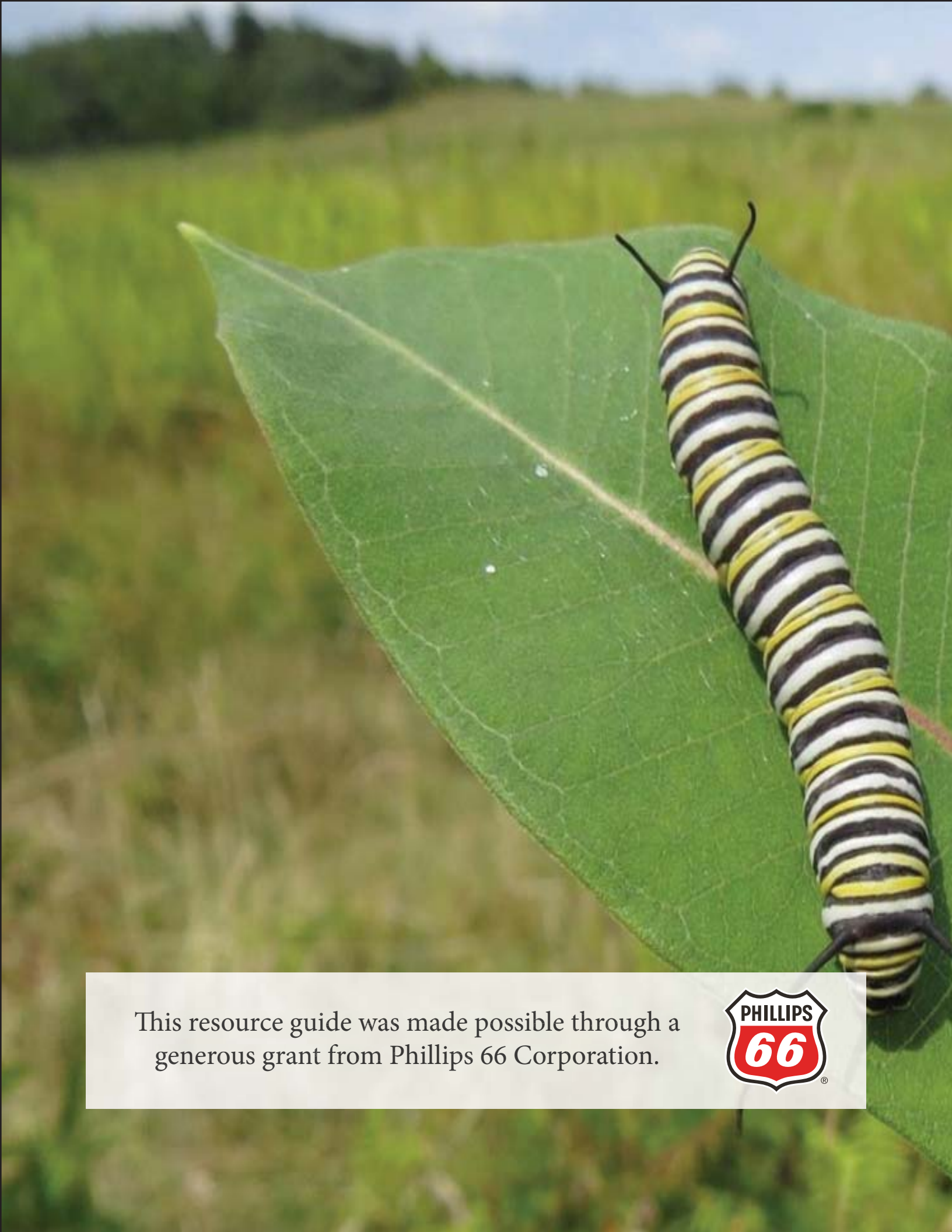


Parks for Monarchs

A Resource Guide for Monarch Conservation





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ABOUT THIS GUIDE

Executive Summary

Parks have long been recognized as places to recreate and to experience natural beauty. Preserving natural landscapes for wildlife conservation is becoming an increasingly important part of the many amenities that parks provide in a rapidly developing world. As native landscapes continue to disappear, parks have an important role to play in their preservation and restoration.

This role is strikingly evident in the case of the monarch butterfly (*Danaus plexippus*). The eastern North American monarch population has diminished by over 90% during the past few decades, and national strategies have called for an “all hands on deck” approach to restoring the population to a sustainable level. One of the best ways to achieve that goal is to create and enhance habitat for monarchs, and parks are ideal places to do so.

This guide provides a framework for how parks can get involved with monarch conservation activities, especially the creation and restoration of high quality habitat for monarchs. The charismatic monarch butterfly offers an opportunity to connect communities with the natural environment and to provide habitat benefits for many other species in parks. Park visitors will relish the opportunity to have close contact with these beautiful butterflies and the variety of other pollinator species that are attracted by creating, restoring or enhancing habitat for monarchs.

In addition, parks are critical in engaging youth and adults alike in conservation learning. Monarch butterflies and their associated habitats provide informal and formal learning opportunities for youth and educators, and also provide an abundance of opportunities for citizen scientists to contribute their observations to a larger understanding of monarch biology and ecology. The impacts of these experiences are often long-lasting, and can encourage individuals toward more conservation-minded thinking and decision-making. Restoring habitat for monarchs and pollinators in parks not only decreases long-term maintenance costs, but provides abundant opportunities for park educators and visitors to explore nature and gain life-long experiences.

Parks are especially important for monarchs on their migration, and have the added advantage of being able to provide long-term habitat if managed correctly. Parks are places that the public can see and enjoy monarchs, and in some cases, learn more about them through interpretive signage, exhibits, and life-cycle displays. Best of all, even the smallest of parks can provide habitat for monarchs and other pollinators.

Whether you are a volunteer or a parks professional, whether you are just beginning or you have installed many monarch waystations and pollinator gardens, this resource guide will provide valuable information on how to increase monarch habitat, create new partnerships for saving the monarch, and engage youth and adults in the conservation of this valuable and much-loved species.

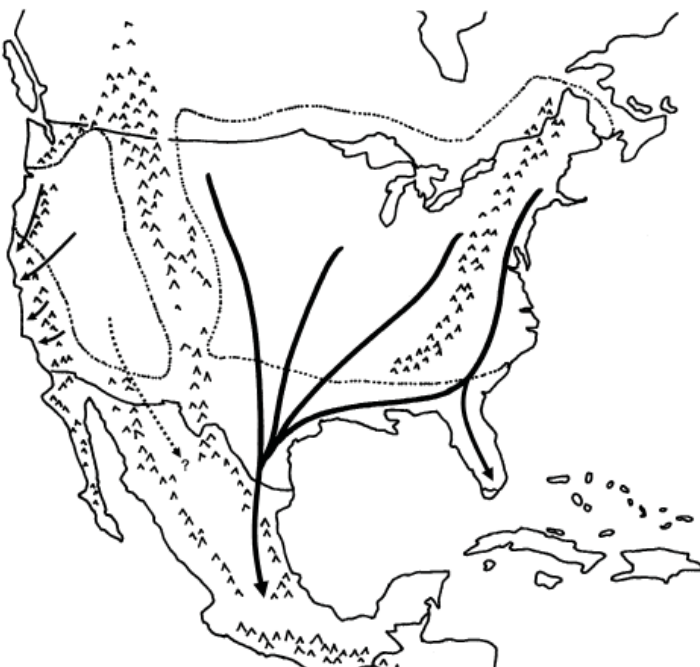


AN INTRODUCTION TO MONARCHS

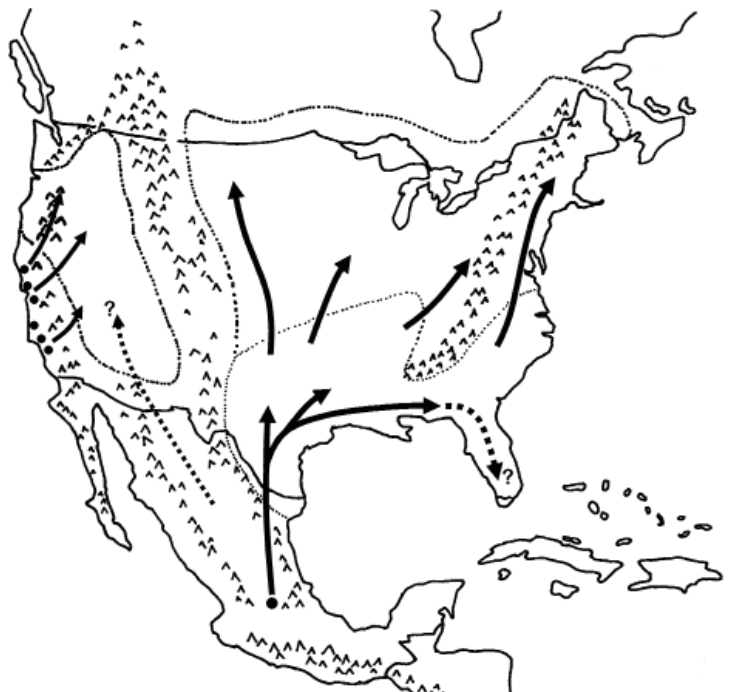
Monarch Migration

The monarch migration is one of nature's most spectacular events. Much as birds migrate to take advantage of resources available across a large landscape, North American monarchs travel up to an astonishing 3,000 miles in an annual migration from their summer breeding habitat to overwintering grounds. During the summer breeding season, eastern monarchs spread across the eastern U.S. and into southern Canada, laying eggs on milkweed plants. Western monarchs make use of milkweeds across the western states, primarily west and south of the Rockies, and into southwestern Canada.

In the fall, monarchs feast on late-blooming nectar plants along the way to their wintering sites. The eastern monarch population winters in oyamel fir forests in the mountains of central Mexico. While the spring migration northward is completed over the course of two or more generations, the final generation of the year flies the entire way back to these forests, new to them, but visited by their ancestors a few generations ago. In the same way, monarchs from across the western U.S. return to Eucalyptus, Monterey cypress, Monterey pine, and other trees in groves along the Pacific coastline, from Mendocino County south to Baja, Mexico. Climatic conditions at these sites allow monarchs to survive the winter before beginning the return trek to their summer breeding grounds.



Fall migration



Spring migration

Monarch Biology and Reproduction

Like all butterflies, monarchs go through complete metamorphosis – starting as an egg, then larva (caterpillar), pupa (chrysalis), and finally adult butterfly. During these distinct life stages, they have different habitat requirements, which are presented in a future section of this guide. From egg to adult, this transformation takes approximately one month.

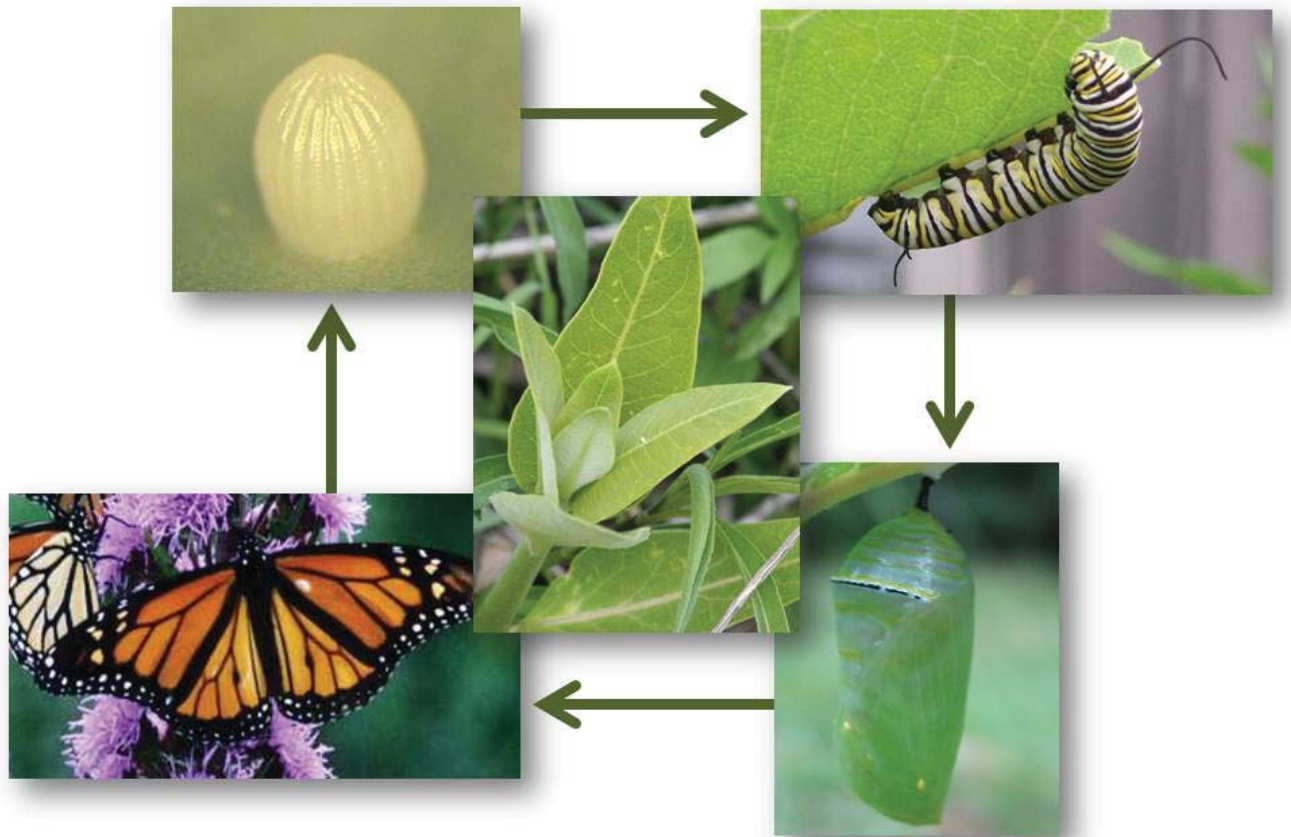
Monarch larvae grow to about two-thousand times their original mass and eat huge amounts of milkweed (relative to their size) as they grow. To accommodate for a rapidly growing caterpillar, monarchs shed their skin approximately every two to three days, totaling five molts over the course of about two weeks. These five larval stages are distinguished as instars.

When a caterpillar is ready to transition to the immobile pupa, or chrysalis stage, it often crawls several meters away from the plant it was eating to find a sheltered area. This might be on another plant in the habitat, or a man-made structure such as a picnic table, bird bath, or building. The fifth instar caterpillar will then spin a silk button with the spinneret located beneath its mandibles (jaws). Once in place, the caterpillar uses this silk pad to secure itself from its last set of hind legs, or prolegs. For 12-18 hours, the monarch maintains the appearance

of the caterpillar stage, but major transformations are occurring inside. When ready, the caterpillar skin is shed one last time (occurring over the course of about one minute), revealing the bright green monarch chrysalis. The fragile new monarch pupa will continue to shape itself and harden in the hour following this transformation.

The immobile pupa phase lasts approximately 10 to 14 days. One of the very last developments before the adult butterfly emerges, or ecloses, is pigmentation of the adult butterfly scales. When the characteristic orange, black, and white colors of the adult butterfly can be seen through the transparent casing of the chrysalis, the butterfly is nearly ready to emerge – usually within one day. Its wings look small and deformed at first, but the monarch will soon pump its abdomen, releasing fluid into the wings to expand them to their full size and shape. The adult will hang upside down for four to five hours after it emerges to let its wings dry and strengthen before it is able to fly for the first time; the butterfly is very fragile during this stage.

Non-migratory adults, referred to as breeding generations, live approximately two to six weeks. During this time adults will find a mate, mate, and in the case of females, lay eggs on available milkweed plants. A single



The monarch life cycle centers on milkweed.

female monarch can lay hundreds of eggs: experts estimate 300-500 over the course of her lifetime. This investment in reproduction is evident by the shorter life-span of breeding monarch generations.

The final generation of the year is referred to as the migratory generation. These monarchs are in a state of delayed reproduction (called reproductive diapause), which is triggered by environmental cues like decreasing day length and temperature, and aging milkweed host plants. In order to survive the long-distance migration to their overwintering sites where they will spend the winter, this generation temporarily foregoes reproduction and focuses on gaining lipids by consuming nectar resources and migrating south.

Compared to the breeding generations, this generation can live up to 9 months. After migrating south, they spend the winter at high-elevation oyamel fir forests in central Mexico (eastern monarch population) and then begin the journey north into the southern U.S. in the spring. Their final task is to produce the first generation offspring. Reproductive development resumes as they

migrate north, the overwintering generation dies after reproduction, and their offspring continue the journey into the northern parts of the monarch range. Monarchs west of the Rocky Mountains undergo a shorter-distance migration, traveling to hundreds of sites along California's Pacific coast. There is a small, non-migratory population of monarchs in southern Florida.

MONARCH MYTH: DO CATERPILLARS TURN TO 'SOUP' INSIDE PUPAE?

It is a myth that butterflies turn to soup inside the pupa. If you look carefully, even a newly formed chrysalis will show wing veins beneath the surface. The wing pads are visible in this photo as the half circle covering the left side of the pupa.



Parks in Action for Monarch Conservation Optimist Park Monarch Waystation



The City of Hagerstown Parks and Recreation collaborated with the Hagerstown Kiwanis Club to install a beautiful Monarch Waystation habitat along its new trailside park.

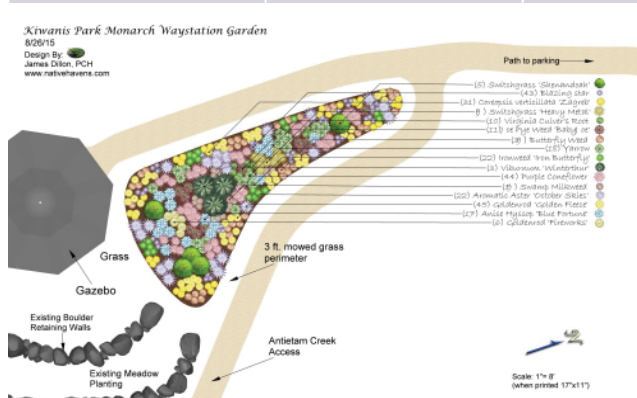
The Department Engineer, Rodney Tissue, reported that the very day they planted the milkweed “monarch butterflies were landing on the milkweed plants. It was amazing.”

Park size, type:

Small, City Park

Partners:

City of Hagerstown Department of Parks and Recreation, Kiwanis Club, Monarch Watch Waystation Program



Photos: Hagerstown Parks and Recreation Department

Monarchs in Decline

The monarch migration was listed by the International Union for Conservation of Nature as an endangered phenomenon in 1983. In 2010, the World Wildlife Fund included monarchs on its list of the “Top 10 to Watch in 2010”: species that are thought to be in need of close monitoring and protection. In 2014, the monarch was petitioned to the U.S. Fish and Wildlife Service for consideration under the Endangered Species Act.

Monitoring of the eastern monarch overwintering population has been taking place each winter since the mid 1990’s, and there is a general declining trend in the population. The eastern population is measured by estimating the area occupied by overwintering monarchs in the Mexican overwintering sites (Morris, Oberhauser, & Brower, 2015). Since there are many fewer individuals in the western population, this population size is estimated by using citizen science volunteers to count individuals (vs. measuring area).

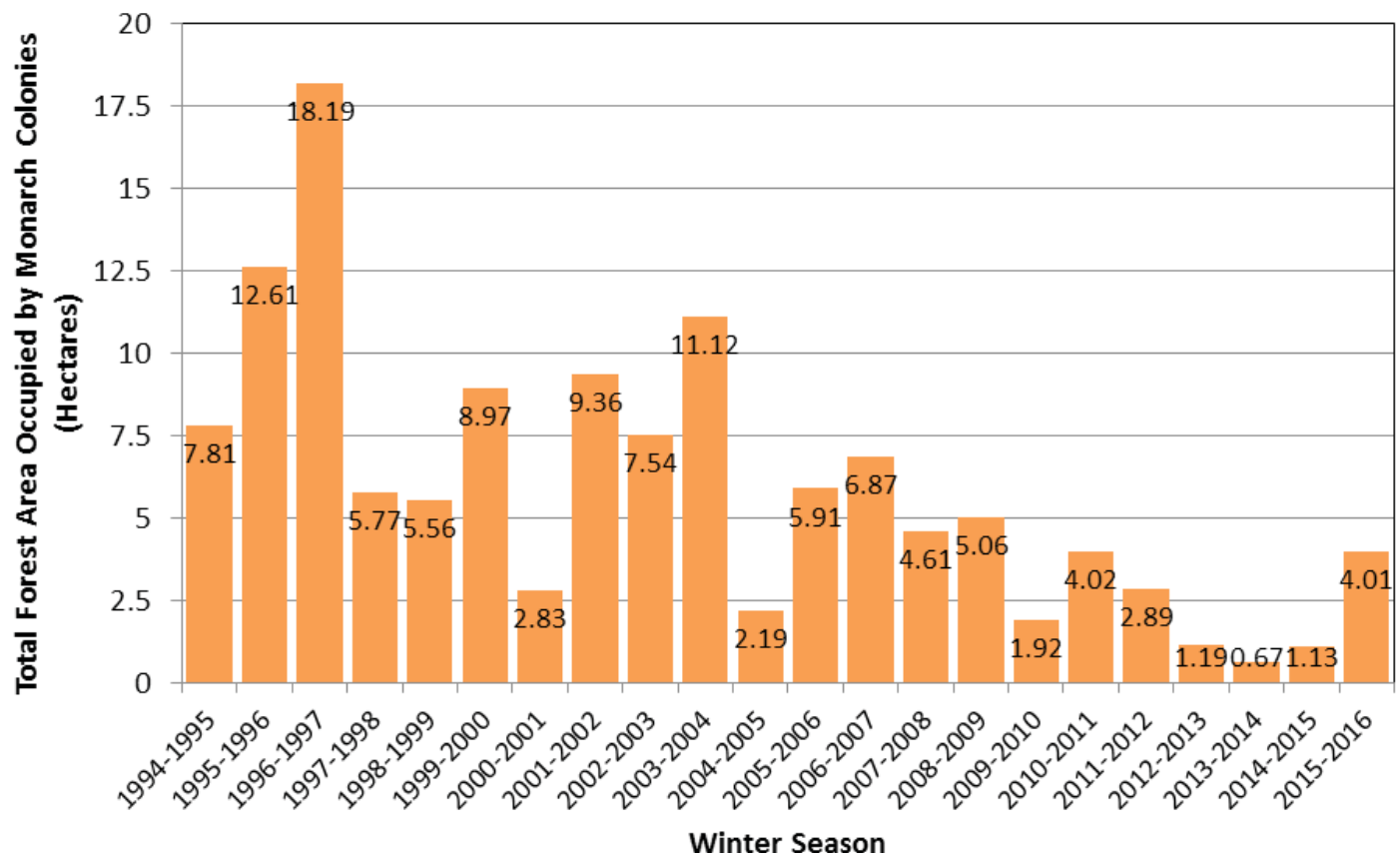
The winter of 2013-2014 recorded the lowest ever eastern monarch population, with butterflies occupying

less than 2.5 acres (1 hectare) of oyamel forest in Mexico. The peak in the late 1990’s was nearly 45 acres (18 hectares). Over the past 20 years, the average population size has been about 15 acres (6 hectares). A decline in the number of western monarchs, most of which spend their entire life cycle in the U.S., has been well documented over the past decade as well.

Monarchs face many challenges that are potentially contributing to this decline. Both eastern and western monarchs are dependent on habitat quality, which is being threatened by:



**Total Area Occupied by Monarch Colonies At Overwintering Sites in Mexico
1994/1995 - 2015/2016**



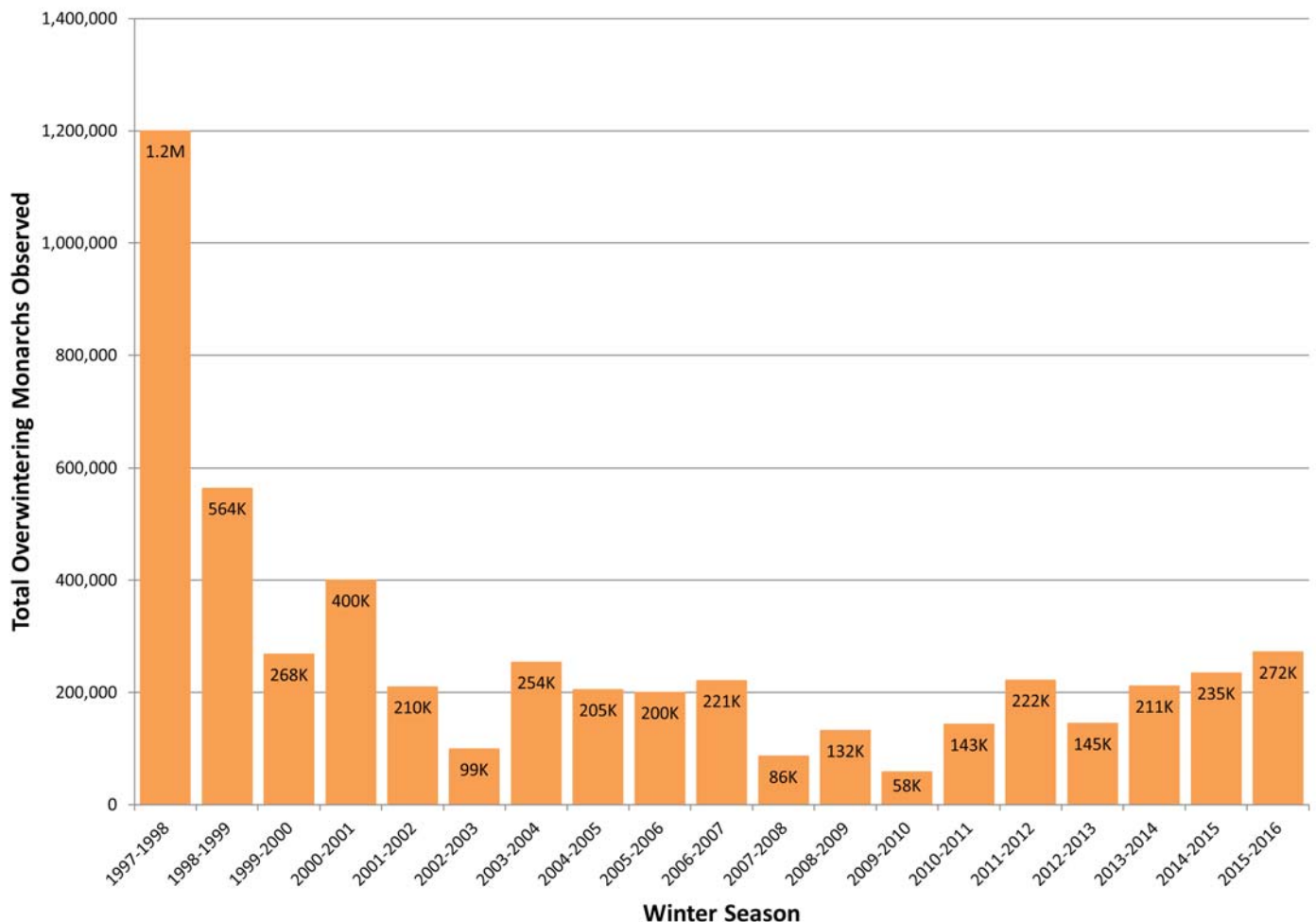
Data from 1994-2003 were collected by personnel of the Monarch Butterfly Biosphere Reserve (MBBR) of the National Commission of Protected Natural Areas (CONANP) in Mexico. Data from 2004-2016 were collected by the WWF-Telcel Alliance, in coordination with the Directorate of the MBBR.

- Habitat conversion and changes in land management practices that are reducing the availability of milkweed;
- Possible changes in milkweed, nectar plant, and oyamel tree availability, quality, and distributions due to effects of climate change;
- Extreme weather events such as drought in the breeding habitat and severe winter storms in the overwintering grounds;
- Increased prevalence of naturally occurring monarch parasites and predators;
- Pesticide use to control other insects, with unintended harmful consequences for monarchs;
- Habitat conversion in California, resulting in reduced availability and quality of overwintering sites; and
- Shifting overwintering habitat quality, as the trees in California's monarch groves age and deteriorate and illegal logging threatens trees in Mexico's overwintering forests.

In the face of these threats, scientists suggest the eastern monarch overwintering population size needs to reach a 6 hectare (14.8 acre) threshold to minimize the risk of losing the eastern monarch migration (Semmens, et al., 2016). All sectors of land managers, from backyard gardeners to farmers to parks and agencies have a role to play in reaching this important population goal.



Total Western Overwintering Monarchs Observed 1997-2015



Data collected by the Xerces Society for Invertebrate Conservation Thanksgiving Monarch Count.

Monarch Habitat Requirements

The Importance of Native Plants

Native refers to species that originated in a given geographic area. Including native plants in your monarch habitat is important. Not only are native plants a food source for monarchs, but they provide nectar for a variety of other pollinators and habitat for many other organisms. Additionally, native plants are well adapted for the climatic conditions of their region and are generally easier to care for.

Preserving not only a diversity of species, but also the genetic diversity within each species is also very important. Diversity in native plant communities supports many native insects and also provides a number of ecological benefits, such as erosion reduction and filtration. Native species vary genetically as they adapt to their particular environmental conditions, resulting in numerous different ecotypes of the same plant species (Wild Ones: Native Plants, Natural Landscapes, 2016). You can obtain locally sourced plants of your ecotype from local nurseries or producers, visit www.plantmilkweed.org for resources on finding local providers.

Monarchs and Milkweed

Monarch caterpillars require milkweed to grow and develop into butterflies, and they feed on many of the over 100 species of milkweed native to North America. Monarch conservation organizations have prioritized species for each region of the U.S. based on their importance to monarchs and potential to be used in restoration efforts, listed on page 21. These plants, key to monarch survival, grow well in disturbed areas and are found along roads and highways; in yards and gardens; in old fields; and in pristine native prairies and other natural habitats. Parks may already have milkweed growing naturally, and often have abundant potential opportunities for habitat expansion.

Many milkweed species are hardy and grow in a variety of different habitat types. Common places to find milkweed include short and tall grass prairies, livestock pastures, agricultural margins, roadsides, wetlands, sandy areas, and gardens. Though monarchs do find and use sites with just few milkweed plants, more plants support more monarchs. It is recommended that at least a few different native species of milkweed be included in plantings to improve the availability of suitable

and attractive milkweed host plants throughout the breeding season. See Appendix 1 for regional milkweed plant lists.

Monarchs and Nectar Plants

Adult monarchs feed differently than caterpillars. Their straw-like mouthpart, called a proboscis, allows them to consume nectar from a variety of different flowering plants. It is essential that adult monarchs have nectar available to them throughout their breeding and migrating seasons in order for them to reproduce and migrate.

It is recommended that all monarch habitats have a diverse set of both milkweed and other flowering resources to be the best habitat for monarchs possible. To ensure that their needs are met during each stage of their annual cycle, it is important to provide a diversity of species that will bloom from spring through fall. Planting native wildflower species, including milkweed, that are of the local ecotype is recommended, meaning that they originally came from the ecoregion where your habitat is. See the map of ecoregions on the next page. Look for nurseries or plant suppliers that sell locally sourced seed to find plants from your ecoregion.

In gardens, include a minimum of two to three different native flowering species for each part of the growing season, although native prairie seed mixes typically have many more species included. Local nurseries will be able to provide recommendations on plants that are



A 5th instar monarch caterpillar feeding on common milkweed (Asclepias syriaca).

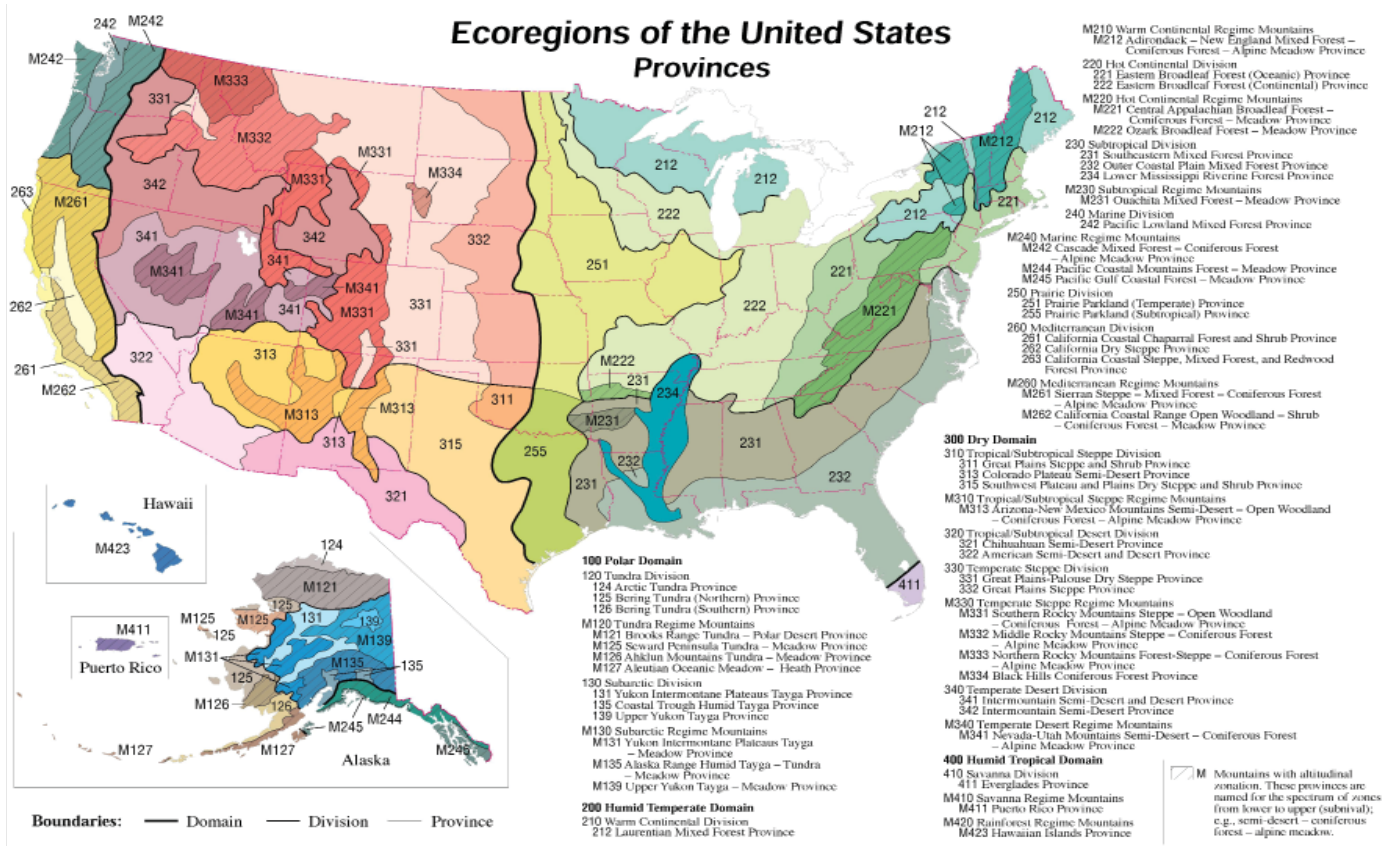
Many shrubs and trees bloom early in the spring, but other flower species are available and should be included in a monarch planting. Summer blooming species are usually readily available. Include many species of milkweed, depending on your region. Fall blooming species, like goldenrods, asters, and blazing star are vital for sustaining the monarch migration. Some examples of native, pollinator-friendly plants in different regions are shown below. This is not a comprehensive list; see Appendix 2 for complete native nectar plant lists by region and bloom time.

Other Habitat Requirements

Butterflies often feed in sunny areas, sheltered from the wind. Fences, shrubs, or other structures can serve as windbreaks, and can also be a good place for pupation. Adult butterflies use the sun's energy to warm up and most nectar and milkweed plants grow best in sunny spots. Adding flat rocks can help create basking zones for butterflies to regulate their temperature.

OPPORTUNITIES TO CREATE OTHER WILDLIFE HABITAT

With monarchs in mind, consider other wildlife habitat needs as well. Other wildlife can use many components of monarch habitat, and there are easy additions to include when incorporating monarch habitat into a landscape. Small pockets of bare ground can provide ground nesting pollinators or birds with suitable habitat for nesting or foraging. Dead trees and wood piles can serve as shelters for many other butterflies and pollinators that may overwinter in the area and use these features as shelter. Stem-nesting bees use plant stems or debris from the previous year as their primary shelter. Native grasses provide habitat for game birds, foxes, rabbits and many other species. Depending on the type of habitat, bird feeders, nest boxes, or baths may be added to help local and migratory song birds. You will be amazed at the wildlife that flocks to your park's monarch habitat.



Region*	Early Season Nectar Flowers	Mid Season Nectar Flowers	Late Season Nectar Flowers
California	Silver lupine, <i>Lupinus albus</i> . California redbud, <i>Cercis orbiculata</i> .	Narrowleaf milkweed, <i>Asclepias fascicularis</i> . California poppy, <i>Eschscholzia californica</i> .	Common sunflower, <i>Helianthus annuus</i> . Great Valley gumweed, <i>Grindelia camporum</i> .
Great Lakes	New Jersey Tea, <i>Ceanothus americanus</i> . Purple Coneflower, <i>Echinacea purpurea</i> .	Lanceleaf coreopsis, <i>Coreopsis lanceolata</i> . Butterflyweed, <i>Asclepias tuberosa</i> .	New England Aster, <i>Symphotrichum novae-angliae</i> . Prairie blazing star, <i>Liatris pynostachya</i> .
Maritime Northwest	Colomia, <i>Collomia grandiflora</i> . Showy milkweed, <i>Asclepias speciosa</i> .	Hardhack spiraea, <i>Spiraea douglasii</i> . Ocean spray, <i>Holodiscus discolor</i> .	New York Ironweed, <i>Vernonia noveboracensis</i> . New England Aster, <i>Symphotrichum novae-angliae</i> .
Midwest	Purple Coneflower, <i>Echinacea purpurea</i> . Wild blue phlox, <i>Phlox divaricata</i> .	Swamp milkweed, <i>Asclepias incarnata</i> . Wild bergamot, <i>Monarda fistulosa</i> .	Tall blazing star, <i>Liatris aspera</i> . Showy goldenrod, <i>Solidago speciosa</i> .
Mid-Atlantic	New Jersey Tea, <i>Ceanothus americanus</i> . Wild bergamot, <i>Monarda fistulosa</i> .	Dense blazing star, <i>Liatris spicata</i> . Butterflyweed, <i>Asclepias tuberosa</i> .	New York Ironweed, <i>Vernonia noveboracensis</i> . New England Aster, <i>Symphotrichum novae-angliae</i> .
Northeast	Eastern redbud, <i>Cercis canadensis</i> . Lanceleaf coreopsis, <i>Coreopsis lanceolata</i> .	Field thistle, <i>Cirsium discolor</i> . Dense blazing star, <i>Liatris spicata</i> .	Yellow ironweed, <i>Verbesina alternifolia</i> . Spotted Joe-Pye Weed, <i>Eutrochium maculatum</i> .
Southern Plains	Dakota mock vervain, <i>Glandularia bipinnatifida</i> . Betony leaf thoroughwort, <i>Conoclinium betonicifolium</i> .	Gray goldenrod, <i>Solidago nemoralis</i> . Blacksamson echinacea, <i>Echinacea angustifolia</i> .	Dotted blazing star, <i>Liatris punctata</i> . Maximillian sunflower, <i>Helianthus maximilian</i> .

*This table is a small selection, not a comprehensive list of recommended nectar plants. See <http://www.xerces.org/monarch-nectar-plants/> for full regional nectar plant lists for monarchs.

CONSERVATION OPPORTUNITIES FOR PARKS

Conservation Strategies for Parks

Without milkweed and nectar plant habitat, there would be no monarchs. Creating habitat is the most important way to contribute to monarch conservation, and the conservation of many other species and ecosystems. With so much land across our nation and in a variety of landscapes, parks have a huge opportunity to participate in this essential conservation strategy. Each of these strategies will be covered in detail in Section 2 of this guide.

However, monarch habitat conservation does not and should not stop at the park boundary. Effective conservation for monarchs will depend on large scale habitat corridors and linked landscapes. Look for opportunities to partner with adjacent public and private landowners, and build a support network for monarch conservation where you can.

Another strategy with ample opportunity for parks to contribute is education and outreach around monarch and pollinator conservation. Teaching park visitors and the general public about the decline in the monarch population and what they can do to support monarchs is vital to monarch conservation success. Parks can participate in this outreach in a wide variety of ways.

THE IMPORTANCE OF POLLINATORS

Plants need pollinators, and people need plants. Without pollinators, more than one third of the plants or plant products consumed by humans would disappear. Crops such as almonds, berries, apples, canola and others are unable to create fruit and reproduce without help from pollinators (Minnesota Department of Agriculture, 2014). The security and stability of our food sources and ecosystems are dependent on healthy pollinator populations. Parks can help protect pollinators by creating habitat and educating the public on the risks facing pollinators and ways they can help.



Continued research is important to understanding what other limitations may be affecting monarchs and discovering next steps for conservation. Park visitors and staff have the opportunity to contribute directly to ongoing monarch research through participation in citizen science programs. Citizen science provides people with hands on research activities and uses their results to inform existing efforts.

Partnerships are vital to an effective monarch conservation movement. Restoring the monarch population will take an 'all-hands-on-deck' approach. With such a widespread habitat range, monarchs will need to be able to find habitat on farms, parks, roadsides, backyards and more across the country to reach a sustainable population level.

The Monarch Joint Venture is working to connect all sectors involved in monarch conservation to coordinate their efforts and achieve better results for monarchs. Parks can work together with individuals, organizations, local businesses, schools and government agencies to improve monarch conservation efforts.

Pollinators and Parks

Monarchs are themselves pollinators, and serve as international and iconic representatives of all pollinators. Conservation of this iconic species will benefit pollinators and many other plants and animals. They use resources common to a large number of pollinators, and the size of their population therefore reflects the overall health of the environment for pollinators in general. The security and stability of our food sources and ecosystems are dependent on healthy pollinator populations.

Pollinators are primarily insects, including butterflies, bees, moths, beetles, wasps, and flies. However, there are even some vertebrate pollinators, such as bats in the southwestern US and various species of birds. Hummingbirds are a common pollinator that people love to see visiting their parks and gardens.

As reflected by the monarch population, pollinators of all kinds are in decline. There is increasing evidence that native bees, butterflies and other pollinators are no longer as abundant as they once were. Other pollinators face similar threats as monarchs do, including habitat

loss to urban and agricultural development, pesticide use, the spread of disease and climate change. Low genetic diversity is a known threat to bumble bee species, as well as the threat of commercially rearing native bees spreading pests and diseases to wild populations (The Xerces Society, 2008).

Monarch habitat benefits these diverse pollinators by providing flowers with the nectar and pollen that they need to survive. In turn, pollinators ensure the plants are able to reproduce as they transfer pollen from plant to plant. For example, milkweed is a favorite nectar source for bees and beetles.

In addition to the existing benefits of monarch habitat to pollinators, it is easy to expand habitat conservation and restoration projects to directly support other pollinators.

MONARCHS NEED PARKS

What you can do to help save the monarch is simple. Create habitat and educate the public.

"Parks can create habitat for monarchs and other pollinators. We have lost tens of millions of acres of habitat. Parks can play a big role in restoring that habitat.

The second, and possibly more important role that parks can play, is to educate the public. The conclusions of two presidential working groups and a host of conservation organizations is that if we are to save the monarch, it will take an all-hands-on-deck effort. We need parks."

- Dr. Chip Taylor, Monarch Watch (Dolesh, 2016).



Native bees require patches of bare sandy soil and dead plant stalks to spend the winter in. These requirements can easily be added to park habitat, and explained to visitors with interpretive signage. Both hummingbirds and insect pollinators like big swaths of colorful flowers; hummingbirds especially prefer red colored flowers. There are many other ways to incorporate diverse pollinator needs into monarch habitat, visit Appendix 1 for more information and resources on this topic.

Benefits of Monarch Conservation in Parks

Aside from the direct advantages to monarchs and other pollinators, as described above, there are many additional benefits that monarch conservation can bring to parks of all sizes.

Restoring native plants can reduce runoff and improve soil quality, benefiting the surrounding landscape and waterways connected to parklands. Native prairie and wildflower plants have deeper roots than typical lawn grasses, and can help stabilize areas prone to erosion because of their root system.

Monarchs are charismatic ambassadors for wildlife conservation. They can be used as a flagship species for talking about wildlife, pollinators, insects, or native landscapes in educational programming or other events. Their habitat is also beautiful, providing aesthetic benefits to park visitors through the opportunity to enjoy the wildflowers, see a monarch or other butterfly up close as they pass by the habitat, and enjoy hearing the sounds of songbirds that often flock to native plant habitat. Because their habitat is beautiful, and monarchs are well loved creatures, engaging in their conservation and publicizing it can lead to an improved reputation for parks.

Connecting monarch habitat creation with other wildlife, water and soil conservation, and beautification initiatives provides more extensive opportunities to seek funding for these conservation projects. For example, regional Soil and Water Conservation Districts may offer funding for water and soil quality improvements, and a monarch habitat thoughtfully constructed to also provide these benefits could be a viable candidate for funding.

Habitat Restoration

Parks provide a wide array of natural and recreational spaces for both people and wildlife across the country. Ranging from urban to remote, vast nature preserves to small neighborhood parks, highly maintained to wild, each different park has the opportunity to enhance or create monarch habitat in its own way. Putting more monarch habitat in the ground and encouraging others to do so is the most important thing parks, and anyone, can do to support monarchs. Every monarch that successfully migrates to wintering sites in Mexico or along the California coast begins its life as an egg on a milkweed plant and depends on nectar sources across miles of migratory flyway.

Small Scale Habitat

The more and bigger habitats the better, but one of the inspiring things about monarch conservation is that every milkweed and nectar plant counts. Monarchs frequent small butterfly gardens as nectar sources and breeding sites. Installing one or many small scale habitats for monarchs in a park can make a big impact. Planting a butterfly garden or other small habitat will provide a safe haven for monarch eggs and caterpillars, and help fuel adults during their migration.

Site Preparation and Characteristics

Start by replacing a patch of lawn or bare ground, or simply adding native plants to an existing site. Follow these guidelines as first steps.

1. Choose a sunny site. Butterflies need the sun's energy to warm up and most nectar and milkweed plants grow best in sunny spots. Adding flat rocks can help create basking zones for butterflies to regulate their temperature.
2. Include windbreaks. Butterflies prefer to feed in areas sheltered from wind. A fence, shrub, or a wall can serve as a windbreak, and can also be a good place for pupation. If the site does not have a wind break, consider planting a shrub.
3. Test the garden soil. This can determine whether the area is suitable for growing plants, or if it needs amendments. Sand, clay or wet soils may be difficult to plant in, and may require specialized techniques.
4. Prepare the soil by removing lawn or other plant cover, and raking the soil. Additional soil can be brought in as needed.

Large Scale Habitat

Installing large scale monarch habitat can take the form of prairies or meadows with abundant milkweed and nectar flowers. Prairies can range in size from very small to many acres, depending on the space you have available and maintenance capacity. In the long-term, pollinator prairie and meadow habitat is very low maintenance after the first few years of initial investment.

Site Preparation and Characteristics

Adequate site preparation and making sure you have the appropriate site characteristics are key to the success of your habitat. Here we cover the basic steps required to install large scale prairie or meadow habitat, and Appendix 2 provides many additional excellent resources for preparation and planning.

Many different kinds of sites can be excellent pollinator habitat, but there are a few important site characteristics to consider. Most native wildflowers require full sun to thrive, so choose an open area that receives full sun for most of the day. Level ground is ideal, but sloped



A Mid-Atlantic native monarch habitat in the Fall. Fall nectar flowers and opening milkweed pods can provide color and structure to landscaping when other landscaping is beginning to fade.

conditions also work if erosion is controlled during establishment. It is important to test the soil when considering a site, this will allow you to identify what kinds of plants will succeed in your habitat, and augment the soil as necessary.

Consider the surrounding area for potential threats such as pesticide drift or neighboring weed sources that may pose maintenance problems or threaten the pollinators you are working to attract. Certain weed species may not have high value for pollinators in general or monarchs specifically, so it is best to start with a plant selection that benefits monarchs and other pollinators.

Prairie habitat is also an excellent fit for marginal land, for example utility corridors that may run through your park, areas near parking lots or other roadside areas where other landscaping is difficult to maintain. Herbaceous plants such as milkweeds and other nectar plants will not penetrate pipes, threaten overhead power

lines, or create traffic hazards (The Xerces Society for Invertebrate Conservation, 2013).

According to the Tallgrass Prairie Center, “site preparation alters the existing vegetation and soil structure in advance of seeding, increasing emergence, growth and survivorship of the seeded natives by removing thatch, improving seed to soil contact, and reducing weeds” (Williams, Prairie Restoration Series #7: Site Preparation, 2015).

If you have non-native plant cover on your habitat site, such as turf grass or weeds, you will want to remove the existing vegetation to prepare your site for seeding. There are multiple ways to do so, one of which is the ‘Spray and Plant Option.’ The steps in this process are to first mow the site 4 inches high or less in the spring or late summer. Then, apply an appropriate herbicide when there is 4 to 6 inches of new growth on the site (this growth can take 2 to 4 weeks). For grass stands,

Parks in Action for Monarch Conservation

Lardner’s Point Park Native Habitat



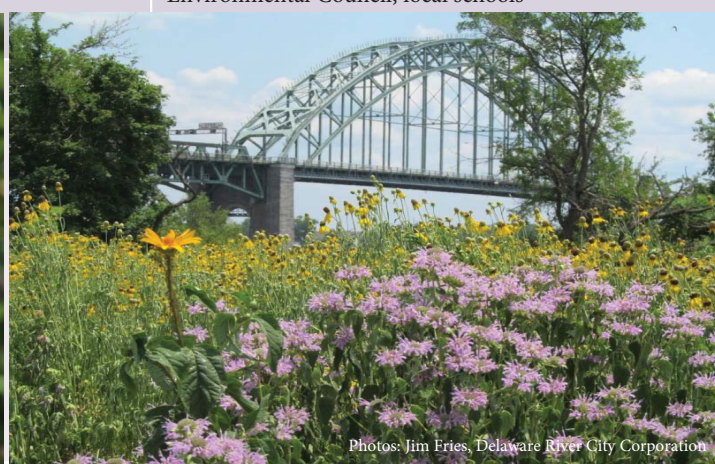
Lardner’s Park opened in Spring 2012, located along the Delaware River in Philadelphia. The Delaware River City Corporation and local school groups maintain pollinator meadows in the 5 acre park. A former brownfield and dumping site, this park has been restored to now have 7 habitat zones and 100 native species as the highlight of the park! Three feet along the park paths is the only mowed area.

Park size, type:

Large, City Park

Partners:

Philadelphia Department of Parks and Recreation, DRCC, Friends of Lardner’s Point Park, Pennsylvania Environmental Council, local schools



Photos: Jim Fries, Delaware River City Corporation

a mix of broadleaf and grass herbicides such as glyphosate and 2,4-D are recommended. If any green plants have grown after 14 days of the first herbicide treatment, re-spray those plants. In another 14 days your site will be ready to seed. Seed can be broadcasted or drilled (Williams, Prairie Restoration Series #7: Site Preparation, 2015). This method is very cost effective, but may not be as successful as longer term methods at removing perennial plant material. For other methods of stand replacement see Appendix 2.

If you have an established native grassland or prairie site and want to improve it to be better habitat for pollinators, you can add native milkweed and other forbs without eliminating the existing vegetation. There are several methods available to achieve this. It is possible to sow seed into the established vegetation with no disruption of the habitat, but the success of this method is low and requires patience. Alternatively, you can repeatedly mow and inter-seed the existing site by removing standing dead plant material through fall prescribed burning or late summer haying, then seeding with your desired seed mix in early spring using a no-till drill, and finally mowing 4 inches high every two or three weeks from late-April to early-September. Another option is to spray, mow and inter-seed the site by removing standing dead plant material through fall prescribed burning or late summer haying, spraying 50 percent of the site with grass herbicide when there is

4-6 inches of new growth, seeding in the fall or early spring using a no-till drill, and mowing once in early summer during the first growing season (Williams, Prairie Restoration Series #7: Site Preparation, 2015). For additional information about and methods of inter-seeding an established site see the Tallgrass Prairie Center Brochures listed in Appendix 2.

There are also several herbicide free methods of site preparation, such as solarization and sod removal. Solarization is particularly effective in smaller sites, and is the process of killing existing vegetation and weed seeds in the soil by laying down clear UV stabilized plastic for several months during the hottest part of the year. To solarize a site you will need to 1) remove all vegetation by mowing and raking the site in the spring, 2) smooth the site and irrigate it thoroughly, 3) lay down UV stabilized plastic (such as high tunnel greenhouse plastic), 4) bury the plastic edges and weigh them down if necessary to prevent airflow, 4) remove the plastic in early fall, and 5) immediately seed the site upon plastic removal. (The Xerces Society for Invertebrate Conservation, 2013)

Forbs, namely herbaceous flowering plants and including milkweeds, are the most important part of monarch and pollinator habitat, so it is important to select a seed mix that has an adequate representation of the right mix of flowering plants. Include a diversity of plants with varying bloom times, flower sizes, shapes, colors and heights to attract monarchs all season long as well as a diversity of other pollinators. Difficult to establish species may be most effectively planted using plugs after seeding the site.

While grasses do not provide nectar or pollen for monarchs or pollinators, they are an important component of a habitat for bees, other wildlife and for the maintenance and longevity of your site. Having a prairie seed mix that includes species from three different plant groups, 1) warm- and cool- season grasses, 2) legume and non-legume forbs, and 3) sedges, will increase the weed-resistance and wildlife-attractiveness of your site (Williams, Prairie Restoration Series #7: Site Preparation, 2015). Diverse mixes are better able to compete with weeds because they cover the site throughout the growing season. Therefore, it is recommended to include more species in the seed mix at lower seed rates than to plant fewer species at a higher seed rate.



Habitats like this filled of common milkweed (Asclepias syriaca) at Big Meadows in Shenandoah National Park are essential for breeding monarchs.

Habitat Maintenance and Management

Land management strategies to promote native milkweed and nectar plant growth are important to consider in monarch conservation efforts. Good management can reduce the effects of habitat disruption and promote native growth in a habitat. Replacing non-native species with native species encourages a healthy diversity of plants and animals and provides more ecological benefits. Some management strategies important in monarch habitat conservation include prescribed burning, well-timed mowing, native seed collection, native planting, and exotic species control.

How to manage your site to improve its value for monarchs:

- Minimize pesticide use in your site and advocate for less pesticide use in areas surrounding your site. If pesticide is required for successful management, make sure to choose compounds that are less toxic (refer to the Xerces Society guidelines (Vaughan, et al., 2015) in Appendix 1), do not apply when plants are flowering, apply using a spot spray or ground application when possible, and avoid spraying milkweed plants. Weed by hand when possible.
- Plan management practices for times outside of when monarchs are present at the site. See *Mowing: Best Practices for Monarchs* (Monarch Joint Venture, 2016) for recommendations by region on the best times to manage.
- Mow only up to 1/2 of the area at one time, so that viable habitat is continuously available during the breeding season.
- Control woody vegetation and non-native plants to encourage milkweed and nectar plant growth.
- Water milkweed and nectar plants in drought conditions and apply organic soil amendments to optimize plant growth (primarily for gardens).

Establishment of pollinator habitat takes 3 to 5 years. Without management during this critical time period, weeds and woody plants will take over the site and out-compete the newly emerging native plants. The intent of management in the first three to five years is to reduce unwanted plants or weeds, and stimulate growth of desired native plants. Early small scale management techniques include hand weeding, watering, and occasionally spot spraying tough-to-kill weeds. Early large scale management techniques include mowing, herbicide use, hand weeding small areas, prescribed burning, and watering (Williams, *Prairie Restoration*

Series #6: *Designing Seed Mixes*, 2015). After the first three growing seasons, most habitats will require little maintenance.

Mowing Newly Established Monarch Habitat

Mowing is essential during the establishment of a prairie or large scale monarch habitat. If weeds are permitted to grow high enough in the first few years of prairie habitat maintenance, they can create a closed canopy resulting in reduced germination, growth and survival of desired native prairie plants. Frequent mowing during the first and second growing seasons can prevent this issue and the resulting long term maintenance problems.

Any type of mower that the blades can be raised at least 4 inches may be used. As a general rule, weeds and other vegetation should not be allowed to get taller than knee high in the first growing season. This first year, mow to a height of 4 to 6 inches whenever vegetation reaches 12 to 18 inches high (Williams, *Prairie Restoration Series #9: Initial Post Seeding and Early Reconstruction Management*, 2015). If the mower leaves substantial debris or thatch behind it you may want to rake it away so as not to cover the seedlings (Minnesota Department of Natural Resources, 2011).

Early establishment mowing will not harm native plant seedlings, as most of them grow below 4-6 inches high in the first growing season. Prairie plants in particular grow primarily underground in the first couple years, as they develop extensive root systems.

Frequency of mowing in the second growing season of a habitat planting depends on the presence of weeds at your site. Never mow below 12 inches in the second growing season to avoid damaging desired native plants. If the weeds in the second season are patchy and scattered, hand pulling or spot mowing may be the most effective maintenance strategy. However, if there is a flush of tall weeds throughout the site, a 12 inch mowing just before weed flowering will reduce the weeds' ability to flower and go to seed (Williams, *Prairie Restoration Series #9: Initial Post Seeding and Early Reconstruction Management*, 2015). By now, most remaining weeds will be biennial species which develop a thick taproot during their first year and flower during the second year to reproduce before dying. It is essential to remove these weeds before they go to seed (The Xerces Society for Invertebrate Conservation, 2013).

Mowing should not be necessary by the third growing season. At this point, your efforts will begin to pay off, with grasses maturing and flowers regularly blooming and attracting pollinators and wildlife with very low maintenance needs. From now on, an annual or every other year cutting and burning cycle can be used as a clean-up procedure and prevention of woody plant growth at your site (Prairie Restorations Inc.). If, on the other hand, weeds persist widely and native plant establishment is less than 1 plant per square foot in the third growing season, site enhancement may be required to augment the site (Williams, Prairie Restoration Series #9: Initial Post Seeding and Early Reconstruction Management, 2015).

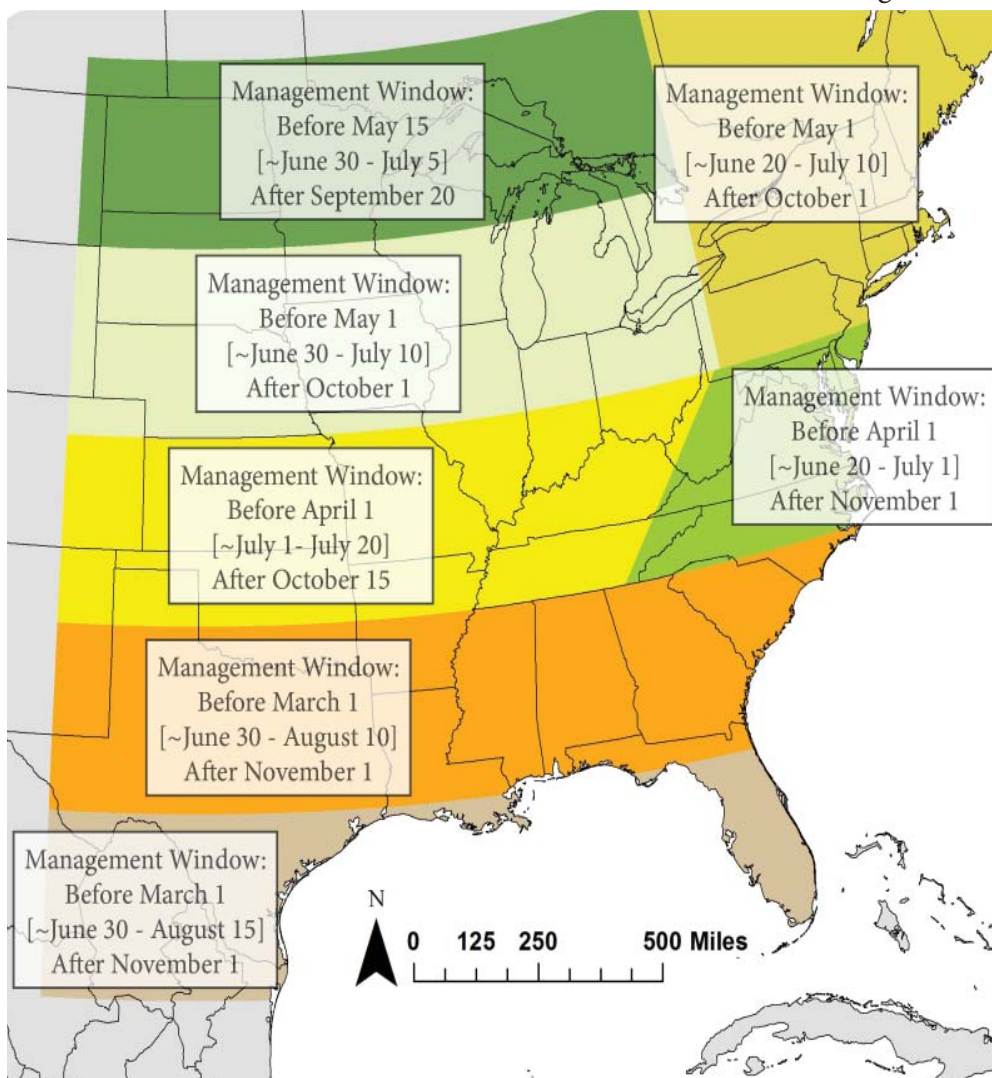
See Appendix 1 for further resources and information about mowing and site enhancement. When mowing, burning or otherwise managing the site after the third growing season, or an existing established site, it is important to consider the pollinators and other wildlife that will be using your site for habitat.

Post Site Establishment Mowing: Best Practices for Monarchs

Mowing an established site can be an effective management tool to control woody and weedy species and manage undesirable species from setting seed if timed appropriately. However, mowing too often or during certain times of the year may result in higher mortality for monarchs and other wildlife, including important pollinators, using the habitat.

Untimely mowing can result in high levels of insect mortality. Insect eggs, larvae, pupae and even adults may be killed directly by the mower, and mowing also destroys landscape features that provide structural diversity and may impact nesting areas used by pollinators. To limit monarch and other pollinators mortality, the following guidelines are recommended for established native plantings:

1. Avoid mowing the entire habitat to leave refuge areas for wildlife using the site at the time of mowing. This will allow for recolonization of the



Management Windows

These regions, separated primarily by latitude, offer different management windows in spring, summer and fall when mowing or other management may be safer for monarchs.

- Spring recommendations are primarily based on monarch breeding activity.
- Fall windows account for both monarch breeding activity and peak migration activity.
- Options listed in [] are recommended only if necessary. These summer mowing intervals may still cause some mortality. The two southernmost regions have been adjusted to avoid the primary nesting season for other grassland species.
- Data are based on long-term trends and variation from year to year may occur.

NOTE: These recommendations are based primarily on monarch breeding and migration activity. Please use these in conjunction with recommendations for other priority species to identify the most appropriate timing for your situation.

Visual created by Kelly Nail, University of Minnesota.

mowed site. Leave areas that may be good nesting or overwintering sites (leaf litter, dead stems, other ground cover) for pollinators or other wildlife, or known host plant areas if mowing during peak reproduction. Marking known areas may prevent accidental mowing.

2. Timing of mowing is critical (see map for regional recommendations). Avoid mowing during times of peak insect activity; this timing will vary between species. If your goal is monarch habitat, do not mow during times of high monarch reproduction or migration. Some areas may benefit from summer management to promote fall milkweed growth (and thus, monarch reproduction); this is reasonable for the southern Great Plains where monarch activity is low for an extended period of the summer.
3. If possible, avoid mowing while native plants are in bloom or before they have dispersed seed.
4. Limit mowing to no more than twice per year, and even less if possible. Mowing too frequently disrupts plant growth and the ability of forbs to compete with grass species. However, during the first year of prairie restoration, more frequent mowing may be needed for weed control.
5. Use a flushing bar and cut at reduced speeds to allow wildlife to escape prior to mowing.
6. Use a minimum cutting height of 8-12 inches (shorter heights may be needed for early establishment mowing). Mowing at this height will effectively remove seed producing parts of most invasive plants while minimizing impact to native plants and many insects.
7. Avoid mowing at night, when insects are inactive and unable to escape.

Timely mowing can promote milkweed growth, but if done during times of peak reproduction or migration it can be detrimental to monarchs. The most appropriate timing for mowing to promote monarch survival will vary with milkweed species and region. Fischer et al. (2015) found that mowing in early July in upstate New York could promote the growth of fresh foliage on milkweed plants, which is preferred for egg-laying by monarchs. Mowing or burning milkweed habitat during the summer in the southern Great Plains (OK, and parts of TX, NM, KS, CO, and NE) can promote milkweed growth to support late summer or early fall breeding in the region (Baum and Mueller, 2015). Research is ongoing to refine regional recommendations.

Nectar resources are needed by adult monarchs throughout their breeding and migration seasons. Thus, it is important to delay fall mowing activity until nectar sources have finished blooming to ensure abundant resources for monarchs' journey to their overwintering grounds. Mowing too frequently may impact floral resource diversity and abundance, in addition to putting monarchs and other pollinators at higher risk of being directly killed by the mower.

Monarchs east of the Rocky Mountains migrate south to the mountains of central Mexico for the winter. They depart from their overwintering colonies beginning in March, laying eggs in Texas and other southern states in mid-March through early-April. These eggs take a month or more to become adults; the adults expand northward, laying eggs on milkweeds along the way and reaching the northern parts of their range in early to mid-June.

As long as milkweed is present in the landscape, there is a chance that monarchs are also there and that mowing could result in direct monarch mortality. Check milkweed plants for monarch eggs and larvae, or for tell-tale signs that monarchs may be present, such as chewed leaves and caterpillar frass. If you find signs of monarchs, consider delaying mowing.

The timing of peak monarch breeding and migrating activity can vary from year to year. The recommendations presented here illustrate long term trends shown by data from Journey North, Monarch Watch, and the Monarch Larva Monitoring Project, but to verify monarch presence, we recommend you visit the Journey North interactive maps (<https://www.learner.org/jnorth/monarch/index.html>) frequently to see real-time observations of monarch activity each year.

Regional Milkweed Plant Lists for Parks

Below are recommendations for readily available milkweed species native to each U.S. region, put together by the Monarch Joint Venture.

See Appendix 2 for more milkweed lists as well as nectar plant recommendations for pollinators by region.



MONARCH JOINT VENTURE

Partnering across the U.S. to conserve the monarch migration

www.monarchjointventure.org

The Monarch Joint Venture is a partnership of federal and state agencies, non-governmental organizations, and academic programs that are working together to protect the monarch migration across the lower 48 United States.

MISSION

Recognizing that North American monarch (*Danaus plexippus*) conservation is a responsibility of Mexico, Canada and the U.S., as identified in the North American Monarch Conservation Plan, this Joint Venture will coordinate efforts throughout the U.S. to conserve and protect monarch populations and their migratory phenomena by developing and implementing science-based habitat conservation and restoration measures in collaboration with multiple stakeholders.

Our mission will be achieved by coordinating and facilitating partnerships and communications in the U.S. and North America to deliver a combination of habitat conservation, education, and research and monitoring.

VISION

The vision of this Joint Venture is abundant monarch populations to sustain the monarch migratory phenomena into perpetuity, and more broadly to promote monarchs as a flagship species whose conservation will sustain habitats for pollinators and other plants and animals.

Monarch Joint Venture
University of Minnesota
monarchs@monarchjointventure.org

Plant Milkweed for Monarchs

Monarchs cannot survive without milkweed. Monarch caterpillars need milkweed plants (*Asclepias* spp.) to grow and develop, and female monarch butterflies only lay their eggs on milkweed. With shifting land management practices, we have lost much milkweed from the landscape. Please plant milkweed to support monarch populations, and their incredible migration! Planting milkweed is a great way to help other pollinators too, as milkweed provides nectar resources to a diverse suite of bees and butterflies.



Northeast Region Milkweed Species



Common Milkweed
Asclepias syriaca
Well drained soils.
Photo by Louis-M. Landry



Swamp Milkweed
Asclepias incarnata
Damp, marshy areas.
Photo by Janet Allen



Butterfly Weed
Asclepias tuberosa
Well drained soils.
Photo by Thomas Muller, Lady Bird Johnson Wildflower Center



Whorled Milkweed
Asclepias verticillata
Prairies and open areas.
Photo © Kim Davis & Mike Stangeland



Poke Milkweed
Asclepias exaltata
Woodland areas (except in NE, KS, MO, ND & SD).
Photo by David Smith

Milkweed Regions

There are many native milkweed species in each of the six "Milkweed Regions" shown on this map. The species highlighted are known to be used by monarchs, and are easy to establish. Please try to find plants grown as close as possible to where you'll be planting them, and from the closest possible seed source.



South Central Region Milkweed Species



Green Antelopehorn Milkweed
Asclepias viridis
Dry areas and prairies. Also known as green milkweed.
Photo by Harlen Aschen



Antelopehorns Milkweed
Asclepias asperula
Desert and sandy areas.
Photo by Kip Kiphart



Zizotes Milkweed
Asclepias oenotheroides
Sandy/rocky prairies and fields.
Photo by Jennifer Kleinrichert

Southeast Region Milkweed Species



Butterfly Weed
Asclepias tuberosa
Well drained soils.

Photo by Thomas Muller, Lady Bird Johnson Wildflower Center



Whorled Milkweed
Asclepias verticillata
Prairies and open areas.

Photo © Kim Davis & Mike Stangeland



White Milkweed
Asclepias variegata
Thickets and Woodlands.

Photo by Melton Wiggins



Aquatic Milkweed
Asclepias perennis
Hydrated soils.

Photo © Kim Davis & Mike Stangeland



Sandhill/Pinewoods Milkweed
Asclepias humistrata
For use in some regions of FL. Dry sandy areas and soils.

Photo © Kim Davis and Mike Stangeland

Note: *Asclepias syriaca* and *Asclepias incarnata* are native to parts of this region and may also be suitable species to plant. More details on the native range of each species can be found at: <http://bonap.net/NAPA/TaxonMaps/Genus/County/Asclepias>

Western Region Milkweed Species

NOTE: Excludes Arizona; see below for Arizona milkweed.



Mexican Whorled Milkweed
Asclepias fascicularis
Dry climates and plains, except in CO, UT, NM & AZ.

Photo by Christopher Christie



Showy Milkweed
Asclepias speciosa
Savannahs and prairies.

Photo by Robert Potts © California Academy of Sciences

Selecting and Finding Milkweed Plants

While any of the species listed here can be grown in garden settings, please use species that are native to your county for larger restoration projects. You can find more information about milkweed, together with a directory of native plant vendors that sell milkweed plants and seeds, on our website:

www.plantmilkweed.org

Arizona Milkweed Species



Butterfly Weed
Asclepias tuberosa
Well drained soils.

Photo by Gail Morris



Antelopehorns Milkweed
Asclepias asperula
Desert and sandy areas.

Photo by Kip Kiphart



Rush Milkweed
Asclepias subulata
Desert areas.

Photo by Gail Morris



Arizona Milkweed
Asclepias angustifolia
Riparian areas and canyons.

Photo by Morris Family

California Milkweed Species



Mexican Whorled Milkweed
Asclepias fascicularis
Dry climates and plains.

Photo by Christopher Christie



Showy Milkweed
Asclepias speciosa
Savannahs and prairies.

Photo by Robert Potts © California Academy of Sciences



Desert Milkweed
Asclepias erosa
Desert regions.

Photo by Christopher Christie



California Milkweed
Asclepias californica
Grassy areas.

Photo by Christopher Christie



Heartleaf Milkweed
Asclepias cordifolia
Rocky slopes.

Photo by Dee E. Warenycia



Woolly Milkweed
Asclepias vestita
Dry deserts and plains.

Photo © 2010 Neal Kramer



Woolly Pod Milkweed
Asclepias eriocarpa
Clay soils and dry areas.

Photo by Br. Alfred Brousseau, St. Mary's College



MONARCH
JOINT VENTURE

*Common names vary from place to place, so we have used the USDA names for consistency.

Habitat Certification Programs

Large-scale habitat restoration across all landscapes is needed to offset the loss of monarch breeding and migratory habitat to help the monarch population rebound. To help drive public awareness and continued promotion of monarch and pollinator habitat, monarch habitats can be registered through various certification programs. This process connects your habitat site with a larger network of sites and can increase interest and engagement from the public. Listed here are several park-appropriate certification programs available to monarch habitats.

Monarch Habitat Success Stories

This online interactive map is facilitated by the Monarch Joint Venture. Points on the map are monarch habitat stories and experiences shared by people across North America. Categorized as gardens, managed corridors, agricultural areas, and natural and restored areas, these habitats represent the diversity of landscapes needed to help monarch populations rebound. <http://www.monarchjointventure.org/success-stories/>

Monarch Waystations

The Monarch Waystation program is administered by Monarch Watch and encourages monarch habitat growth in a variety of landscapes. You can register an existing habitat as a Waystation, or purchase a kit from

Monarch Watch that includes information and seeds for your region. You can also order a weatherproof sign to display at your registered Waystation, which will be included in an international Waystation registry. <http://www.monarchwatch.org/waystations/index.html>

Bring Back the Pollinators

Developed by the Xerces Society, this certification encourages planting nectar and pollen plants, establishing nesting and growth areas for pollinators, and the elimination of pesticides and herbicides in pollinator gardens. Participants can also display a weatherproof sign and sign a Pollinator Protection Pledge to help spread the word about the importance of habitat restoration. <http://www.xerces.org/bringbackthepollinators/>

NWF Certified Wildlife Habitats

The National Wildlife Federation (NWF) also encourages active habitat restoration through their Garden for Wildlife program. To create a Certified Wildlife Habitat, participants provide food and water for pollinators and other wildlife, create cover for various animals, provide safe places for wildlife to raise young, and actively maintain the health of their habitat area. <http://www.nwf.org/how-to-help/garden-for-wildlife/create-a-habitat.aspx>

Simply Have Areas Reserved for the Environment (SHARE)

The Pollinator Partnership administers an online interactive map highlighting natural habitats for pollinators. Participants plan and plant a pollinator habitat, focusing on habitat services such as food, water, and shelter and are encouraged to monitor and report their observations. A weatherproof habitat sign is also available for display. http://www.pollinator.org/SHARE_howto.htm

Million Pollinator Garden Challenge

The National Pollinator Garden Network developed the Million Pollinator Garden Challenge in order to address the dwindling pollinator populations across the United States. These gardens target an array of pollinators including bees, butterflies, birds, and bats. They have a five step process: Provide food, provide water, create cover, provide breeding space, and help establish a healthy and sustainable habitat. The habitats are included in this challenge are catalogued on the SHARE interface mentioned above, and many of the



A Monarch Watch Waystation habitat with milkweed and nectar flowers.

programs listed here contribute their registered habitats to the Million Pollinator Garden Challenge effort. <http://www.millionpollinatorgardens.org>

Education and Outreach

Parks are uniquely situated to not only create habitat, but to raise awareness and build community support for monarchs by educating the public about monarchs, their decline and conservation opportunities that individuals can take at home or outside the park. Setting an example by creating excellent monarch habitat can inspire visitors to create their own or take other conservation actions, and effective education about monarchs is key to achieving this ripple effect. Parks across the country, of any size, can contribute to monarch conservation by teaching visitors through educational signage, activities for adults and kids, and community events at the park.

Educational Signs and Displays

Interpretive signage is essential to public acceptance of and education about monarch habitat. Signage is an excellent way for visitors to enjoy their park experience by learning about the park, monarchs, habitat and conservation opportunities while enjoying the habitat.

Visitors may not be used to seeing prairie, native wildflowers, or plants once considered lowly weeds, such as milkweed, in their favorite park. Signage can also be very useful during the initial establishment of monarch habitat. A monarch garden or meadow takes a

few years to reach its prime. Especially during the first growing season, the public may be surprised at its appearance. Signage informing visitors the value of the landscaping changes they are seeing can improve their appreciation of the park and your conservation efforts, and will build excitement about what is to come with the maturing of this habitat site.

Displays in visitor centers and exhibits can be a wonderful educational experience for park visitors, and have the advantage of being indoors and usable year-round. Displays can provide more information and interactive experiences for visitors, and can range in investment and complexity. For example, a simple exhibit such as bringing a few monarch caterpillars indoors and raising them to adulthood can provide visitors an opportunity to see monarchs up close and personal and get excited about pollinators through that experience. A display such as a diagram or series of posters of the monarch life cycle can allow visitors to learn more in depth about monarch biology.

Educational signs and displays take many forms. Important considerations when designing signage are audience, readability, images, and materials. Considering the audience is essential for designing appropriate content. Take into account the demographics of your visitors and who frequents the location where your sign or display is to be located, and how the message best fits with your audience.

MONARCH INTERPRETIVE SIGNAGE

Signage can vary from permanent posters to temporary signs that can be updated or used for multiple purposes. There are benefits to both kinds of display, and considerations such as cost and intended audience are important to take into account. Below are examples of both varieties, a chalkboard with pollinator preferences at Pacific Grove Museum of Natural History, and a permanent interpretive display about the monarch migration.



Readability is one of the most important considerations. Ensuring there is a limited amount of text, that it is clearly legible and appropriately located will allow visitors to get the most out of your efforts and stay engaged with the message. Images draw the viewer in and should be a major component of any sign or display. Selecting the appropriate materials for your sign or display should involve considering how long you intend to use the display, if it is indoors or outdoors, and cost.

Public Engagement

In addition to educating the public about monarchs, parks can also involve visitors in monarch conservation activities directly, providing ways for families and individuals to engage in their community and support monarchs collectively. Whether through taking a class, attending a monarch festival or volunteering their time to create or monitor habitat, visitors can become more connected to your park and active in monarch conservation.

Monarch Activities for Kids and Families

Monarchs can inspire children to be more interested and engaged in nature, and providing educational opportunities at your park may spark a lifelong interest in conservation. Incorporating monarch activities for kids and families into your park's programming is one of the most important ways parks can support pollinators, and there are many ways to do so. Activities such as making Milkweed Seed Balls (see Appendix 3) are a hands-on way for kids of all ages to create monarch

habitat and learn about milkweed and monarchs. Giving a presentation for children can be interactive, informative and serve as a teaching opportunity for kids and their parents. Volunteers can lead indoor and outdoor activities for kids (such as the Monarch Migration Game or other hands-on activities). See Appendix 3 to find monarch presentations, activities and all kinds of monarch educational resources to put to use in your park.

Monarch Citizen Science in Parks

To understand the monarch migration, monarch researchers rely on the help of citizen scientists to collect data during all phases of the annual life cycle of monarch breeding, migrating, and overwintering. While measuring and studying overwintering colonies may provide the best estimate of population size, it is important to gain insight into breeding population trends and factors influencing the migration within the U.S. Each phase of the monarch annual life cycle plays a role in the overall health and abundance of North American monarchs.

Since eastern monarchs breed and migrate in and through the U.S., citizen scientists primarily collect data in those areas. In the western U.S. where monarchs overwinter along the Pacific coast, citizen scientists also help to estimate and record the overwintering population size. There are many opportunities for parks to participate in monarch citizen science efforts in the U.S.

FAMILY AND PARK FRIENDLY MONARCH ACTIVITIES



Activities like creating Milkweed Seed Balls (right) and participating in monarch tagging (left) are easy to implement and exciting programs that parks can provide to park visitors of all ages. Families, school groups, summer camps and everyday visitors can get involved in these fun, simple conservation actions.

Monitoring milkweed for monarch eggs, larvae and survival during the monarch breeding season is the perfect opportunity to engage park volunteers in an ongoing activity. Parks can also contribute to citizen science by holding monarch tagging events and demonstration in order to track the monarch migration and overwintering. Since Fred Urquhart's tagging success, researchers and citizen scientists have continued tracking the migration by reporting their observations of migrating monarchs and tagging. Parks and volunteers can also test tagged or reared monarchs for disease, helping researchers better understand the natural role of disease in monarchs. Below are examples of a few citizen science programs well suited for park engagement (see more in Appendix 3).

The Monarch Larva Monitoring Project helps researchers understand factors that affect monarch reproduction and development during the breeding season, determining how breeding populations vary in time and space. Volunteers from across North America observe and report monarch eggs and larvae on milkweed plants. Numerous activities provide different opportunities, depending on volunteer interests and time commitment. Activities include recording weekly monarch density, rainfall tracking, comparing characteristics of milkweed plants with and without monarchs, measuring rates of attack by monarch predators, and reporting single or anecdotal observations of monarchs or milkweed plants during the breeding season.

With over 1 million butterflies tagged and approximately 16,000 recovered tags, the **Monarch Watch** volunteer tagging program helps us understand the eastern monarch fall migration to Mexico. Tagging and recovery data provide information on the dynamics of the migration. Volunteers order circular, lightweight stickers that they place carefully on the wings of monarchs. Some monarchs are captured as adults and tagged, others are captured as eggs or larvae and then the adult butterfly is tagged and released. A unique ID number on each tag is used to keep track of information associated with each butterfly, tagger, and recovery.

The spread of a protozoan parasite of monarch butterflies, *Ophryocystis elektroscirrha* (OE), is tracked with the help of citizen scientists participating in **Project Monarch Health**. Volunteers receive a parasite sampling kit from Monarch Health before capturing

wild monarchs to sample. Samples can be from wild caught adults, or adults that have been collected as larvae and raised in captivity. To sample for the parasite, volunteers gently squeeze a small piece of tape around the abdomen of the butterfly. These scale samples are preserved on a note card, which is sent to Monarch Health for analysis.

Many smaller, localized citizen science programs have been implemented throughout the country. Based in the desert southwest, **The Southwest Monarch Study** program provides both tagging and monitoring of monarch habitats in Arizona, New Mexico, Nevada, Utah, western Colorado and the California deserts. Data collected from this project help us to understand the migration, breeding, and overwintering strategies of monarchs in the southwest U.S. Citizen scientists help Monarch Alert study western overwintering population characteristics. Volunteers tag monarchs at select California overwintering sites to help track movement between sites during the overwintering season.



Monarch citizen science is a great way to experience the outdoors, learn about conservation and get involved with the community.

Volunteer Engagement for Monarchs

Volunteers can be involved with monarch conservation efforts in parks in many ways, whether by attending a one-time habitat installation event, or monitoring your butterfly garden for monarchs every week. Important considerations when working volunteers are 1) good communication, 2) consistency, 3) training, and 4) follow-up.

Communication is essential to conveying what the expectations of volunteering are, and why it is important that volunteers get involved. Consistency refers to having regular opportunities for volunteers to engage in order to maintain their interest and commitment to your park. If you are doing weekly monarch monitoring through the Monarch Larva Monitoring Project, hold your monitoring events at regular times and commit to having a staff member lead the team every single week so volunteers can plan a consistent schedule, for example.

Training is essential for any kind of volunteer activity, regardless of how simple. At one time events, teach people who may never have worked with monarchs before about their habitat and population decline. When new volunteers join an ongoing project, make sure an experienced volunteer or staff can show them how to participate. It is a good idea to provide ongoing training opportunities for even experienced volunteers, or allow them to train in new participants, so they stay interested and feel a sense of personal growth.



A park volunteer running the Monarch Migration Game for children at a 'Monarch Fiesta' event held at Black Hill Regional Park, Maryland.

Good follow-up through thank-you's, regular updates on the progress of a habitat installation, or reminders about when the next monitoring session is will show volunteers their time is valued and can build a sense of connection to the park. With these four elements in place, your park can build an engaged community of monarch volunteers.

Citizen science is a perfect opportunity for volunteer engagement, through monarch tagging events or weekly monitoring of your milkweed habitat. Appendix 3 has information about various citizen science programs, and where to find more information about participation and training. Having a trained staff member who has practiced the project is essential to training in volunteers, and many programs offer detailed instructions or training videos on their websites.

Monarch habitat installations are also excellent ways to draw visitors to your park to participate in supporting monarchs. With a few knowledgeable staff to help supervise and instruct volunteers on how and where to plant, you can achieve a small scale monarch habitat installation while simultaneously providing the public with a meaningful way to get involved in monarch conservation and with your park.

Trained volunteers can contribute to promoting monarch conservation in parks. In addition to the ways described above, volunteers in parks can lead programs, supervise children's activities, teach gardeners how to plant certified monarch habitats, raise native plants (as many Master Gardeners do), construct monarch selfie-boards, mark milkweed stands to prevent mowing, answer questions from the public, and many other ways. You and your volunteers are only limited by your imagination and resources.

Monarch Festivals and Events

Holding a community monarch festival or other event can bring together the community at your park to celebrate and support monarchs. Festivals can be a large time commitment, and are most successful when many community partners are involved to increase awareness and publicity for the event.

Important considerations when thinking about hosting a monarch festival are 1) planning in advance, 2) building a planning committee, 3) involving diverse community partners in planning and implementing, 3)

considering your intended audience, and 4) considering what is feasible in the time and space available.

A successful example of a monarch festival is the annual Minneapolis Monarch Festival, produced by the Minneapolis Parks and Recreation Board and the Nokomis East Neighborhood Association in partnership with the University of Minnesota Monarch Lab and the U.S. Forest Service International Programs. Other community partners are involved through sponsorships and as exhibitors, local restaurants set up food stands, and community groups put on music and performances. The festival meets the needs of the local community by having many activities and materials available in Spanish as well as English, having activities for children and adults, and bringing in local exhibitors that can connect their content to monarchs. It is held around the same time each year, and has grown over time.

Parks Bringing Back Milkweed

Milkweed is essential to monarch butterfly survival, but historically it has been considered a weed that needs to be removed. Milkweed has been drastically removed from the U.S. landscape, and it can be hard to find a place to buy seeds or plants. This limited milkweed

plant and seed availability is often a barrier to creating habitat for monarchs, especially when seeking native plants derived from locally-sourced seeds. However, parks can help bring back these essential plants using milkweed on park lands to increase seed availability.

Parks and Local Milkweed Supply

There are often milkweeds and nectar flowers growing wild on park lands, and these plants can be used as a source of local seed for park and community habitat restoration projects. Volunteers in partnership with a local agency, native plant nursery or larger program can participate in such initiatives.

Organizations such as the Maryland Natural Heritage Program and Boulder County Parks and Open Space have worked on their parks to collect milkweed and wildflower seed for restoration projects happening within their park. Volunteers assist with collecting, cleaning and processing seeds in order to improve native plant seed availability for park restoration projects. If you have surplus milkweed seeds, they can be shared with the surrounding community or with the Monarch Watch Milkweed Market to broaden the reach of your park's monarch habitat conservation.

Collecting Milkweed Seed

To collect milkweed seeds from your park's monarch habitat, follow these guidelines (Monarch Watch, 2016), (Downs, How to collect milkweed seeds, 2014):

- Collect species native to your region. Do not collect seeds of rare or endangered milkweeds.
- When ripe pods split upon touch and the seeds are brown or "browning up," they are ready to collect. Do not collect pods in which the seeds are white, cream colored or pale. Check the pods for beetles or other seed eating insects.
- Label a separate, sealed container for the seeds of each milkweed species.
- Do not collect all of the milkweed seed pods. You want to leave some seed on site to disperse naturally. A good rule of thumb is to collect 1/3 and leave 2/3 of the seed pods. Many pounds of milkweed seeds are needed for seed mixes used in roadside or landscape restoration. Two to four paper bags of pods will yield about one pound of seeds.
- Keep the pods and containers dry, as they can mold quickly. You can use paper bags, boxes lined with newspapers, or other breathable, dry containers.

THE MILKWEED MARKET

Monarch Watch is taking a novel approach to building the commercial availability of regionally-sourced milkweed plants, while creating a demand for these plants. With increased demand, that native plant suppliers will be motivated to support this effort long term. Monarch Watch staff and volunteers are collecting, processing, storing, and shipping milkweed seeds and plants, recruiting milkweed buyers, and coordinating production and sales of milkweed. If you would like information about where to find local milkweed seeds, to gather and send milkweed seeds, organize a plant sale, or otherwise get involved you can find more information about this work at:

www.bringbackthemonarchs.org



- Incorporate as much genetic diversity as you can into your sampling of pods. Some species of milkweed form genetically identical clones through underground rhizomes. Therefore in order to get the widest range of genetic diversity you should collect pods from more than one site.
- Do not get milkweed sap in your eyes or mouth.

Once you have collected milkweed seed, you may need to process, store or germinate the seed. There are many ways to do so, see Appendix 1 for resources on cleaning, storing and germinating milkweed seed.

Growing Milkweed from Seed

Milkweed and most native wildflower plants need to be vernalized, or go through cold treatment in order to germinate. The easiest way to achieve this is to plant milkweed seeds in the fall, and allow it to occur naturally throughout the winter. Another excellent way to vernalize the seeds is through stratification.

To stratify milkweed seeds, place them in cold, moist potting soil in a dark place for several weeks or months. They can also be refrigerated between moist paper towels in a plastic bag. After 3-6 weeks the seeds are ready to be planted in warm soil. If you are having low germination rates even after cold treatment, it may help to ‘scarify’ the seeds through some form of physical abrasion such as shaking them in coarse sand. This process breaks down the seed coat and may be required or improve germination for some milkweeds (Downs, Milkweed seeds and propagation, 2014). See Appendix 1 for instructions on planting from seed.

Parks in Partnership for Monarchs

Partnership is a vital part of successful monarch conservation projects. Parks are often already engaged in community partnerships with educational programs, city partners and other initiatives. Community stakeholders such as schools, gardening clubs, Master Naturalists or Gardeners, local government, businesses, NGOs and agencies are wonderful resources when installing monarch habitat, hosting an event, or otherwise kicking off monarch conservation efforts in your park. The Monarch Joint Venture and the National Recreation and Park Association can serve as resources for finding partner organizations working with monarchs across the country and for information to get you started.

Innovations in Park Monarch Conservation

These projects found in parks nationwide show creative ways to implement monarch conservation partnerships. Ranging from large scale to small and from Massachusetts to Texas, there are ways for parks of all shapes, sizes and regions to bring monarch conservation into their communities.

Alexandra McFadden, education coordinator for New Bedford Parks, Recreation and Beaches in New Bedford, Massachusetts, says, “We have an after-school program at Hayden-McFadden Elementary School that has been participating in a weekly pollinator education program. Every Friday after school, about 50 students work with a local college student to learn about pollinators like monarch butterflies and why they are so important. They do all kinds of research and arts and crafts projects relating to pollinators and plant milkweed seeds in soil to take home to replant in their own gardens for monarch conservation. The program will culminate with a trip to a local university to present their research and see Jane Goodall give a presentation on environmental conservation.”

The Kansas City, Missouri, Department of Parks and Recreation is partnering on a monarch demonstration garden at Loose Park in Kansas City, according to Director Mark McHenry. This project is funded in part by a monarch conservation grant from the National Fish and Wildlife Foundation. The garden will be the site of educational programs and will be maintained and monitored by volunteers from a local garden club. The volunteers will report results to monarch monitoring organizations and the Field Museum in Chicago as part of the EPIC program (Ecological Places in Cities).

In Fort Worth, Texas, Gail Manning, entomologist and education team leader at the Fort Worth Botanic Gardens, part of the Fort Worth Parks and Recreation Department, says “I collect wild milkweed seeds from local native milkweed plants, package them up with an instruction sheet and distribute them to the public.” She says the center has an extensive program for monarchs and other pollinators. “I came up with the idea for distributing milkweed seeds simply because I wanted to give people an opportunity to provide habitat for monarchs. We talk a lot about creating habitat for monarchs, and this just seemed one of the best ways to do it.” She noted the importance of planting other nectar-bearing plants on which a variety of pollinators

can feed, but it is monarchs that the public loves most. “When the weather cools and monarchs come through Fort Worth, our residents might see a dozen monarchs. When they come here to the botanic garden they might see hundreds. People really look forward to the migration of the monarchs” (Dolesh, 2016).

Finding Funding for Monarch Conservation

Large and small scale monarch conservation projects can benefit from financial support, either to enhance an existing site with native, locally sourced milkweeds or nectar sources, or to establish a new site from scratch. If you are looking for funds to install or enhance habitat for monarchs and other pollinators, here are a few tips to consider when looking for funding.

For small-scale garden habitats, the primary funding opportunities are local to your state or community. Some

national garden grant opportunities may be available, but these opportunities are not consistently available and may vary from one year to the next. Contact your state’s department of conservation or natural resources as a starting point. Locally, you may also find support from a business or other local entity that may have resources to support community development or engagement.

Partnering with a school or educational institution can broaden your access to funding, and can draw students to your park’s habitat for environmental education opportunities around monarchs. The University of Minnesota Monarch Lab has a list of garden grants (see Appendix 1) for school and educational institutions (University of Minnesota Monarch Lab, 2016).

It is important to connect with other stakeholders in your community that have similar conservation interests. These groups may have funding available for

Parks in Action for Monarch Conservation
Oahe Downstream Prairie Butterfly Garden



The USFWS South Dakota Field Office received a grant and partnered with the South Dakota Game Fish and Parks staff to create this habitat in 2013. It is a noticeable feature for state park visitors, with elementary school groups making regular visits. The park hosts special events to promote local interest in butterflies and other pollinators. This garden is as much an education al site as a monarch habitat!

Park size, type:	Medium, State Park
Partners:	USFWS South Dakota Field Office, South Dakota Game Fish and Parks, local elementary schools, Monarch Watch Waystation Program



Photos: Charlene Bessken, USFWS

local projects, have information and expertise to share as your project progresses, and may be able to help you leverage opportunities for low-cost or free materials to use for your project. Connect with naturalist groups like Master Naturalists, Master Gardeners, Pheasants Forever, or Wild Ones chapters (among others!) who have similar interests. These groups could provide local seeds they have collected, or may have plant materials to transplant from existing gardens.

Community scale projects or public projects may be able to work with local native plant producers to provide seeds or plant at low or no-cost. Talk with local nurseries to see if there are opportunities to work closely with them on these types of projects.

The National Fish and Wildlife Foundation Monarch Butterfly Conservation Fund is an opportunity for large projects; they typically have an annual request for proposals. A number of parks initiatives have been funded through this foundation. State wildlife

conservation groups; local community foundations; clubs such as the Kiwanis, Rotary, and others; and community improvement foundations are ideal sources to seek funding for a monarch waystation or a pollinator garden.

Also keep in mind that restoring habitat for monarchs has many co-benefits. Leverage other funding opportunities that prioritize migratory bird habitat, water quality, or another conservation initiative. If you recognize and make connections to multiple species and environmental benefits, you will broaden your opportunities to support a habitat restoration project, even if your primary goal is monarch conservation. There may be professional development opportunities to train park employees in conservation efforts for these additional species and environmental issues that could also teach skills applicable to monarch conservation. Think creatively, and search to find conservation minded funding opportunities through agencies, trusts, foundations, or other entities.



APPENDICES

1. Additional Resources

General Monarch & Pollinator Information

- Monarch Joint Venture Resources: <http://www.monarchjointventure.org/resources/>
- Monarch Conservation Talking Points, Monarch Joint Venture: <http://www.monarchjointventure.org/resources/downloads-and-links/>
- Pollinator Conservation Resource Center, The Xerces Society for Invertebrate Conservation: <http://www.xerces.org/pollinator-resource-center/>

Creating Monarch Habitat

- Create Habitat for Monarchs, Monarch Joint Venture: www.plantmilkweed.org
- Bring Back the Monarchs Milkweed Information, Monarch Watch: <http://monarchwatch.org/bring-back-the-monarchs/milkweed/>
- Establishing Pollinator Meadows from Seed, The Xerces Society for Invertebrate Conservation: <http://www.xerces.org/wp-content/uploads/2013/12/EstablishingPollinatorMeadows.pdf>
- Growing Milkweed for Monarch Conservation, Monarch Joint Venture and USFWS National Conservation Training Center: https://youtu.be/51DVhq7k7BA?list=PLZb5DyVcCk955KQKL4J_Ca7aVmzBbM7pr
- Guidelines for Establishing a Prairie, Prairie Restorations Inc.: <http://monarchjointventure.org/images/uploads/documents/guidelinesII.pdf>
- How to collect milkweed seeds, Native Plant Society of Texas: npsot.org/wp/story/2014/5885/
- Milkweed Seed Finder, The Xerces Society for Invertebrate Conservation: <http://www.xerces.org/milkweed-seed-finder/>
- Milkweed seeds and propagation, Native Plant Society of Texas: npsot.org/wp/story/2014/5933/
- Monarch Garden Grant Opportunities, University of Minnesota Monarch Lab: <http://monarchlab.org/education-and-gardening/gardening-for-monarchs/garden-grants/other-garden-grant-opportunities/>
- Monarch Waystation Program, Monarch Watch: <http://monarchwatch.org/waystations/index.html>
- Prairie Restoration Series Technical Guides, Tallgrass Prairie Center: http://monarchjointventure.org/images/uploads/documents/Tallgrass_Prairie_Center_Technical_Guides_all_in_one.pdf
- Pollinators in Natural Areas: A Primer on Habitat Management, The Xerces Society for Invertebrate Conservation: http://monarchjointventure.org/images/uploads/documents/pollinators_in_natural_areas_xerces_society.pdf
- Tallgrass Prairie Center Publications: <http://www.tallgrassprairiecenter.org/publications>

Citizen Science

- Monarch Citizen Science, Monarch Joint Venture: http://monarchjointventure.org/images/uploads/documents/citizen_science.pdf

2. Regional Plant Lists

National

- Eco-regional Pollinator Planting Guides, Pollinator Partnership: <http://www.pollinator.org/guides.htm>
- United States Regional Milkweed Plant Guide, Monarch Joint Venture: <http://monarchjointventure.org/images/uploads/documents/MilkweedFactSheetFINAL.pdf>
- United States Regional Monarch Nectar Plant Guides, The Xerces Society for Invertebrate Conservation: <http://www.xerces.org/monarch-nectar-plants/>

Eastern

- Eastern Migration Monarch Fueling Guide, Pollinator Partnership: <http://pollinator.org/monarchfueling.htm>

- Mid-Atlantic Pollinator Plant List, Lady Bird Johnson Wildflower Center, The Xerces Society for Invertebrate Conservation: http://www.wildflower.org/collections/collection.php?collection=xerces_mid-atlantic
- Midwest and Northeast United States Monarch Host and Nectar Plants, Wild Ones: http://monarchjointventure.org/images/uploads/documents/WFM_Brochure_final.pdf
- Northeast Pollinator Plant List, Lady Bird Johnson Wildflower Center, The Xerces Society for Invertebrate Conservation: http://www.wildflower.org/collections/collection.php?collection=xerces_northeast

Midwest

- Great Lakes Pollinator Plant List, Lady Bird Johnson Wildflower Center, The Xerces Society for Invertebrate Conservation: http://www.wildflower.org/collections/collection.php?collection=xerces_greatlakes
- Midwest and Northeast United States Monarch Host and Nectar Plants, Wild Ones: http://monarchjointventure.org/images/uploads/documents/WFM_Brochure_final.pdf
- Midwest Plant Recommendations for Monarch Butterflies, NRCS, The Xerces Society for Invertebrate Conservation: http://www.xerces.org/wp-content/uploads/2015/10/Midwest_Plants_List_for_Monarch_Butterflies.pdf
- Midwest Pollinator Plant List, Lady Bird Johnson Wildflower Center, The Xerces Society for Invertebrate Conservation: http://www.wildflower.org/collections/collection.php?collection=xerces_midwest
- Native Milkweeds of the Central United States, Monarch Joint Venture, NRCS, The Xerces Society for Invertebrate Conservation: http://monarchjointventure.org/images/uploads/documents/Milkweeds-of-Central-US-plus-vendors_XercesSociety.pdf

Southeast

- Southeast Monarchs, Milkweeds and Host Plants, Florida Museum of Natural History, University of Florida, The Xerces Society for Invertebrate Conservation: <http://monarchjointventure.org/images/uploads/documents/SE-Monarch-milkweed-butterfly-host-plant-brochure-final-2012.pdf>

Southern Plains

- Southern Plains Plant Recommendations for Monarch Butterflies, NRCS, The Xerces Society for Invertebrate Conservation: http://www.xerces.org/wp-content/uploads/2015/10/Southern_Plains_Plants_List_for_Monarch_Butterflies.pdf

Southwest

- Native Milkweeds of the Desert Southwest, USDA, Monarch Joint Venture, The Xerces Society for Invertebrate Conservation, Southwest Monarch Study, National Park Service, Make Way for Monarchs: http://monarchjointventure.org/images/uploads/documents/Native_Milkweeds_of_the_Desert_Southwest.pdf

Western

- California Pollinator Plant List, Lady Bird Johnson Wildflower Center, The Xerces Society for Invertebrate Conservation: http://www.wildflower.org/collections/collection.php?collection=xerces_california
- Maritime Northwest Pollinator Plant List, Lady Bird Johnson Wildflower Center, The Xerces Society for Invertebrate Conservation: http://www.wildflower.org/collections/collection.php?collection=xerces_northwest

3. Educational Resources

Classroom Resources

- Journey North Monarch Migration Tracking: <http://www.learner.org/jnorth/monarch/index.html>
- Parks and Kids Saving the Monarch Butterfly Webinar, National Recreation and Parks Association: <http://www.nrpa.org/media/webinars/Monarch%20Tag%20Team/lib/playback.html>
- Project Monarch Health Classroom Resources: <http://monarchhealth.wix.com/monarch#!classroom/c1inz>
- University of Minnesota Monarch Lab Curricula: <http://monarchlab.org/education-and-gardening/curricula/>

Hands-on Activities

- Macaroni Monarchs Activity, University of Minnesota Monarch Lab: http://monarchjointventure.org/images/uploads/documents/Macaroni_Monarchs_Write_Up.pdf
- Monarch Migration Game, University of Minnesota Monarch Lab:: http://monarchlab.org/images/uploads/curricula/K2_MO_Lesson_4_migration_game.pdf
- Monarch Watch Tagging: <http://monarchwatch.org/tagmig/index.htm>
- Origami Butterflies, University of Minnesota Monarch Lab:: http://monarchlab.org/images/uploads/curricula/Origami_Butterflies_LC36.pdf
- Seed Bombs for Monarchs, University of Minnesota Monarch Lab:: http://monarchjointventure.org/images/uploads/documents/Seed_Ball_Write_Up_FINAL.pdf
- Southwest Monarch Study Tagging: <http://www.swmonarchs.org/>

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