Milkweeds and Monarchs in the Western U.S.

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A Xerces Society Guide

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Acknowledgements

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Front Cover Photograph:
Monarch butterfly on showy milkweed (*Asclepias speciosa)* by Ed Lisowski.

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Introduction

Milkweeds (*Asclepias* spp.) are perhaps best known for their role as the larval food plants of the monarch butterfly (*Danaus plexippus*). These hardy wildflowers, with their distinctive pods, milky sap, and wind-borne seeds, can be found in a wide range of habitats, from dusty roadsides and desert landscapes to forest clearings and marshes. Milkweeds are highly prized nectar sources for a diversity of pollinators that includes bees and butterflies, and their leaves, seeds, roots, and flowers are eaten by a host of specialist herbivores. Female monarchs lay their eggs on the leaves of milkweeds—the sole food source for their caterpillars. But despite their importance to a wide range of invertebrate wildlife, milkweeds in many areas of the country are being eradicated on a broad scale, most notably as agricultural practices intensify and the adoption of herbicide resistant crops becomes more widespread (Pleasants & Oberhauser 2012; Hartzler 2010). At the same time, monarch populations have steeply declined, and researchers cite the loss of milkweed across the North American landscape as a significant driving factor. Researchers pinpoint identification and protection of existing milkweed stands and the large-scale restoration of milkweed populations as critical next steps in reversing these declines.

What You'll Learn From This Guide

This guide is designed to help natural resource agencies and other land managers understand the importance of milkweeds to monarch butterflies and become involved with managing, protecting, and enhancing milkweed stands on their land. In the following pages we will provide basic information on monarch and milkweed biology, discuss the importance of milkweed and monarchs, highlight threats to monarchs and their breeding habitat, and outline how land managers can help by identifying and reporting milkweed stands and monarch breeding occurrences on their lands. For those interested in taking the next step to enhance and restore milkweed on their lands, detailed information on milkweed seed production and restoration can be found in the Xerces Society guide, *Milkweeds: A Conservation Practitioner's Guide. Plant Ecology, Seed Production Methods, and Habitat Restoration Opportunities*, which can be downloaded from http://www.xerces.org/milkweeds-a-conservation-practitioners-guide/.

Milkweed and Monarch Biology

Milkweeds

Across the U.S. and parts of southern Canada, milkweeds occur in a broad range of habitats including prairies, plains, deserts, open woods, pine barrens, canyons, arroyos, bogs, marshes, and wet meadows (Woodson 1954). Some milkweed species also successfully colonize disturbed areas such as roadsides, railways, and agricultural field borders. Excluding subspecies, there are 72 milkweed species native to the U.S. and Canada, at least 37 of which are found in the West. The vast majority of these perennial species are deciduous, although evergreen species do occur. In general, milkweeds typically flower between late spring and the end of summer. Fleshy, pod-like fruits develop after flowering, splitting when mature to release the seeds. White, fluffy hairs (also called the floss, pappus, coma, or silk) are attached to each seed and facilitate their wind dispersal. Following dispersal, the aboveground plant growth usually dies back to the ground. Non-evergreen species remain dormant through the winter, reemerging in the spring from established root systems. Evergreen species may continue to flower sporadically throughout the year in response to seasonal rainfall.

Monarchs

The monarch's migration from the eastern U.S. to the mountains of central Mexico is a widely known phenomenon. Fewer people are aware of a smaller migration of monarchs from breeding areas in the West to the California coast and, to some extent, the mountains of central Mexico. In late winter and early spring, monarchs begin breeding and departing from these overwintering sites in search of milkweeds on which to lay their eggs. Once hatched, caterpillars feed on the plants for up to two weeks before forming chrysalises. Adults generally emerge 8–10 days later. Over the course of the spring, summer, and early fall, these monarchs continue to breed successive generations throughout the inland West where milkweed occurs, heading north toward Washington and Idaho and east toward the Rocky Mountains. Most monarchs born in late summer or early fall will then migrate back to the California coast and begin the process all over again, although tagging studies suggest some western monarchs may go to Mexico for the winter.

At all stages of their movement across the landscape, adult monarchs depend upon abundant nectar resources, from summer breeding areas to overwintering sites and the migratory pathways they follow in between. Monarchs are generalists when it comes to nectar, but are particularly attracted to certain plants. In the West, these include:

- Aster (*Symphyotrichum* spp.)
- Buckbrush (*Ceanothus* spp.)
- Buckwheat (*Eriogonum* spp.)
- Bur marigold (*Bidens* spp.)
- Coyote bush (*Baccharis* spp.)
- Goldenrod (*Solidago* spp.)
- Manzanita (*Arctostaphylos* spp.)
- Milkweed (*Asclepias* spp.)
- Rabbitbrush (*Chrysothamnus* spp.)
- Sage (*Salvia* spp.)
- Sunflower (*Helianthus* spp.)
- Thistle (*Cirsium* spp.)
- Willow (*Salix* spp.)

When selecting nectar plants for monarchs, we recommend choosing species native to your local area that will bloom during the specific time(s) of year when monarchs are present.

Photos: 1. Aster (Matthew Shepherd, The Xerces Society); 2. Buckbrush (Franz Xaver, Wikimedia Commons); 3. Buckwheat (Stan Shebs, Wikimedia Commons); 4. Bur marigold (Fritz Flohr Reynolds, Wikimedia Commons); 5. Coyote bush (Franco Folini, Wikimedia Commons); 6. Goldenrod (Stan Shebs, Wikimedia Commons); 7. Manzanita (USDA Lockeford Plant Materials Center); 8. Rabbitbrush (Wallace Keck, Wikimedia Commons); 9. Sage (Stan Shebs, Wikimedia Commons); 10. Sunflower (Jennifer Hopwood, The Xerces Society); 11. Thistle (Stan Shebs, Wikimedia Commons); 12. Willow (Stan Shebs, Wikimedia Commons).

Why Care About Monarchs & Milkweed?

Monarchs Are in Decline

The monarch is one of the best-known and most beloved butterflies in North America, occurring throughout a broad range of habitats across the U.S. and into southern Canada and central Mexico. Two populations migrate to overwintering sites each fall: monarchs east of the Rocky Mountains migrate primarily to high-elevation forests in central Mexico, while most monarchs west of the Rockies migrate to hundreds of smaller, wooded groves along the California coast. Yet, this once-common butterfly now faces an uncertain future, with annual monitoring of overwintering monarchs in central Mexico and along the California coast revealing significant population declines. In the 1990s, estimates of up to one billion monarchs made the epic flight each fall to Mexico, and more than one million monarchs overwintered in forested groves along the California coast. In the winter of 2014–2015, estimates from overwintering sites in Mexico suggest that only about 56 million monarchs overwintered, an 82% drop from the 21-year average (SEMARNAT 2015). Western monarch populations have faced similar declines. As of 2014, the western monarch population, which overwinters in California, had declined by an estimated 48% from the 18-year average (Monroe et al. 2015).

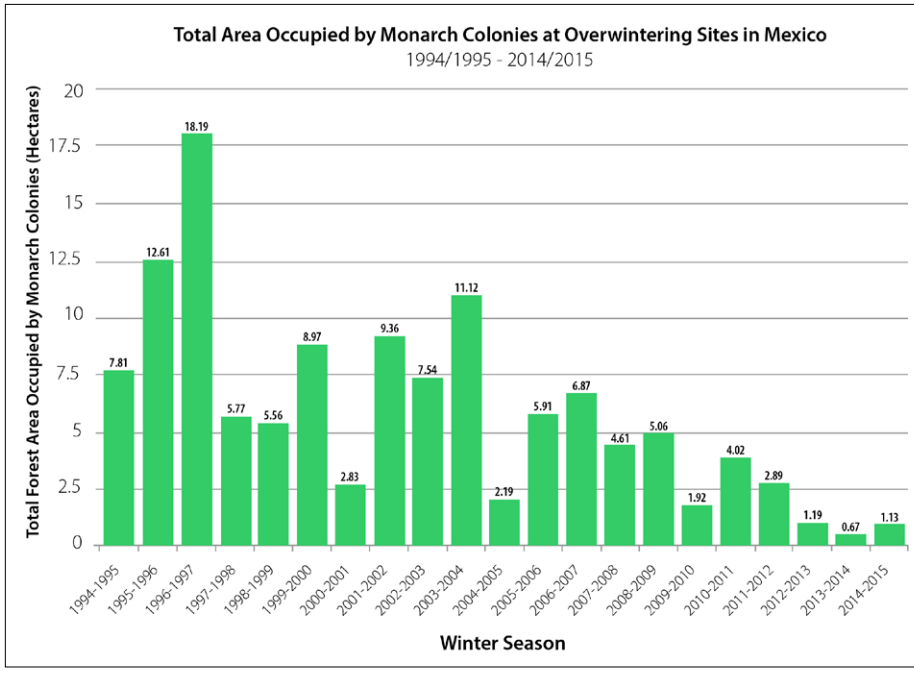

Figure 1: Monarch population trends at the Mexican overwintering sites. Data from 1994–2003 were collected by personnel of the Monarch Butterfly Biosphere Reserve (MBBR) of the National Commission of Protected Natural Areas (CONANP) in Mexico. Data from 2004–2015 were collected by the WWF–Telcel Alliance, in coordination with the Directorate of the MBBR. 2000–2001 population number as reported by Garcia-Serrano et al (The Monarch Butterfly - Biology and Conservation, 2004).

The conservation status of monarchs and the threats to their populations in the eastern U.S. have been thoroughly researched, but much less is known about the monarch population west of the Rocky Mountains. In particular, the locations and quality of existing monarch breeding sites in the West are generally unknown. In the eastern U.S., researchers have identified loss of milkweed as the most significant factor contributing to the observed declines of monarchs overwintering in Mexico (Pleasants & Oberhauser 2012; Flockhart et al. 2013). It is thought that loss and degradation of monarch breeding sites in the West has triggered similar declines observed at the California overwintering sites. However, before this can be assessed, we must understand where these important breeding locations are within the Western landscape. Initial modeling work by Stevens and Frey (2010) identified probable breeding habitat in most of California; western Nevada; Arizona; and isolated regions of Oregon, Washington, Utah, and Idaho. Their work highlighted large key areas to target; however, data are needed at a finer scale in order to effectively plan conservation and restoration work on the ground.

Milkweeds Are Valuable to Other Wildlife

In addition to their vital role in the monarch butterfly's life cycle, milkweeds provide food and shelter for many other insects. Adult butterflies and many moths feed primarily on nectar, and milkweeds are a valuable source. In the East, common milkweed (*A. syriaca*) continuously produces nectar and pollinators, including nocturnal moths, visit it both day and night (Willson & Bertin 1979; Morse & Fritz 1983). Milkweeds are also larval hosts for moths and butter-

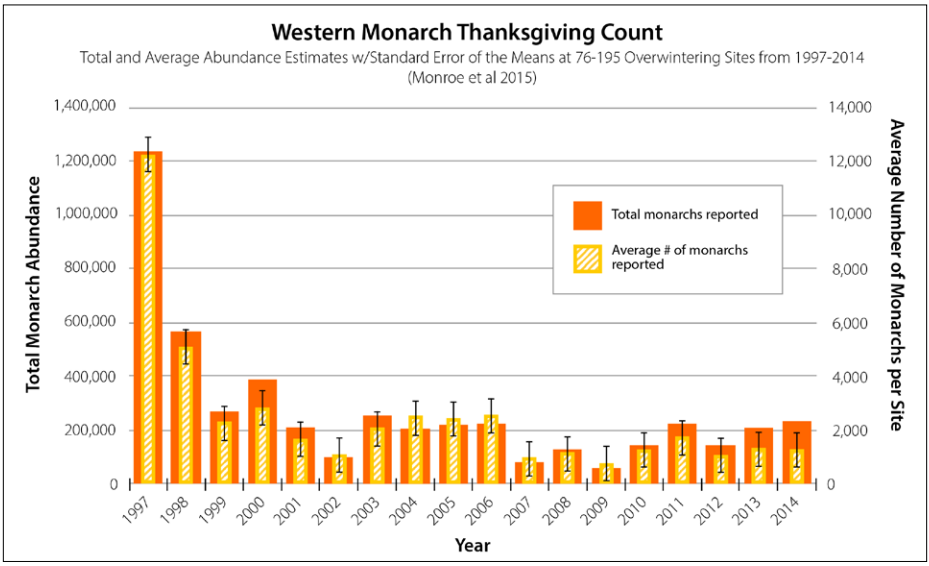

Figure 2: Monarch population trends at California overwintering sites (The Xerces Society for Invertebrate Conservation 2015).

flies other than monarchs, including the queen butterfly (*Danaus gilippus*), the dogbane tiger moth (*Cycnia tenera*), and the blue-green lichen moth (*Pygoctenucha terminalis*).

Nectar is also the primary food source for adult bees, and milkweeds help support a broad diversity of bee species, including bumble bees (*Bombus* spp.); carpenter bees (*Xylocopa* spp.); and solitary bees such as digger bees (*Anthophora* spp.), sweat bees (*Halictus* spp.), plasterer bees (*Colletes* spp.), and leafcutter bees (*Megachile* spp.). Milkweeds also support wasps, flies, and specialist herbivores like seed bugs, long-horned beetles, and leaf beetles.

While less is known about vertebrate wildlife interactions with milkweed, hummingbirds use many *Asclepias* species as a nectar source. Additionally, some birds like the vermilion flycatcher (*Pyrocephalus rubinus*) and black-capped chickadee (*Poecile atricapillus*) use milkweed seed floss and stalk fibers as nesting material (Hilton Pond Center for Piedmont Natural History 2013; Stewardship Garden 2013).

How Land Managers Can Help

The future of North America's monarch migration is at risk, and these butterflies need your help! To ensure the availability of breeding and migratory habitat for western monarchs, it is essential to both protect existing milkweed populations and increase the abundance of milkweeds and nectar plants through restoration activities. As a land manager, you can directly support the migration by providing habitat for monarchs. You can also participate in programs that are tracking the presence of milkweeds and breeding monarchs. Information gathered in these programs will give researchers a better understanding of the timing and location of breeding and migratory movement in the west.

Figure 3: Number of native milkweeds by state.

Identifying Milkweed

Identifying habitat is the first step toward protecting it. There are 37 species (not counting subspecies) of milkweed throughout the West (see Fig. 3, left, and Table 1, on page 10). Unless you are already familiar with the native milkweeds of your region, you may not be able to identify different species if they are not flowering or bearing fruits. Milkweed flowers and fruits are very distinctive and easy to recognize, allowing confident identification when they are present, so the best time to positively identify milkweed is when it is in bloom or fruiting.

Flowers

Milkweed flowers are arranged in clusters. Depending on the species, the stalk that bears the flowers can be either erect or drooping. The showy, upper part of each flower, called the corona, consists of five hoods, where nectar is stored. The shape of the hoods varies across species. Five petals—the corolla—form the lower part of the flower and are bent backwards in most species.

Fruits

Milkweed fruits (pods) are also very distinctive, although their size and shape vary between species. When mature, the fruits split open lengthwise, releasing the seeds. Each seed is attached to fluffy hairs (floss) that aid in wind dispersal.

Milky Sap

Milkweeds are named for their milky latex sap, which oozes from the stems and leaves when plants are injured. Milkweeds are not the only plants that have milky sap, but in combination with their flowers' unique shape, this can help to positively identify a milkweed plant. To check for the sap, tear off a small piece of leaf to see if it oozes from the torn area. Avoid any contact of the sap with your skin, eyes, or mouth, as it can be irritating.

Xerces Milkweed Guides

Xerces has created milkweed guides for four western states (California, Oregon, Nevada, and Washington) that can help you identify milkweeds on your land. If you live in a state outside of these four, keep in mind that some species are present in multiple states, and one of these guides may still be helpful. See Table 1 (page 10) for a list of milkweed species by state. If you find milkweed plants that do not match the species included in the following guides, you can view photos of the other species listed on CalPhotos (http://calphotos.berkeley.edu/flora/) and see species' county-level distribution using the USDA Plants Database (http://plants.usda.gov).

Top: Milkweeds used along a Michigan roadside in a habitat restoration planting (Jennifer Hopwood, the Xerces Society). Bottom, from left to right: Swamp milkweed (*A. incarnata*) flowers with green sweat bee (Nancy Adamson, The Xerces Society); Spider milkweed (*A. asperula*) fruits (pods) (Linda Kennedy, National Audubon Society); Open narrow-leaved milkweed (*A. fascicularis* pods showing seeds and floss (John Anderson, Hedgerow Farms, Inc.).

Guides by State

California

http://www.xerces.org/wp-content/uploads/2011/10/CA-milkweed-guide_XercesSoc6.pdf
http://www.xerces.org/wp-content/uploads/2011/03/xerces-nrcs-california-milkweed-guide.pdf

Oregon

http://www.xerces.org/wp-content/uploads/2011/10/OR-milkweed-guide_XercesSoc2.pdf

Nevada

http://www.xerces.org/wp-content/uploads/2011/10/NV-milkweed-guide_XercesSoc2.pdf

Washington

http://www.xerces.org/wp-content/uploads/2011/10/WA-milkweed-guide_XercesSoc1.pdf

Reporting Occurrences

If you find milkweed growing on your property, we encourage you to share your observations via our online milkweed survey: http://www.xerces.org/milkweedsurvey/. The survey includes questions about monarch breeding observations. These observations will contribute to our understanding of the western monarch's migration and breeding dynamics and will help us identify important breeding areas. While we hope you are able to identify the milkweed species on your land from the resources provided in this guide, identification is not necessary in order to complete this survey. Photos of unidentified milkweed species can be sent to the Xerces Society at milkweed@xerces.org. In your email, please include a description of the habitat, the approximate location of the plants, and the date the photos were taken.

Finding and Identifying Monarchs

Adult monarchs are the easiest life stage to find and identify, as they are large and showy and can be found flitting around milkweeds or other nectar plants. However, to determine whether milkweed patches are being used by breeding monarchs, we are most interested in observations of the immature stages of monarchs or of females actively ovipositing (laying eggs) on milkweeds.

Clockwise, from top left: Monarch butterfly eggs on a milkweed plant (Armon, Wikimedia Commons); A monarch caterpillar, likely in its 2nd instar (Sara Hollerich, USFWS, Wikimedia Commons); 2nd, 3rd, and 4th instar monarch caterpillars (Ansel Oommen, Bugwood.org); A monarch chrysalis (Armon, Wikimedia Commons).

Immature life stages can be more difficult to find and identify. If you are searching for monarchs when no adults are present, it is important to closely examine milkweed leaves and stems. Adult females usually lay eggs on the undersides of milkweed leaves, depositing one egg per plant. Once a larva hatches, it immediately eats the eggshell and then begins feeding on the leaf. In many cases a single larva can defoliate an entire plant, sometimes even moving on to another plant before it forms a pupa. Keying in to signs of herbivory and the presence of frass (insect droppings, which typically appear as small, dry, usually dark-colored pellets on the leaves) can help you locate larvae. Look carefully at both sides of the leaves and the stems, and keep in mind that very young caterpillars may drop off the plant as a form of defense. Monarch caterpillars go through five instars, or stages between molts, during which they can range in size from ½" –1¾". First instar caterpillars are very small and may be pale green or grayish white, appearing almost translucent. Subsequent instars are distinctly striped in yellow, white, and black, with a pair of black tentacles on both ends of their bodies.

Monarch adults, larvae, and pupae are fairly distinct, but land managers in the southwest states may also come across the closely related queen butterfly (*Danaus gilippus*). In addition, the viceroy (*Limenitis archippus*), a monarch mimic, may also be found throughout the West, but its larvae neither use milkweeds, nor are they visually similar to monarch larvae. Below are photos illustrating some of the key characteristics differentiating queens and monarchs.

Monarch butterfly caterpillars have two sets of tentacles, while queen butterfly caterpillars have three. Left: monarch caterpillar (David Cappaert, Michigan State University, Bugwood.org); right: queen butterfly caterpillar (Desert Botanical Garden).

Monarch and viceroy butterflies look very similar, but viceroys have a black line crossing the lower part of their hindwings. Meanwhile, queen butterflies' coloration is browner than monarchs' vivid orange. Queen butterflies also lack the contrasting black venation visible on monarchs' dorsal (top) side. From top to bottom: adult monarch (Bryan E. Reynolds); adult viceroy (Benny Mazur, Wikimedia Commons); adult queen butterfly (Anne Toal, Wikimedia Commons).

Table 1: Native Milkweed Species in the Western States

Species name	Common name	WA	OR	ID	NV	CA	UT	AZ
Asclepias albicans	whitestem milkweed					x		x
Asclepias angustifolia	Arizona milkweed							x
Asclepias asperula	spider milkweed			x	x	x	x	x
Asclepias brachystephana	bract milkweed							x
Asclepias californica	California milkweed					x		
Asclepias cordifolia	heartleaf milkweed		x		x	x		
Asclepias cryptoceras	pallid milkweed	x	x	x	x	x	x	x
Asclepias cutleri	Cutler's milkweed						x	x
Asclepias engelmanniana	Engelmann's milkweed						x	x
Asclepias eriocarpa	woollypod milkweed					x		
Asclepias erosa	desert milkweed				x	x	x	x
Asclepias fascicularis	narrow-leaved milkweed	x	x	x	x	x	x	
Asclepias glaucescens	nodding milkweed							x
Asclepias hallii	Hall's milkweed				x		x	x
Asclepias hypoleuca	mahogany milkweed							x
Asclepias incarnata	swamp milkweed			x	x		x	
Asclepias involucrata	dwarf milkweed						x	x
Asclepias labriformis	Utah milkweed						x	
Asclepias latifolia	broadleaf milkweed					x	x	x
Asclepias lemmonii	Lemmon's milkweed							x
Asclepias linaria	pineneedle milkweed							x
Asclepias macrotis	longhood milkweed							x
Asclepias nummularia	tufted milkweed							x
Asclepias nyctaginifolia	Mojave milkweed				x	x		x
Asclepias oenotheroides	zizotes milkweed							x
Asclepias quinquedentata	slimpod milkweed							x
Asclepias rusbyi	Rusby's milkweed				x		x	x
Asclepias solanoana	serpentine milkweed					x		
Asclepias speciosa	showy milkweed	x	x	x	x	x	x	x
Asclepias subulata	rush milkweed				x	x		x
Asclepias subverticillata	horsetail milkweed			x	x		x	x
Asclepias tuberosa	butterfly milkweed						x	x

Table 1: Native Milkweed Species in the Western States

Species name	Common name	WA	OR	ID	NV	CA	UT	AZ
Asclepias uncialis	wheel milkweed				x		x	x
Asclepias verticillata	whorled milkweed							x
Asclepias vestita	woolly milkweed					x		
Asclepias viridiflora	green comet milkweed							x
Asclepias welshii	Welsh's milkweed						x	x

For More Information

Xerces Society Resources and Programs

Milkweed Survey
Help us document milkweed distribution across the West to identify available breeding habitat for the monarch butterfly.
www.xerces.org/milkweedsurvey/

Western Monarch Conservation Campaign
A project focused on the conservation and management of western monarch overwintering habitat; includes the annual Western Monarch Count.
www.xerces.org/western-monarchs/

Project Milkweed
This initiative promotes milkweed conservation and increases native milkweed seed availability in key areas of the monarch butterfly's North American breeding range.
www.xerces.org/milkweed/

Milkweed Seed Finder
A national directory of milkweed seed vendors to help you find local sources of seed.
www.xerces.org/milkweed-seed-finder/

Milkweeds: A Conservation Practitioner's Guide
This guide includes detailed information on milkweed seed production and restoration.
www.xerces.org/milkweeds-a-conservation-practitioners-guide/

Monarch Butterflies
For more information on monarch conservation, threats, and what you can do to help them recover.
www.xerces.org/monarchs/

Pollinator Conservation Resource Center
An online database that contains pollinator plant recommendations, guidelines on establishing and protecting pollinator habitat, and lists of native plant nurseries for every region of the U.S. and Canada.
www.xerces.org/pollinator-resource-center/

Pollinator Habitat Assessment Form and Guide for Natural Areas and Rangelands

Together with the USDA-NRCS, the Xerces Society has developed a tool for land managers to quantify habitat or land management improvements on their land.
www.xerces.org/wp-content/uploads/2014/12/PollinatorHabitatAssessment_NaturalAreasRangelands_web.pdf

Other Resources and Related Citizen Science Programs

Western Monarch Count

Every winter, monarch butterflies gather by the dozens, hundreds, and even thousands at more than 200 overwintering groves up and down the California coast. An incredible group of citizen scientists monitor these groves each year, gathering information on habitat conditions and estimating population numbers. The highlight of this effort is the annual Western Monarch Thanksgiving Count (WMTC), which takes place for three weeks around the Thanksgiving holiday.
www.westernmonarchcount.org

Journey North

A citizen science program that allows participants to report observations of migrating monarchs to real-time migration maps. These maps also track first monarch eggs, first monarch larvae, and first emergence of milkweeds across the country.
www.learner.org/jnorth/

Monarch Breeding Habitat Assessment Tool

Developed by the University of Minnesota Monarch Lab in partnership with the Monarch Joint Venture, this tool is designed to help land owners assess the quality of milkweed and nectar habitat for monarchs.
www.monarchjointventure.org

Monarch Larva Monitoring Program (MLMP)

The MLMP is a project of the University of Minnesota's Monarch Lab. Volunteers in the U.S. and Canada collect long-term data on larval monarch populations and milkweed habitat in order to better understand how and why monarch populations vary in time and space.
www.mlmp.org

If you would like more information about using native milkweeds in restoration and revegetation efforts in the western U.S., please reach out to us at milkweed@xerces.org.

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The Xerces Society

for invertebrate conservation

Protecting the life that sustains us

The Xerces Society for Invertebrate Conservation is a nonprofit organization that protects wildlife through the conservation of invertebrates and their habitat. Established in 1971, the Society is at the forefront of invertebrate protection, harnessing the knowledge of scientists and the enthusiasm of citizens to implement conservation programs worldwide. The Society uses advocacy, education, and applied research to promote invertebrate conservation.

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