves.
- ✓ Nectar Plants: Incorporate a variety of native flowers that provide nectar like goldenrod, bee balm, and asters. Adults need fuel (nectar) throughout the spring, summer and into fall, especially during peak migratory periods. Strive to maintain a continuous bloom from late April into mid-October. Use the Planting List on page 28.

### Sun

- ✓ Adult monarchs need warm, sunny areas to regulate their temperatures or bask. Add a few rocks to your planting project to provide a warm resting area where adult monarchs can bask.

### Shelter

- ✓ Windbreaks help slow wind speed and can create desirable areas for adult monarchs to feed. A windbreak can be a fence, hedge, or just a shrub.

### Water

- ✓ Some butterflies and other pollinators benefit from having a fresh source of water available. This can take the form of mineral rich moist soil from which they can extract water (known as “puddling”) or a pond, birdbath, or shallow bowl of water with stones, pebbles and/or sand in it which rise above the water surface to provide them with a perch from which to drink. While much of the water that a butterfly needs comes from the flower nectar they consume, additional water and the minerals that it can contain can provide key hydration and nutrients. Remember to change the water frequently to reduce mosquito larvae or other contaminants.



Photo: Amber Barnes

## Additional Monarch Resources

This list of resources will help you get started, with plants and seeds for your new habitat site or with additional information on the monarch migration and how you can get involved. There is an ever growing body of knowledge on monarchs. The list below is just a sample of what is available.

### *Plants*

#### Nurseries

Ohio Prairie Nursery, Hiram, Ohio  
Scioto Gardens, Delaware, Ohio  
Keystone Native Flora, Cincinnati, Ohio  
Natives in Harmony, Marengo, Ohio  
Indigenous Landscapes (Pioneer Landscapes), Loveland, Ohio  
The Wilderness Center, Wilmot, Ohio  
Natural Communities, Native Plants, Illinois  
Nodding Onion Gardens, Columbia Station, Ohio  
Milkweed Market, Kansas  
North Creek Nursery, Pennsylvania  
Applied Ecological Services, Wisconsin

#### Plant Sales

Holden Arboretum  
Nature Center at Shaker Lakes  
Cleveland Museum of Natural History

### *Migration Information*

Journey North

### *Organizations with Additional Resources*

Lake Erie Allegheny Partnership (LEAP)  
Monarch Watch  
Monarch Joint Venture  
Wild Ones  
Pollinator Partnership  
David Suzuki Foundation  
Farmers for Monarchs  
USDA: Natural Resources Conservation Service (NRCS)  
Xerces Society

### *Ohio Monarch Initiatives*

Monarch Wings Across Ohio  
Ohio Pollinator Habitat Initiative

### *Regional and National Initiatives*

Monarch Wings Across the Eastern Broadleaf Forest  
Project Wingspan  
Integrated Monarch Monitoring Program (IMMP)  
Mid-America Monarch Conservation Strategy  
The Bee & Butterfly Habitat Fund  
S.H.A.R.E



# Notes





# FARMS

