

A QUICK GUIDE TO

# Monarch Habitat on Farms in California's Central Valley



(Photo: Xerces Society / Stephanie McKnight.)



(Photo: Xerces Society / Stephanie McKnight.)



(Photo: Xerces Society / Brianna Borders.)

## About this Guide

Monarch butterflies and their milkweed host plants have historically been common throughout California. Over the past few decades, however, monarch populations across the United States have declined. The western population is now less than 1% of its size in the 1980s. In California, monarch butterflies overwinter along the coast, then migrate inland to spend the spring and summer breeding throughout the state, as well as other parts of the western U.S. The Central Valley is an important part of this breeding range. This guide provides information for farmers in the Central Valley interested in adding monarch habitat to their farms.

## Meet the Monarch

Monarch butterflies are found across North America as far north as southern Canada. Western monarchs breed west of the Rocky Mountains and overwinter primarily in forested groves scattered along the Pacific coast from Baja California to Mendocino County.

Female monarch butterflies lay eggs on milkweed, which the caterpillars require as food to develop into adults. It takes approximately one month for a monarch to develop from an egg to adult. Multiple generations are produced over the spring and summer, with the fall generations migrating to overwintering sites. Spring and summer generations typically live 2–5 weeks as adults, while overwintering butterflies may live up to 9 months.

In the spring, monarchs leave their overwintering grounds to breed and seek out milkweed for their caterpillars. As fall approaches, native milkweeds go dormant for the winter season, and the last monarchs to reach adulthood search for flowers to fuel their journey back to the overwintering grounds. Once the butterflies reach their overwintering sites (typically in September or October), they form clusters with other monarchs to conserve warmth and settle in for the months ahead.

## Importance of the Central Valley to Monarch Butterflies

California's Central Valley is particularly important to the health of the western monarch population. Monarchs travel through the Central Valley as they migrate to and from their overwintering grounds on the California coast, and historically monarch caterpillars developed on milkweed that grew throughout the Central Valley. Much of the high-quality habitat of milkweed and other wildflowers that was historically found in the Central Valley has been lost as grasslands and rangelands have been developed or converted to crops. Because the Central Valley is so important to the western monarch population, producers in this region have a unique opportunity to help monarchs and other pollinators by planting milkweed and wildflowers on their farms.

## How You Can Help

You can play an important role in reversing the monarch decline by restoring habitat for monarchs on your property. Monarch habitat patches do not have to be large, and there are many options for beneficial habitat on Central Valley farms (see monarch habitat case studies 1–2). In this region, good monarch habitat provides for the species' needs during the breeding and migration seasons.

### Monarch butterflies require:

- ⇒ **Native milkweeds.** Monarch caterpillars feed solely on milkweed. Adult monarchs use milkweed flowers as a nectar source.
- ⇒ **Wildflowers.** Adult monarchs feed on nectar from a variety of plants. Wildflowers are especially important to monarchs during the spring and fall when the butterflies need plenty of energy to fuel their migration. Because monarchs pass through the Central Valley during migration, planting monarch-attractive flowers that bloom early in the spring or late in the fall can be especially beneficial.
- ⇒ **Shelter and water.** Trees or shrubs provide a place for monarchs to rest during hot days and as they migrate. Monarchs will also utilize sources of fresh water to stay hydrated.
- ⇒ **Protection from pesticides.** Habitat should be placed in areas that are protected from pesticide drift (see Limiting Pesticide Exposure, page 9). Because insecticides can be lethal to monarchs, it is especially important to avoid insecticide use in and around habitat when monarchs may be present (mid-March through to the end of October). Avoid using neonicotinoids and other systemic insecticides, when possible.
- ⇒ **Protection from disease.** Avoid planting non-native tropical milkweed to minimize the spread of the pathogen *Ophryocystis elektroscirrha* (OE). OE is able to build up on tropical milkweed as these plants do not die back in the winter.



Historically, milkweed grew throughout the Central Valley, supporting monarch caterpillars. Today, providing native milkweeds is vital in contributing to their recovery. Milkweed is only one nectar source for adult monarchs; they also rely on a variety of wildflowers, including rabbitbrush (pictured, bottom). (Photos: Xerces Society / Stephanie McKnight.)

## What to Plant

Monarch larvae require milkweed to develop, while the adults drink nectar from a variety of plant species. Milkweed is an essential resource for monarchs in the Central Valley, but flowering plants that provide monarchs with nectar are also very important, especially those that bloom in early spring and late fall during the monarch migration. Plant milkweed and a variety of nectar plants to provide quality monarch habitat. Please see Table 1 for a list of commercially available milkweeds and nectar plants that are recommended for the Central Valley.

## Where to Plant

Farmers have a variety of habitat enhancement and management options, because individual patches of monarch habitat do not have to be large to make a positive impact. Small areas scattered across your farm will help transform the landscape. Monarch habitat consisting of milkweed and nectar plants can be incorporated:

- ⇒ In flowerbeds around buildings such as barns, offices, or houses;
- ⇒ In the corners of equipment yards;
- ⇒ In hedgerows and field borders;
- ⇒ In tree rows and windbreaks;
- ⇒ Along the edges of irrigation canals and ditches;
- ⇒ Along streams and rivers; and
- ⇒ Along roadsides.

## Areas to Avoid

- ⇒ Do not place new monarch habitat in areas where insecticides will be used or where pesticide drift is likely because pesticide drift reduction methods are not being used (see Limiting Pesticide Exposure, page 9).
- ⇒ Do not plant milkweeds or other pollinator attractive nectar plants in locations where systemic insecticides (e.g., neonicotinoids) were applied within the previous two years (this includes areas planted with treated seeds), as neonicotinoids could persist in the soil and be absorbed by plants.

**Table 1: Commercially Available Milkweeds & Nectar Plants for the Central Valley**

Common Name	Scientific Name	Plant Type	Bloom
<b>MILKWEEDS</b>			
Narrow-leaf milkweed	<i>Asclepias fascicularis</i>	Perennial	June – Sept
Woolypod milkweed	<i>Asclepias eriocarpa</i>	Perennial	June – Aug
Showy milkweed	<i>Asclepias speciosa</i>	Perennial	June – July
<b>NECTAR PLANTS</b>			
Lacy phacelia	<i>Phacelia tanacetifolia</i>	Annual	Mar – May
Chia sage	<i>Salvia columbariae</i>	Annual	Mar – June
Vinegarweed	<i>Trichostema lanceolatum</i>	Annual	Aug – Oct
Clover	<i>Trifolium sp.</i>	Annual	Varies by species
Common yarrow	<i>Achillea millefolium</i>	Perennial	April – Aug
Pearly everlasting	<i>Anaphalis margaritacea</i>	Perennial	June – Aug
Indian hemp	<i>Apocynum cannabinum</i>	Perennial	June – Aug
Nodding beggartick	<i>Bidens cernua</i>	Perennial	Aug – Sept
Smooth beggartick	<i>Bidens laevis</i>	Perennial	Aug – Sept
Elegant clarkia	<i>Clarkia unguiculata</i>	Perennial	June – Sept
Fort Miller clarkia	<i>Clarkia williamsonii</i>	Perennial	May – July
Western virgin's bower	<i>Clematis ligusticifolia</i>	Perennial	June – Aug

**Table 1, Cont.: Commercially Available Milkweeds & Nectar Plants for the Central Valley**

<b>Common Name</b>	<b>Scientific Name</b>	<b>Plant Type</b>	<b>Bloom</b>
Bluedicks	<i>Dichelostemma capitatum</i>	Perennial	Feb – April
Sulphur flower buckwheat	<i>Eriogonum umbellatum</i>	Perennial	Aug – Oct
Wallflower	<i>Erysimum capitatum</i>	Perennial	Mar – July
Western goldentop	<i>Euthamia occidentalis</i>	Perennial	Aug – Oct
Gumweed	<i>Grindelia camporum</i>	Perennial	April – Oct
Gumplant	<i>Grindelia stricta</i>	Perennial	May – Oct
Sunflower	<i>Helianthus annuus</i>	Perennial	June – Aug
Bolander's sunflower	<i>Helianthus bolanderi</i>	Perennial	June – Oct
Cardinal flower	<i>Lobelia cardinalis</i>	Perennial	June – Aug
Lupines	<i>Lupinus</i> sp.	Perennial	Varies by species
Seep monkeyflower	<i>Mimulus guttatus</i>	Perennial	April – June
Desert mint	<i>Monardella odoratissima</i>	Perennial	June – Aug
Coyote mint	<i>Monardella villosa</i>	Perennial	June – Aug
Foothill penstemon	<i>Penstemon heterophyllus</i>	Perennial	May – July
Showy penstemon	<i>Penstemon speciosus</i>	Perennial	June – July
California phacelia	<i>Phacelia californica</i>	Perennial	May – Aug
Cleveland sage	<i>Salvia clevelandii</i>	Perennial	May – Aug
Goldenrods	<i>Solidago</i> sp.	Perennial	Aug – Sept
Pacific aster	<i>Symphyotrichum chilense</i>	Perennial	July – Aug
Western vervain	<i>Verbena lasiostachys</i>	Perennial	April – Sept
California buckeye	<i>Aesculus californica</i>	Shrub	May – July
Manzanita	<i>Arctostaphylos</i> sp.	Shrub	Varies by species
Coyotebrush	<i>Baccharis pilularis</i>	Shrub	Sept – Jan
Mule-fat	<i>Baccharis salicifolia</i>	Shrub	Year-round
Oregon grape	<i>Berberis aquifolium</i>	Shrub	Feb – April
California lilac	<i>Ceanothis</i> sp.	Shrub	Varies by species
Common buttonbush	<i>Cephalanthus occidentalis</i>	Shrub	Aug – Oct
Rubber rabbitbrush	<i>Ericameria nauseosa</i>	Shrub	July – Oct
Toyon	<i>Heteromeles arbutifolia</i>	Shrub	June – Aug
Beloperone	<i>Justicia californica</i>	Shrub	Mar – June
Bladderpod	<i>Peritoma arborea</i>	Shrub	Nov – June
Lewis' mock orange	<i>Philadelphus lewisii</i>	Shrub	May – June
Hollyleaf cherry	<i>Prunus ilicifolia</i>	Shrub	Feb – April
Chokecherry	<i>Prunus virginiana</i>	Shrub	April – May
Sugar sumac	<i>Rhus ovata</i>	Shrub	April – May
Golden currant	<i>Ribes aureum</i>	Shrub	April – May
Black sage	<i>Salvia mellifera</i>	Shrub	Mar – July
Snowberry	<i>Symphoricarpos albus</i>	Shrub	June – July
Willow	<i>Salix</i> sp.	Tree	Varies by species

## How to Maximize Success of Planting Monarch Habitat Site Preparation

As with growing crops, proper site preparation to control weeds is necessary for the successful creation of habitat for monarch butterflies. This is especially true for the establishment of milkweeds, which emerge later in spring than common weed species—and many wildflower species—and thus, are vulnerable to competition. A detailed discussion of site preparation methods can be found at [xerces.org/guidelines-organic-site-preparation](https://xerces.org/guidelines-organic-site-preparation).

Recommended methods of site preparation in Central Valley farms include solarization and frequent mowing; when those approaches are not feasible, herbicide applications can be used. These methods can also be used in conjunction with each other to increase effectiveness. Any necessary soil disturbance, such as tillage or grading, should occur at the beginning of the site preparation process only.

### Solarization

Solarization is commonly used on Central Valley farms for killing weeds. This highly effective technique works by covering the area with clear, UV-stable plastic sheeting, under which weeds are killed and the seed bank reduced with heat. Solarization is not effective in shady or wet areas. It is labor-intensive, so is best used in areas less than a half-acre; the plastic can be reused multiple times. Detailed instructions for solarization can be found at [xerces.org/organic-site-preparation-methods-a-comparative-overview](https://xerces.org/organic-site-preparation-methods-a-comparative-overview). The basic steps are as follows:

- ⇒ Cultivate the site to a depth of not more than 2 inches just prior to laying plastic.
  - ⇒ Level and smooth the site and remove any debris.
  - ⇒ Lay plastic (4 or 6 mm thickness) in late spring or early summer.
  - ⇒ Dig a trench approximately 4 inches deep around the perimeter.
  - ⇒ Water the area being covered if soil is dry.
  - ⇒ Lay the plastic and pull it taut, burying the edges in the trench.
  - ⇒ Check the plastic monthly for holes or rips, which can be repaired with tape.
  - ⇒ Remove the plastic in late fall, right before planting.
- ⇒ NOTE: Do NOT till or otherwise disturb the soil again prior to planting.



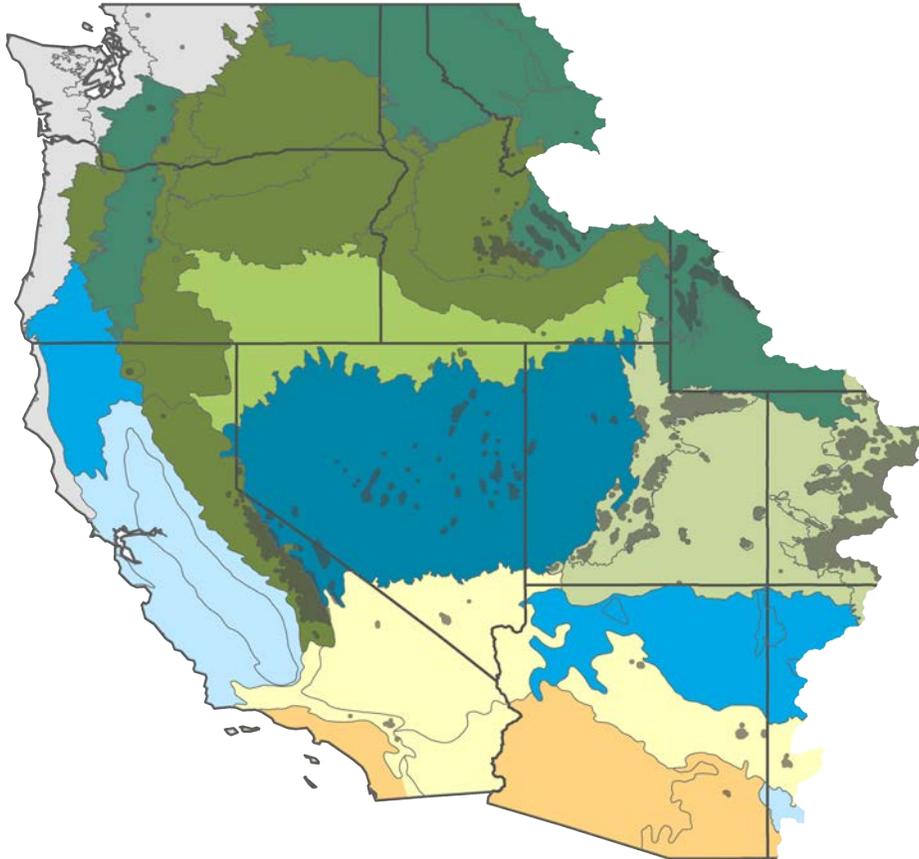
Solarization in process at the Heidel Family Farm in Wisconsin. (Photo: Kerry Lynch.)

### Mowing

In areas where weed pressure is low and dominant weed composition consists of annual species, regular mowing prior to planting can be a cost-effective way to keep weeds in check. This method is also most effective when using transplants, and where no tillage or soil disturbance is required prior to planting. Begin mowing in late winter or early spring, and continue until fall planting. Timing mowing to ensure that resident weedy species do not go to seed is critical to the success of this method. Once the habitat is established, limit mowing to times when monarchs will not be present (i.e. November through mid-March for the Central Valley, Fig. 1, next page).

**Figure 1: Map showing the time periods within which management activities such as mowing can be done in monarch breeding habitat without disrupting monarchs.**

*It is generally safe to manage monarch habitat between October 31 and March 15 in the Central Valley.*



**Date range to manage within; monarchs typically not breeding during this time period.**

- November 30 - March 15
- October 31 - March 15
- October 31 - April 1
- October 31 - May 1
- September 30 - May 1
- September 30 - May 15
- September 30 - June 1
- August 31 - June 1
- Potential year-round breeding [Summer: June 20 - August 10, Winter: November 30 - March 15]
- No breeding/milkweed
- Above 9,000 feet (no breeding)
- EPA Level III Ecoregions

Data: EPA Level III Ecoregions, Western Monarch Milkweed Mapper, Journey North, Southwest Monarch Study, Department of Defense Legacy Fund Research, Dingle, et al., 2005.



## Herbicide

Broad-spectrum herbicide applications can be used to remove weeds in areas where solarization or mowing are not feasible, or in conjunction with any of the above methods. Treatments should begin in the late winter or early spring and continue until fall planting. Multiple treatments will likely be necessary, and should be timed such that weed species are not permitted to produce seed between applications. Do not use pre-emergent herbicides in areas that will be planted with seed. Once the habitat is established, limit herbicide exposure to winter and early spring (November through mid-March, Fig. 1), when monarchs are unlikely to be present.

## Milkweed and Nectar Plant Establishment

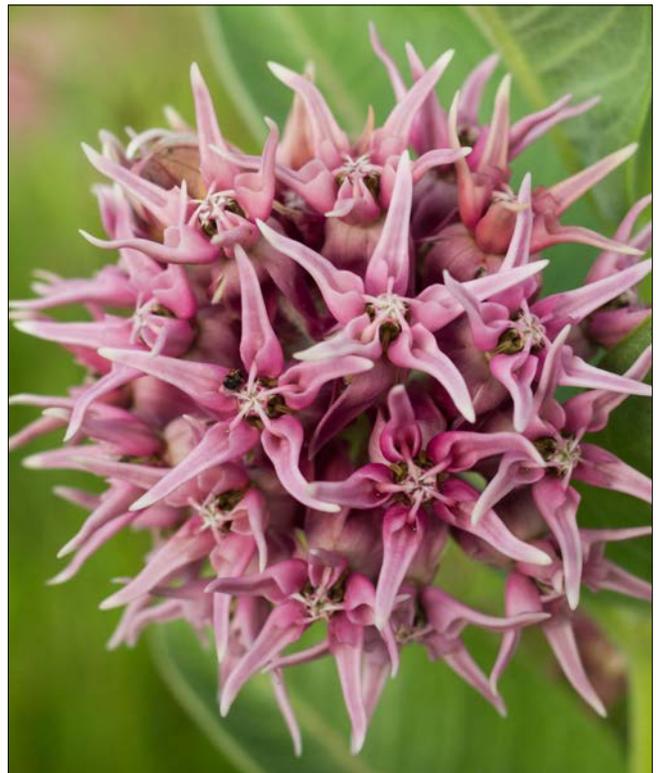
Native plants grow best when planted in the fall, once the rains start. In general, habitat established from transplants (plugs or container plants) is more successful and easier to maintain than seed-planted projects, and it is the recommended method when irrigation is available. Water the plugs and container plants immediately after planting and continue to provide irrigation as needed during the dry season for the first several years until the plants are established. For most native plants, water requirements are minimal after this period.

If irrigation is not available, planting from seed is the only option, and site preparation must be thorough. After spreading seeds onto a prepared seedbed, incorporate them into the soil immediately using a rake, harrow, ring-roller, or gentle over-head irrigation.

## Milkweed Establishment

Native milkweed can be difficult to establish in California. Because of these challenges, Xerces and the USDA-NRCS Plant Materials Center at Lockeford are conducting milkweed planting trials to improve recommendations for successful establishment. The following recommendations are based upon current results from the milkweed trials, discussions with local nurseries, and our own experiences establishing milkweed in this region:

- 1. Prepare the site adequately.** Because milkweed germinates and breaks dormancy so late in the spring, it is often out-competed by other plants. Site preparation to reduce competition with other plants is key to milkweed establishment. In addition, mowing in the late winter and repeating as needed until the milkweed germinates or breaks dormancy (usually in April) can be effective.
- 2. Choose milkweeds that are native to your area.** Showy milkweed (*Asclepias speciosa*) and woollypod milkweed (*A. eriocarpa*) are generally found in the Sacramento Valley, while narrow-leaved milkweed (*A. fascicularis*) is found throughout the Central Valley.



Showy milkweed (*Asclepias speciosa*), a common Sacramento Valley species. (Photo: Justin Meissen / Flickr Creative Commons 2.0.)

3. **If irrigation is not available, plant milkweed from seed.** Narrow-leaved milkweed does fairly well from seed. Plant milkweed seed alone, rather than in a mix with other wildflowers. This will reduce competition.
4. **If irrigation is available, planting milkweed plugs is recommended.** Plant milkweed plugs in the early to mid-fall, before milkweed goes dormant.
5. **Showy milkweed does very well from rhizomes.** However, these are currently not commercially available. Cut rhizomes into 2-inch-long pieces and plant in the fall, anywhere from just below the surface to 8 inches down. Provide at least occasional irrigation (three times per year, for example) until established.
6. **You can collect milkweed seed yourself to use in plantings.** If you plant the seed in the fall after collection, no seed treatment is needed. If you store the seed, cold stratification in the refrigerator before planting will enhance germination. The guides available from the Western Monarch Milkweed Mapper website, [monarchmilkweedmapper.org](http://monarchmilkweedmapper.org), will help you identify milkweed species already on your property.



You can collect your own milkweed seeds to use in plantings. (Photo: Tina Shaw / USFWS.)

## Sourcing Plants

The Xerces Society's online Milkweed Seed Finder ([xerces.org/milkweed-seed-finder](http://xerces.org/milkweed-seed-finder)) lists vendors of milkweed seed and plugs by state. Nectar plants can be sourced from nurseries around the state, especially those that specialize in native plants. The California Native Plant Society maintains a list of native plant vendors in California at [calscape.org/plant\\_nursery.php](http://calscape.org/plant_nursery.php). When purchasing plants for monarch habitat, be sure to get plants that have not been pre-treated with neonicotinoids, as these insecticides can persist in the plant for long periods of time.



The Xerces Society offers a variety of resources on growing milkweed, from the Milkweed Seed Finder, which lists local vendors throughout the U.S., to advice on growing and establishing milkweed in California. (Photo: Xerces Society / Brianna Borders.)

## Managing Habitat for Monarchs

Ongoing maintenance will be necessary to keep the habitat project intact, including irrigation line checks and general weed management during the habitat establishment phase.

### Limiting Pesticide Exposure

Insecticides can harm monarchs directly, so avoid using them in habitat areas. Herbicides may have indirect effects on monarchs by removing important food and nectar sources. The following recommendations can help you to minimize the potential impacts of pesticide use near monarch habitat.

#### General Pesticide Considerations:

- ⇒ Any pesticide should be used within an integrated pest management (IPM) plan that incorporates: (1) actions to prevent the conditions that support pests; (2) biological, physical, and cultural methods to manage pests; (3) monitoring of pest levels and the use of pesticides only if the pest reaches established economic threat thresholds; and (4) steps to minimize the risk of pesticide use on non-target organisms. As IPM plans are crop and region specific, it helps to work with the University of California Cooperative Extension Service or other agricultural researchers to design an IPM plan. The University of California Statewide IPM program ([ipm.ucanr.edu](http://ipm.ucanr.edu)) provides excellent resources for growers.
- ⇒ Avoid the use of long-lived, highly toxic neonicotinoids (clothianidin, dinotefuran, imidacloprid, and thiamethoxam), and other systemic insecticides.
- ⇒ Do not apply pesticides when any stage of monarchs are present.
- ⇒ Include spatial or vegetative buffers around areas with milkweed and nectar sources. If using a vegetative buffer, ensure it is not attractive to pollinators (i.e., plant conifers and grasses instead of blooming flowers or shrubs). You can find more information on pages 8–9 of our Bee Better Certified™ Production Standards (available at [beebettercertified.org/docs](http://beebettercertified.org/docs)).
- ⇒ When applying pesticides to crops, take precautions to avoid off-site pesticide movement onto field margins, such as making applications on low-wind days, using of precision application equipment, or changing application pressure and droplet size. Other suggestions to limit off-site movement can be found on labels and on the U.S. Environmental Protection Agency’s webpage outlining drift reduction efforts ([epa.gov/reducing-pesticide-drift](http://epa.gov/reducing-pesticide-drift)).
- ⇒ If aerial applications cannot be avoided, take precautions to limit drift, including flying at the lowest height and speeds possible, and using large droplets and low pressure.
- ⇒ Apply herbicides during plant life stages when weeds are most vulnerable.
- ⇒ Plants should not be sprayed while in bloom or after they have gone to seed.
- ⇒ Milkweed pests are specific to milkweed and will not spread to adjacent crops, so it is not necessary to treat milkweed pests with insecticides.



It is important to avoid pesticide use while any monarch life stage is present. (Photo: Xerces Society / Stephanie McKnight.)

## Mowing

While mowing can be an effective strategy to control weeds prior to planting, mowing after the habitat is installed should be done with care to avoid harming monarch larvae. Frequent mowing may also reduce the quantity of floral resources available to adult butterflies. In the Central Valley, mowing of monarch habitat should be avoided from mid-March through to the end of October, the period when monarch larvae can be found on milkweeds (Figure 1). If an area needs to be mowed, consider mowing around milkweed and nectar plants during this period. From March to early June, set the mowing height to a minimum height of 10–12 inches to avoid cutting newly emerged milkweed plants.

## Funding and Technical Assistance Opportunities

- ⇒ **Natural Resources Conservation Service.** The NRCS is part of the U.S. Department of Agriculture. It provides farmers and ranchers with technical assistance and funding to improve pollinator and monarch habitat on their land. The California NRCS webpage ([nrcs.usda.gov/wps/portal/nrcs/site/ca/home](https://nrcs.usda.gov/wps/portal/nrcs/site/ca/home)) provides information on current Farm Bill conservation program implementation in the state, including funding announcements, application deadlines and “5 steps to getting assistance.” Find your local NRCS office at [offices.sc.egov.usda.gov/locator/app?state=CA](https://offices.sc.egov.usda.gov/locator/app?state=CA).
- ⇒ **Partners for Fish & Wildlife Program.** This U.S. Fish & Wildlife Service cost-share and technical assistance program is focused on working with private landowners to improve fish and wildlife habitat on their lands. Visit [fws.gov/cno/conservation/partners.html](https://fws.gov/cno/conservation/partners.html) for more information.
- ⇒ **California Healthy Soils Program.** This program is part of the Healthy Soils Initiative, and provides funding for projects that improve soil health, including the planting of hedgerows and monarch conservation cover. Visit [cdfa.ca.gov/oefi/healthysouils](https://cdfa.ca.gov/oefi/healthysouils) for more information.
- ⇒ **Xerces Society.** The Xerces Society provides technical assistance in restoring monarch habitat. Please contact [monarchs@xerces.org](mailto:monarchs@xerces.org) or visit [xerces.org](https://xerces.org) for more information.

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Thanks to the farmers who work with us and inspire us!



## Monarch Habitat Case Study 1

### **F. M. Upton and Sons Ranch in Chowchilla**

The Upton family has been farming in southern Merced County since 1946, producing corn, wheat, alfalfa, cotton, and almonds on 983 acres. They also maintain 15 acres of wildlife habitat, including wetlands, riparian creek borders, and pollinator meadows. They are particularly interested in aiding vulnerable and declining wildlife species like tricolored blackbirds, burrowing owls, and monarch butterflies.

In 2015, the Uptons began working with the USDA Natural Resources Conservation Service to create more wildlife habitat on their land. As part of this project, restoration plantings have included multiple species of native milkweed, as well as native wildflowers.

Monarchs can often be spotted nectaring there in spring, and their caterpillars have been found on the milkweed.



Above: Monarch caterpillar on narrow-leaved milkweed at the Uptons' farm. (Photo: Stephanie Upton.) Below: California poppies and monarch nectar plants abound in a 15-acre wildlife area adjacent to the Uptons' farm. (Photo: NRCS / Priscilla Baker.)



## Monarch Habitat Case Study 2

### **Erdman Farms in Colusa County**

With help from the Xerces Society, the USDA Natural Resources Conservation Service (NRCS), and other organizations, Kimberly and Patrick Gallagher of Erdman Farms have created over 30 acres of flower-rich habitat around their 400-acre almond ranch in Colusa County, CA.

This habitat, which includes grasslands, meadows, hedgerows, cover crops, and riparian areas, supports pollinators, monarchs, birds, and other wildlife. These areas are planted with native wildflowers, which provide nectar, as well as milkweed. Flower-rich habitat that is protected from pesticides also supports improved pollination and natural pest control on their orchard.

Despite the high value of land in the Central Valley, the Gallaghers remain committed to preserving the habitat around their farm. As Kim Gallagher says, “Every farmer’s dream is to leave the land a little better for the next generation.”



A wildflower meadow incorporating milkweed and nectar plants borders the Gallaghers’ almond orchard, providing food and habitat for monarchs and other pollinators. (Above: Xerces Society / Eric Lee-Mäder; below: Xerces Society / Liz Robertson.)

