



Gardeners and scientists are working together to preserve and create habitat that will benefit monarchs as well as other important pollinating insects.

Plight *of the* Butterfly

BY GABRIEL POPKIN

FOR MANY American gardeners, seeing the flicker of orange-and-black wings that signals the arrival of the first monarch butterflies of the year is one of the eagerly anticipated benchmarks of the summer garden season. Monarchs (*Danaus plexippus*) overwinter in a forested region of the Sierra Madre in Mexico. In spring they return north to a wide swath of the United States and Canada as part of a fascinating and complex life cycle that is deeply interwoven with a genus of plants known as milkweeds (*Asclepias* spp.).

STARTLING DECLINE

Now it appears that not only is our love affair with the monarch threatened, but the health of the American ecosystems in which the butterfly has played a key role over the centuries is also at risk. Over the last decade, ecologists who study monarchs have reported dramatic declines in the butterfly's overall population. "Last winter was the lowest ever overwinter-

A monarch caterpillar feeds on a milkweed—the only plant that the caterpillars consume.

ing population of monarchs," says Karen Oberhauser, a monarch researcher at the University of Minnesota in St. Paul. Data released in late January by the World Wildlife Fund and the Mexican government confirmed that the area of forest inhabited by this year's overwintering monarch population is even smaller, down to 1.65 acres from a peak of some 45 acres in the mid-1990s.

Oberhauser and other scientists who study monarchs are quick to point out the greater significance of these findings: the



Herbicides often used in the large-scale production of soybeans, above, and corn, have drastically reduced wild stands of milkweed, which is a critical component of the monarch's life cycle.

monarch is just one of millions of native insects, and what benefits one of them tends to benefit all of them. "I see them as a flagship species," she says. "By preserving monarch habitat that includes nectar sources and milkweed, we're going to be helping a lot of other organisms as well."

Yet monarchs are not the only flagship insect scientists are worried about. Honeybees, while not native to North America, have been devastated by a still mysterious phenomenon scientists call colony cluster disorder (CCD). And a study published in the journal *Nature* in February indicates that wild bumblebees are now also showing susceptibility to CCD. Both honeybees and wild bumblebees are important pollinators of a wide range of plants, including many food crops.

CAUSES FOR DECLINE

The monarch's many woes are well-documented. The butterfly overwinters in small patches of forest in Mexico; much of this habitat has been cut for timber. Although the Mexican government has protected what's left, illegal logging and tourism continue to be problems. Bad weather has also taken a toll; several consecutive spring droughts have dried out monarch eggs and reduced the numbers that hatch.

But most scientists agree the butterfly's number-one plight is the dwindling wild milkweed population. Large-scale corn and soybean farming facilitated by the pervasive

use of herbicides and herbicide resistant crop varieties has decimated the common milkweed plant, once ubiquitous in prairies and fields. Milkweeds are the only plants monarch caterpillars can eat; without them, the insect cannot complete its life cycle.

This is where gardeners come in. As milkweed has disappeared in nature, the plant has sprouted in thousands of home gardens as well as those of schools, librar-

ies, parks, and nature centers. Throughout the United States, gardeners are building a network of monarch-safe patches to help the butterfly navigate the inhospitable modern landscape. More than 10,000 have already joined the cause, and the numbers are growing. "There's really no excuse for not doing it," says Denise Gibbs, a Maryland-based naturalist and citizen scientist who has been involved in dozens of monarch habitat plantings.

AN AWE-INSPIRING JOURNEY

The key to creating monarch habitat is understanding the butterfly's life cycle. Like all butterflies, the monarch begins life as an egg that hatches into the larval stage commonly called a caterpillar. Unlike most caterpillars, however, the monarch can feed only on milkweed plants. Milkweeds contain chemicals called glycosides that monarchs concentrate in their bodies. These substances give the caterpillars and butterflies a bitter taste, and are toxic to many birds and mammals. The orange markings that so thrill us warn predators: "Stay away—I'm poisonous."

In two weeks of feasting on milkweed, the monarch caterpillar grows over a thousand times larger, and is ready to move on to adulthood. It builds a chrysalis on the underside of a milkweed leaf and dangles



Adult monarchs are nectar feeders; the Mexican sunflower (*Tithonia rotundifolia*) above is one of many nectar sources for the butterflies that gardeners can easily include in their landscapes.

there for two weeks. Then, triggered by a complex chemical process, the adult emerges, stretching damp orange-and-black wings that soon dry, allowing it to fly.

As adults, monarchs need nectar, not leaves. They can get this sustenance from many different plants, including but no longer limited to milkweeds. Adults feed for up to eight weeks, in the process mating and—if female—laying new eggs, thus starting the cycle anew.

This life cycle is superimposed on a mind-bogglingly long and complex annual migration. Every spring, monarchs fly north from their overwintering grounds in southern Mexico, eventually arriving in Texas, where they seek out milkweeds on which to lay their eggs. Over the next two generations, the butterflies fan out eastward to the Atlantic Ocean, westward to the Rocky Mountains, and as far north as Toronto, Canada. In the fall, the monarchs turn south, but this time the same individuals that start the journey also finish it, eventually coming to rest back in Mexico. The three generations that together complete the migration are often called a “supergeneration.” Smaller populations winter in California, Florida, and the Caribbean, and shuttle up and down the west and east coasts of the United States.

The monarch butterfly migration is a magnificent event, inspiring nature lovers and artists alike. In her 1974 book *Pilgrim at Tinker Creek*, Annie Dillard describes the butterflies passing by her window in the Appalachian foothills of Virginia. “It looked as though the leaves of the autumn forest had taken flight, and were pouring down the valley like a waterfall, like a tidal wave, all the leaves of hardwoods from here to Hudson’s Bay.”

The migration has inspired scientists as well. Canadian biologist Fred Urquhart spent decades searching for the monarchs’ winter resting place, finally tracking it down—with the help of his wife, Norah, and assistants in Mexico—to fir and pine forests in the states of Mexico and Michoacán. To this day, nobody has figured out how individual butterflies know where to go, since it was not they who left the forests the previous winter, but rather their great-grandparents.

Then there’s the butterfly itself, perhaps its own best advertisement. “This is one of our largest and most conspicuous insects, it’s very colorful, it’s slow mov-



During migration, monarch butterflies rest at night in groups called roosts. Here a roost congregates on a eucalyptus tree in Pacific Grove, California.

ing,” says Chip Taylor, professor of ecology and evolutionary biology and long time monarch researcher at the University of Kansas. “Almost anybody who has lived in the area it breeds in has had some experience with the caterpillars and the chry-



After two weeks in its chrysalis, the adult monarch butterfly emerges.

alis and the life stages it goes through.” Combined with the monarch’s remarkable migration, Taylor says, “This is an extraordinary biological phenomenon.”

MONITORING THE DECLINE

About a decade ago, Taylor realized this extraordinary phenomenon could be coming to an end. Several studies were documenting sharp declines in milkweed populations in the Midwest, through which the bulk of the monarch migration passes. But the clincher came from Oberhauser’s Monarch Larval Monitoring Project. She and her colleagues went out to fields in the Midwest and counted monarch larvae. They found the numbers fell precipitously throughout the 2000s, and the drop was strongly correlated with milkweed decline. In a paper published in 2012, the researchers say the loss of milkweed accounts for almost half of the decline in the Midwest monarch population, which is the one that makes the famous migration.

Common milkweed (*Asclepias syriaca*) is not some botanical weakling. Its native range

extends from northern Mexico to southern Canada, and given a chance it will spread by underground rhizomes, as any gardener who has planted it can attest. But even milkweed cannot stand up to repeated sprayings of glyphosate, the chemical herbicide best known by its trade name, Roundup. In 1994, Monsanto, a chemical and agriculture biotechnology company based in Missouri, introduced 'Roundup-Ready' soybeans, which are genetically modified to survive spraying with glyphosate. Widely adopted by farmers, this variety now covers millions of acres in the United States, along with 'Round-up Ready' varieties of several other major crop plants such as corn. Because these varieties tolerate the herbicide, it can be broadly sprayed on entire fields to control weeds. Plants without resistance to the herbicide, including milkweed, are being completely eliminated from this vast acreage.

Few farmers probably mourned the loss of a plant whose name, after all, includes the word "weed." But until recently, many Midwest farms still included milkweed in field margins and areas left intentionally unplanted under the USDA's Conservation Reserve Program (CRP). Thanks to ethanol mandates and other factors, however, corn prices have risen so high that farmers have taken millions of acres out of the CRP. A paper published in the *Proceed-*



Common milkweed (*Asclepias syriaca*) is one of several species of milkweed upon which monarch caterpillars feed.

ings of the National Academy of Sciences last March reported that the rate was comparable to that of deforestation in the tropics.

At the rate the overwintering monarch population is shrinking, it will soon reach zero. This does not mean the monarch

itself is going extinct—yet—but when populations of a species get too low, individuals have trouble finding each other to mate, which can lead to further declines. At a recent conference, James Hansen, former head of NASA's Goddard Institute for Space Studies and one of the world's best known climate scientists, described watching a lone male monarch in his garden skittering around in vain for a mate. Monarch researchers have had the bitter experience of observing in acute detail the loss of an insect they love, says Oberhauser.

GARDENING FOR MONARCHS

In 2005, alarmed by what he and his colleagues were learning, Taylor launched the Monarch Waystation program. The concept is simple: gardeners agree to grow at least 10 milkweed plants and four varieties of nectar plants. They also make sure to provide the monarch shelter, some exposure to sunlight, and space. A monarch waystation doesn't have to be large; according to the program's website, a 100-square-foot area can suffice.

Monarch Watch, the group that oversees the waystation program and of which Taylor is the director, sells monarch habitat seed kits, as do many other organizations. Gardeners preferring to strike out on their own have more than 70 milkweed species

CREATING A MONARCH HABITAT FOR CERTIFICATION

Here are some guidelines for creating a monarch habitat in your garden, adapted from Monarch Watch's Monarch Waystation Certification Requirements (www.monarchwatch.org/waystations).

Size: A space of at least 100 square feet is recommended.

Exposure: At least six hours of sun a day.

Drainage and Soil Type: Milkweeds and nectar plants do best in low-clay soils with good drainage.

Shelter: Plants should be close together but not overcrowded.

Milkweed Plants: Plant at least 10 individuals, preferably representing multiple species to increase the length of time nectar will be available.

Nectar Plants: At least four species whose bloom times are distributed throughout the migration season.

Management: Even native plantings need to be maintained. Water during prolonged droughts and weed regularly. Mulch with compost or shredded leaves in spring.

Other Certification Programs

■ **Xerces Society's "Bring Back The Pollinators" program** asks gardeners to plant nectar plants, provide homes for pollinators, avoid harmful pesticides, and engage in pollinator outreach. www.xerces.org/bringbackthepollinators.

■ **North American Butterfly Association's Butterfly Garden Certification Program** requires three native food plants for caterpillars and three native nectar plants for adults. www.nababutterfly.com/cert_index.html.

■ **Wild Ones' Native Plant Butterfly Garden Recognition Program** certifies gardens that provide monarch habitat using native plants. www.wildones.org/learn/wild-for-monarchs/butterfly-garden-recognition.

to choose from, although not all are available commercially. Common milkweed is the monarch's staple food in the wild, and it is the foundation of many monarch habitat plantings. But for gardeners daunted by common milkweed's aggressive growth habit, smaller, more manageable species like butterfly milkweed (*Asclepias tuberosa*) and swamp milkweed (*A. incarnata*) are good alternatives. (For more about garden-worthy milkweed species, see the web special, "Milkweeds for the Garden.")

Tropical milkweed (*A. curassavica*) is a non-native species that is popular for its brilliant orange-and-yellow blooms that open from tiny red buds; the plant makes a beautiful showpiece in a garden, and monarchs love it. In northern gardens it is treated as an annual, but it survives mild winters in parts of the South, and some scientists are concerned that this survival could actually inhibit monarch migration. Their reasoning is that if the tropical milkweed is allowed to flower through the mild southern winters, the butterfly may continue to breed on it rather than complete its journey to Mexico. And if allowed to grow unchecked, some fear that plants may come to harbor a parasite harmful to monarchs. Experts advise that southern gardeners who grow tropical milkweed can avoid these problems by cutting it back twice a year, once in fall and again in spring.

Options for nectar plants are considerably wider; the goal is to provide consistent sustenance throughout the monarch's migratory season. Besides milkweeds, Donna Van Buecken, director of the native plant landscaping organization Wild Ones, says gardeners can plant serviceberries (*Amelanchier* spp.) and violets (*Viola* spp.) for nectar in the spring, sumacs (*Rhus* spp.) and blazing stars (*Liatris* spp.) for the summer, and asters (*Symphyotrichum* spp.) and witch-hazels (*Hamamelis* spp.) for the fall—all species native to North America.

Although there is undeniable logic to growing native plants to support a native insect, plants do not need be native to sustain monarchs. "The zinnia's not a native plant, but it's a good plant, and it's attractive not only to butterflies but to gardeners," Taylor says. Other garden-worthy plants that serve as nectar sources include: buddleias, lilacs (*Syringa* spp.), sweet alyssum (*Lobularia maritima*), impatiens, scabiosa, and marigolds (*Tagetes* spp.), to name just a few.



The perennial swamp milkweed (*Asclepias incarnata*) is both a monarch caterpillar host and an attractive garden plant; its flowers appear from midsummer to early fall.

ENCOURAGING HABITAT GARDENS

Thanks largely to Taylor's efforts with Monarch Watch, the number of registered monarch waystations now tops 7,000. Those who register their gardens can receive a sign advertising their garden's monarch-friendliness; the name and city of each waystation owner is also listed on the program's website.

Local efforts have amplified the program's reach. The program is thriving in Pennsylvania, Michigan, and Texas, says Taylor. Denise Gibbs has planted or instigated dozens of monarch-friendly plantings in the Washington, D.C., suburbs. Lexington, Kentucky has 25 waystations. The Garden Club of Kentucky, not traditionally a conservation organization, has made expanding the program one of its

core projects. "We can't change farming practices," says Joanna Kirby, the club's president. "But we can help educate and work with gardeners" to create waystations.

Other conservation organizations not exclusively focused on the monarch butterfly have recognized the insect's potential to highlight their causes. The North American Butterfly Association has a certification program that covers habitat for all butterflies, and Wild Ones just launched a monarch-specific certification program for gardens planted with species native to North America. The Xerces Society, which focuses on invertebrate conservation, has certified more than two thousand gardens as "pollinator habitat." (For tips on creating monarch habitat, see the sidebar on page 21.)



This butterfly waystation at Shaker Village in Harrodsburg, Kentucky, includes milkweeds as well as a variety of nectar plants.

Between all the certification programs, well over 10,000 American gardeners have made a public statement about their wish to support the monarch butterfly. Countless others provide crucial habitat without registering their gardens. The vision shared by all who do so is that if enough gardens, distributed around the country, contain monarch habitat, the butterfly will be able to hopscotch over farm fields—which are food deserts as far as the monarch is concerned—and find the sustenance it needs to continue its migratory cycle.

Resources

Monarch Joint Venture, <http://monarchjointventure.org>.

Monarch Larva Monitoring Project, www.mlmp.org.

Monarch Watch, www.monarch-watch.org.

Wild Ones Wild for Monarchs, www.wildones.org/learn/wild-for-monarchs.

Xerces Society, www.xerces.org/monarchs.

HOW MANY GARDENS ARE ENOUGH?

“That’s really the \$100,000 question,” says Oberhauser. The amount of prairie and grassland that has disappeared from the Midwest is hard to fathom. In a recent *New York Times* article, Taylor estimated it at 120 to 150 million acres, an area larger than California. Ten thousand gardens, even if they were each an acre—a generous size—would make up for less than one percent of one percent of the loss.

Oberhauser guesses that hundreds of thousands of plantings are needed before there is any chance of making a difference for the butterfly. Even then, the migration won’t be the same as it once was. “One of the things I’m talking about a lot now is a new normal,” she says. “I think it’s very unlikely that we’ll see the monarch numbers that we saw a decade ago. We can’t make up for all the habitat that was lost.”

Betty Hall, a gardener in Lexington, Kentucky, created the city’s first waystation in her backyard in 2012. She has since led workshops that inspired dozens of others to follow suit. Though she

loves monarchs, Hall agrees it’s not just about them. It’s also about the zebra swallowtails, pipevine swallowtails, and fritillaries. It’s about the bees, too, and the wasps, and all the other insects that buzz around a summer garden. “I see monarchs as a gateway,” she says. “If you can get people to plant a monarch waystation, you’ve created a great place for lots of other butterflies and pollinators.”

Opening that gateway may be the monarch waystations’ greatest gift to gardeners. At any moment in even a small patch of yard, hundreds of species are present and interacting.

Once people made gardens to create order out of wildness. Now gardens may be wildness’s last refuge. How well gardeners succeed in recreating patches of wilderness in suburbs and cities may be the monarch’s best hope. And that’s something anyone with even a small piece of land can do. As Hall puts it, “Anybody can create a piece of nature in their backyard.”

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