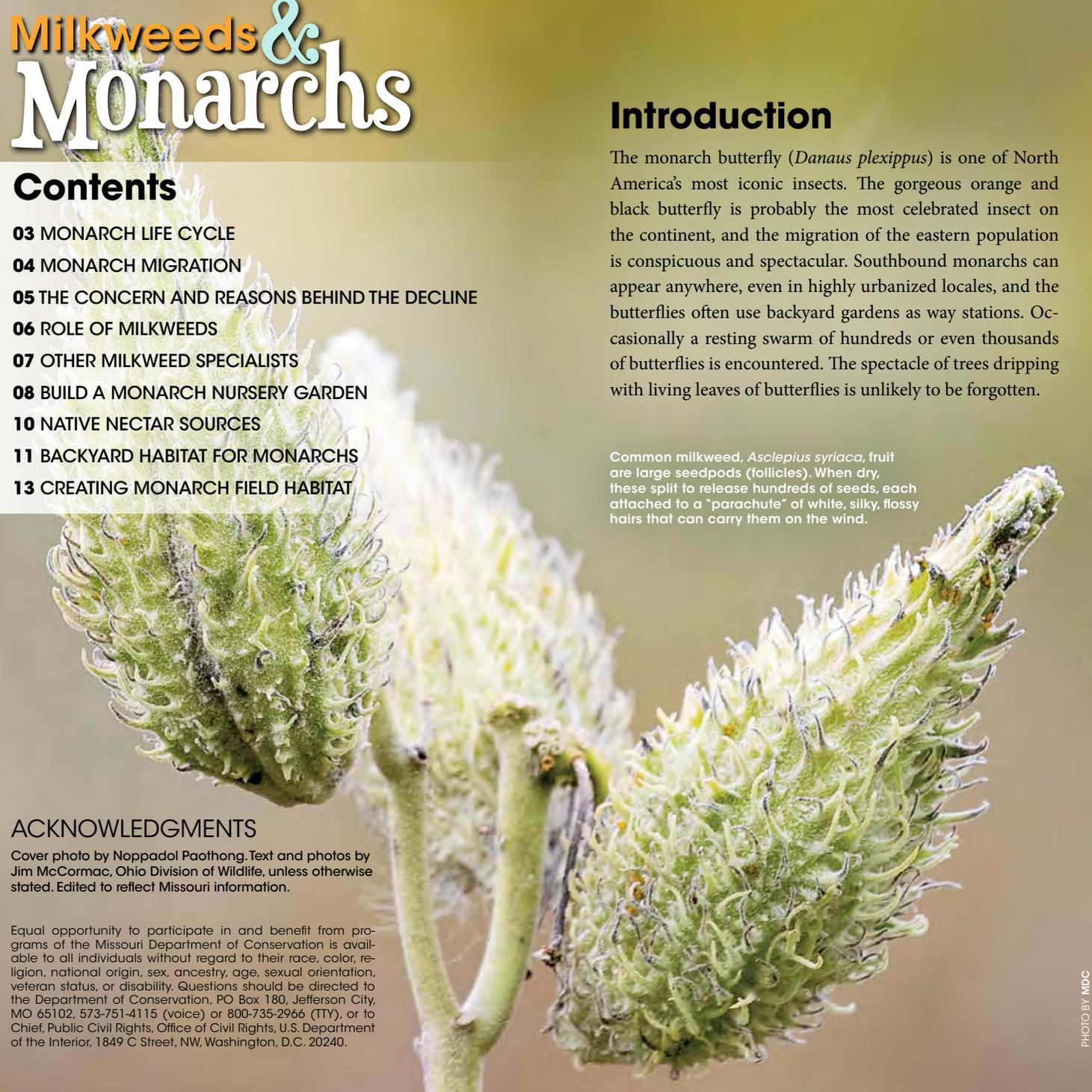


Milkweeds & Monarchs



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Introduction

The monarch butterfly (*Danaus plexippus*) is one of North America's most iconic insects. The gorgeous orange and black butterfly is probably the most celebrated insect on the continent, and the migration of the eastern population is conspicuous and spectacular. Southbound monarchs can appear anywhere, even in highly urbanized locales, and the butterflies often use backyard gardens as way stations. Occasionally a resting swarm of hundreds or even thousands of butterflies is encountered. The spectacle of trees dripping with living leaves of butterflies is unlikely to be forgotten.

Common milkweed, *Asclepius syriaca*, fruit are large seedpods (follicles). When dry, these split to release hundreds of seeds, each attached to a "parachute" of white, silky, flossy hairs that can carry them on the wind.

ACKNOWLEDGMENTS

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A Journey From Egg to Caterpillar to Chrysalis to Butterfly



PHOTOS BY NOPPADOL PAOTHONG

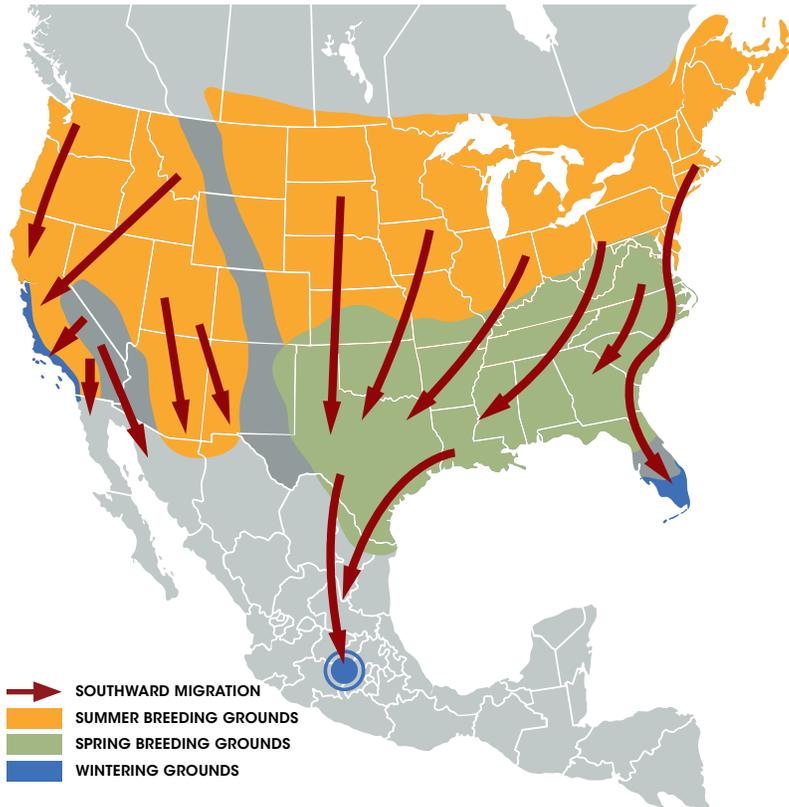
Monarch Life Cycle

Like all species in the order Lepidoptera (moths and butterflies), monarchs undergo **complete metamorphosis**. This term indicates that there are four parts to the life cycle: egg, caterpillar, pupa, and adult. A vital component of the monarch's life cycle is its **host plant**. Host plants are plant species that a moth or butterfly must have as food for the larvae (caterpillars). Caterpillars can only eat a select suite of plant species that are chemically compatible with that particular moth or butterfly species. In the case of the monarch, the host plants are milkweeds and a close relative called sand vine (*Cynanchum laeve*), native in Missouri. The butterfly lays its eggs on milkweed plants, and tiny caterpillars soon hatch. The caterpillars then begin eating the

milkweed foliage, and they grow rapidly. The growth process involves five molts where the caterpillar sheds its skin and emerges slightly larger each time. Each stage between molts is termed an **instar**. After reaching the end of its fifth and final instar, the monarch caterpillar enters the pupa stage and forms a beautiful chrysalis, in which its tissues are transformed and reorganized into the adult butterfly. Once the transformation is complete, the butterfly forces its way from the chrysalis and fluid is pumped into the wings to make them expand. Once the wings harden, the butterfly is ready to take flight. The entire process, from egg to adult butterfly, takes four to five weeks.

Monarch Migration

The state of Missouri is within the migratory flyway of the eastern population of the monarch butterfly—a species that has declined dramatically over the past 20 years. Depending on the length of the season, which can be dictated by weather, monarchs might have from two to four different broods in Missouri. In the fall, the adults produced from the last hatch will make an incredible journey to high-elevation oyamel fir forests in central Mexico. This journey might entail traveling nearly 2,000 miles, one way. Once in Mexico, the butterflies congregate in massive numbers in a few favored locales. Roosting trees are blanketed with butterflies, creating one of North America's greatest natural spectacles. In the spring, usually early March, monarchs start returning north to their breeding areas, a range that includes Missouri, and the cycle starts again. Females lay eggs on emerging milkweeds throughout most of the green area on the map. The offspring of this first brood then colonize the remainder of the breeding range in eastern North America.



Monarch nectaring on ox-eye sunflower, *Heliopsis helianthoides*.



Monarch egg on common milkweed, *Asclepius syriaca*, leaf; caterpillar in back.



Monarchs resting after crossing Lake Erie, Cleveland, Ohio.

The Concern

Eastern monarch populations have declined alarmingly in recent years. The wintering population in Mexico was at its lowest recorded level in winter 2013–2014, and many observers reported seeing few if any monarchs in eastern North America in summer and fall of 2013. The two next lowest wintering population levels were recorded within the last decade. Experts estimate that the eastern population of monarchs has diminished by 90 percent over the past 20 years. This alarming downturn in numbers serves as an environmental red flag, and efforts are underway to correct the conditions that have led to losses in the monarch population.

Reasons Behind the Decline

Scientists who study monarchs cite several causes for population declines: 1) Timbering, possibly increased infestations of bark beetles, and perhaps an escalation of air pollution, have been detrimental to the Mexican oyamel fir forests where many monarchs overwinter. 2) An apparent increase in untimely weather events characterized by hail, freezing temperatures, and high winds have buffeted monarchs on the wintering grounds and during their northbound migration. The mortality caused by storm events in 2010 was thought to be 50 percent. 3) A precipitous decline in milkweeds in much of eastern North America is likely a major factor in monarch declines. The organization Monarch Watch calculates that about 2.2 million acres of potential milkweed—and thus monarch—habitat is lost in the United States each year. Much of the loss in native milkweeds stems from land use changes and more efficient management practices on commercial, residential, and agricultural lands, as well as a lack of milkweed management on conservation lands, both public and private.



PHOTO BY NORADOA

Monarchs gather at the Monarch Butterfly Biosphere Reserve in central Mexico.



PHOTO BY © Dan Guraevich/CORBIS

Illicit logging has threatened monarch wintering grounds.

Role of Milkweeds

Monarchs depend on milkweeds as host plants. The butterflies deposit eggs on milkweed plants, which then provide nutrition for the caterpillar phase of the butterfly's life cycle. Plants in the milkweed family contain poisons known as cardiac glycosides, which render them unpalatable to most insects. Monarch caterpillars, and a handful of other insects, have evolved the ability to assimilate milkweed toxins. As the caterpillars, and subsequently the butterflies, sequester these toxic compounds in their bodies, they become distasteful to many predators.

While milkweeds were long placed in their own family (Asclepiadaceae), they are now considered a subfamily of the much larger dogbane family (Apocynaceae). Eighteen species have been recorded in Missouri, and monarchs will use at least 13 of them as host plants (see Pages 8–9 for our top suggestions). If you plant milkweed, avoid using tropical milkweed, or blood flower, *Asclepias curassavica*, which is often sold as an ornamental plant attractive to monarchs. It is an annual, indigenous from southern Mexico south into South America. Stick to species native to Missouri, or whatever region you live in. Monarch Watch is an excellent source for milkweeds; visit their website at monarchwatch.org/milkweed/market.



PHOTO BY MDC

Red milkweed beetle, *Tetraopes tetraphthalmus*, larvae feed on milkweed roots; adults eat leaves, buds, and flowers.



The milkweed tussock moth caterpillar, *Euchaetes egle*, resembles a mass of pipe cleaners twined together. It is a charismatic component of milkweed fauna.



Large milkweed bugs, *Oncopeltus fasciatus*, are often fixtures on milkweed plants.



The unexpected cynthia moth, *Cynthia inopinatus*. Its caterpillar feeds on milkweed and dogbane.



Milkweed blooms attract many nocturnal pollinators such as this banded tussock moth, *Halysidota tessellaris*.



Butterflyweed attracts scores of interesting pollinators, such as this great golden digger wasp, *Spheg ichneumoneus*.

Milkweed leaf beetles, *Labidomera clivicollis*, are colorfully ornate and prefer swamp milkweed.

Other Milkweed Specialists

It isn't just monarch butterflies that depend upon milkweeds. These plants spawn a blizzard of biodiversity, especially with the legions of pollinators that visit the flowers. In addition to monarchs, there are numerous other insect species that are milkweed dependent—milkweeds are the only plants that meet their nutritional requirements. It doesn't take much inspection of milkweed plants to find milkweed specialists. Most of the insects that specialize on milkweeds are boldly marked with black and orange. Such "loud" coloration is termed aposematic—the bright hues serve to warn would-be predators that the colorful insects are toxic, and predators quickly learn to shun them. These insects' toxicity is derived from consuming the poisonous cardiac glycosides in milkweed sap. If you plant milkweeds, chances are great you will soon attract one or more of the species on this page and the previous one. The species shown on Pages 8 and 9 do not harm monarchs, and some are beneficial pollinators.

Orange assassin bugs, *Psellipus barberi*, are one of many tiny predators that hunt in milkweed flowers.



Build a Monarch Nursery Garden

The following four species might be considered über-milkweeds—species that monarchs seem especially attracted to for egg-laying purposes. All are fairly easy to grow, attractive, and available in the native plant trade. Any monarch nursery garden in Missouri should be planted with at least one of these species, and the more the better! On Page 9 is a list of other native Missouri milkweeds known to host monarchs. Page 10 shows a small selection of native plants that are prime nectar sources for adult monarchs; they are also attractive companion species in a milkweed garden.

Don't mow down the old plants once they have flowered. The fruit pods of milkweeds are attractive, and they release their wind-borne seeds well after the plants have bloomed. American goldfinches use the silky hairs (comas) attached to milkweed seeds for their nests. Long-dead milkweed stalks that are still standing the following spring can provide nesting fibers for Baltimore orioles and other birds.



Baltimore oriole nests often incorporate the fibers from dried milkweed stalks.

BUTTERFLYWEED

Asclepias tuberosa

This is one of only a handful of native Missouri plants with bright orange flowers. Butterflyweed is a real attention-getter, both to people and insects. While monarchs may not use it as a host plant as frequently as they do some other milkweed species, butterflyweed more than carries its weight in the garden. Its flowers are a magnet for all manner of pollinating insects. Not only are monarchs attracted to its blooms, so are numerous other species of butterflies.



COMMON MILKWEED

Asclepias syriaca

The aromatic flowers of this species exude a powerfully sweet scent that can be detected many feet away. Common milkweed is aptly named, as it is by far the most frequent species in the state, and it occurs in every county. Unfortunately, common milkweed is often considered a weed, and people often try to eradicate it. Common milkweed can spread rather aggressively, so gardeners may have to rein it in on occasion.



PURPLE MILKWEED

Asclepias purpurascens

Few milkweeds can match the gorgeous magenta flowers of this species. So striking is purple milkweed when in full bloom that it might be mistaken for an exotic ornamental. It is fairly tolerant of a variety of conditions, from partial shade to full sunlight, and dry to moist soil. Blooming period is typically in June and July. In addition to numerous species of butterflies, the flowers attract a variety of interesting moths.



SWAMP MILKWEED

Asclepias incarnata

This is our only wetland milkweed species, and it will flourish along pond margins or other damp sites. Swamp milkweed normally grows well in rich, well-drained soils of gardens, too. While its flowers are normally a stunning rose-pink, a form with snow-white flowers is found on occasion. It seems to be a favorite of the gorgeous milkweed leaf beetle, *Labidomera clivicollis* (Page 7, top right), and monarchs are strongly attracted to this species. Smooth milkweed, *Asclepias sullivantii*, will also tolerate moist conditions.



Other Native Missouri Milkweeds

These milkweeds are native to Missouri and may also be used as host or nectar plants by monarchs. The seed and plants of these species may not be widely available at seed dealers and nurseries.

Statewide Occurrence

Whorled milkweed *Asclepias verticillata*

From Southern Missouri

Green milkweed *Asclepias viridis*

Narrow-leaved milkweed *Asclepias stenophylla*

Sand milkweed *Asclepias amplexicaulis*

White milkweed *Asclepias perennis*

Green milkweed *Asclepias viridiflora*

Smooth milkweed *Asclepias sullivantii*

From Northwestern Missouri

Smooth milkweed *Asclepias sullivantii*

Prairie milkweed *Asclepias hirtella*

Native Nectar Sources

Planting other flowers also benefits monarchs because adult monarchs require nectar from a variety of native plants, not just milkweed. When gardening for wildlife, native plants are immeasurably preferable to nonnative species. Insects, including butterflies and moths, often have specific relationships with select native plant species that are dictated by the chemical compositions of the plant. Nonnative plants are often chemically incompatible with native insects, and as a consequence alien plants add little if anything to the food web. The species pictured to the right are all native to Missouri and would be excellent additions to a milkweed garden. Select nectar source plants for seasonable blooming and color variety. Check out grownative.org for additional information.



PHOTO BY FRANK OBERLE

EASTERN BLAZING STAR

Liatris scariosa



SMOOTH ASTER

Symphyotrichum laeve



RATTLESNAKE MASTER

Eryngium yuccifolium



PHOTO BY MDC

NEW ENGLAND ASTER

Symphyotrichum novae-angliae



PHOTO BY MDC

WILD BERGAMOT

Monarda fistulosa



PHOTO BY BRUCE SCHUETTE

SHOWY GOLDENROD

Solidago speciosa



PHOTO BY MDC

PURPLE CONEFLOWER

Echinacea purpurea

Backyard Habitat for Monarchs

SIZE

Suitable monarch habitat can be easily integrated with an existing flower garden. The minimum size of a milkweed planting is 9 square feet; however, a truly effective monarch habitat will be at least 100 square feet. The total area may be split among several sites at your location, and there is no upper limit for the size of a monarch habitat.

EXPOSURE

Monarch plants need lots of sun; therefore, monarch habitats need to be located in an area that receives at least six hours of sun a day. Find shade tolerance of recommended plants at mdc.mo.gov/monarch.

DRAINAGE AND SOIL TYPE

Milkweeds and nectar plants will do best in relatively light (low-clay) soils. Good drainage is needed to avoid root rot and provide good aeration of the roots. Areas with poor drainage may need more moisture-tolerant species such as swamp milkweed and New England aster.

SHELTER

To ensure that the maximum number of monarchs survive in your habitat, the plants should be located relatively close together. However, they should not be crowded—be sure to follow the planting recommendations specific to each plant. All monarch life stages need shelter from predators and the elements. Planting milkweeds and nectar plants close together contributes to this shelter for monarchs and other wildlife.

FOOD

Milkweed Plants

To maximize the use of your habitat by monarchs, include a number of milkweed species. It is best to have at least 10 plants, made up of two or more species; however, a large number of plants (more than 10) of one species is sufficient. Milkweeds of different species mature and flower at different times during the season. By increasing the number of milkweed species in your habitat, you will increase the likelihood that monarchs will use your property for a longer period during the breeding season.



Nectar Plants

Monarchs, other butterflies, and numerous pollinators need nectar. When your monarch habitat provides nectar sources that bloom sequentially, it supplies nutrients throughout the breeding season and the migration in the fall. A monarch habitat should contain at least four biennial or perennial native plants that provide nectar for butterflies.

NATIVE PLANT SPECIES RECOMMENDED FOR MISSOURI

Visit mdc.mo.gov/monarch for a list of recommended native wildflowers for monarchs and planting diagrams. Plants, rather than seeds, are recommended in flower gardens to obtain the fastest results. Local sources for seeds and plants of these native species can be found at grownative.org. Learn about propagating milkweed plants at short.mdc.mo.gov/ZJ3.



Milkweed species: Flowering swamp milkweed, *Asclepias Incarnata*.

On adult monarchs, the upper surfaces of the wings are rusty or tawny orange with black veins; the wing edges are black with small white spots. The undersides of wings are lighter orange or yellow-brown. The veins are darker on females, and males have a black spot on their hindwings. Monarch wings are covered with powdery, overlapping scales.

PHOTO BY MDC

Creating Monarch Field Habitat

PLANTING SPECIFICATIONS

Timing

Planting a wildflower mix containing milkweeds will provide habitat for monarch caterpillars as well as for adult monarchs during migration. These plantings should ideally be completed in late fall or winter to expose seed to the cold, moist soil conditions necessary for seed germination.

Planting Depth and Methods

Proper planting depth for native forbs is approximately 2.5 times the seed thickness using a no-till drill. Broadcast planting with no seed coverage will need to be done during the fall or winter on bare soil to allow time for the seeds to be worked deep enough into the soil by freezing action or rain.

Seeding Rate

It is important to plant a variety of native forbs, in the right ratio, that bloom at different times of the year. For the best results, the planting rate should be 5 pounds/acre. Use a combination of at least nine species. You should also have at least three species blooming in each season (spring, summer, and fall). A minimum of 4 percent of the mix will be composed of milkweed seed. Milkweeds and sand vine are the only larval food sources for the monarch butterfly. Two-thirds of this milkweed seed should be common milkweed (*Asclepias syriaca*). Common milkweed is native to this region, is readily established, and is one of the most widely available milkweed species. The remaining third of the milkweed seeds should be butterfly milkweed (*Asclepias tuberosa*) on well-drained upland soils or swamp milkweed (*Asclepias incarnata*) on richer, less well-drained soils.

See the Missouri Natural Resources Conservation Service Native Forb Information Sheet (IS-MO643 Native Forb) at 1.usa.gov/1Su6BKW for details on planting dates, depths, and methods. Additional forbs and milkweed species may be used from Table 2 of the information sheet, depending on availability, site conditions, and necessity to meet the requirements of the plantings listed above.



Milkweed seeds must be planted in the fall or winter to ensure exposure to the cold, moist soil conditions necessary for germination. Alternately this process may be replicated in a refrigerator.

Common milkweed emerges in April and is ready when the majority of monarchs migrate into Missouri from their wintering grounds in late May. Its leaves are opposite, at least 4 inches long, and about half as wide. The underside of its leaves have a white, downy appearance.



A mix of milkweed and native wildflower seeds provides caterpillars with food and habitat and butterflies with nectar sources.



PHOTO BY MDC

Prescribed fire



PHOTO BY MDC

Light disking in fall



PHOTO BY MDC

Spraying invasive, nonnative plants

MANAGEMENT

See the Missouri Natural Resources Conservation Service Native Forb Information Sheet (IS-MO643 Native Forb) for details on management of new plantings and existing monarch habitat. Monarch habitat may be managed by one or a combination of the following methods: prescribed burning, spraying, or mechanical disturbance.

Recommended Frequency of Management for All Methods

Habitat management projects should begin prior to the arrival of most of the migrating monarchs (May 15), or after most adults begin the fall migration (October), when most monarchs have departed from the upper Midwest states for their fall migration.

Managing the entire patch at once can negatively affect monarchs, as this will remove all available habitat for a period of time. Therefore, where feasible, management activities should not occur on more than one-third of the monarch habitat each year over a three-year period.

Prescribed Burning

Monarch habitat may be managed through periodic burning. Prescribed burns can allow germination of seed-bearing annuals, increase plant species diversity, control unwanted woody vegetation, and open up the stand for native pollinator nest sites.

Recommended Timing

- Avoid burns after May 15 to avoid disturbing monarch eggs or caterpillars present on site.
- Early or late in the day is preferred.
- Fall (October) burns favor monarch and pollinator habitat.
- Burning after March 15 may harm wildflowers that emerge early.

See Natural Resources Conservation Service Practice Standard 338—Prescribed Burning at [1.usa.gov/1P6PWkw](https://www.1.usa.gov/1P6PWkw)

Spraying

Use approved herbicides, according to their labels, as necessary to control noxious weeds and undesirable plants during the establishment period. A grass-selective herbicide treatment may be needed to deter encroachment of nonnative cool-season grasses. Avoid using broad-spectrum herbicides.

Mechanical Disturbance

(Includes light disking or mowing)

Recommended Timing

- Fall mechanical disturbance (after October) is preferred when nectaring flowers have died back or are dormant.

Disturbance at this time will also minimize disruption to nesting bumblebees and other beneficial insects.

Recommendations applicable to both methods

- Reduce speed to 8 mph or less to allow wildlife time to escape.
- Use a flushing bar where possible to move wildlife out of the path of machinery.
- Avoid disturbance at night when nesting and roosting birds are less likely to flush.

Light Disking/Harrowing

Light disking or harrowing (2–4 inches deep) of existing stands can increase the amount of open ground and encourage a diverse plant community of annuals and perennials, including common milkweed. Do not disk in native prairie.

Mowing

Mowing may be used to support monarch habitat by reducing woody plants, preventing weeds from setting seed, and reinvigorating milkweed stands that may otherwise go dormant.

Mowing at the wrong time can kill monarch eggs and larva or eliminate food sources.

Summer mowing can be accomplished July 1–July 7, if absolutely necessary. However, managing the entire patch can severely affect monarchs and other wildlife. Manage no more than $\frac{1}{4}$ – $\frac{1}{2}$ of the habitat each year, over a multiyear period.

Mowing should be done in conjunction with another management practice such as burning, disking, or spraying and not as a stand-alone practice.

Use a rotary or flail mower to evenly distribute grass clippings. Do not swath, as the windrows will smother seedlings. Clippings should be baled and removed to accommodate forb germination. Mow no lower than 8–12 inches to minimize mortality and leave adequate residual cover.



In an area cleared of invading brush, common milkweed is flourishing.

MONITORING

Monitor your planting before and after management actions are completed to determine whether the planting is maximizing benefits for monarchs. The Monarch Breeding Habitat Assessment Tool (bit.ly/IMPAKCz) developed by the University of Minnesota Monarch Lab in partnership with the Monarch Joint Venture, is an excellent tool for assessing the results of post-establishment management actions.

Native milkweed plants are an essential feature of monarch breeding habitat. Estimate the abundance and diversity of milkweeds on site. Having 500 or more milkweed plants per acre (in widely dispersed clumps), composed of three or more species, is considered good monarch habitat; however, more plants support more monarchs. The planting should also continue to support a variety of nectar plants that bloom throughout the growing season. Learn about propagating milkweed plants at short.mdc.mo.gov/ZJ3.

Contact your local Natural Resources Conservation Service or Missouri Department of Conservation office for recommendations on managing or upgrading existing cover.

For more information about monarchs and planting pollinator-friendly habitat, visit these websites:

grownative.org

MonarchWatch.org

Xerces.org

MonarchJointVenture.org

Or contact Missourians for Monarchs at

MissouriansforMonarchs@gmail.com or stlouis-mo.gov/monarchs.

The following partners
are working together
to restore monarch
habitat in Missouri.

PHOTO BY MDC

