

*Considerations for Planning and Maintaining*

# A POLLINATOR & MONARCH GARDEN

*For Citizen Science, Education, and Conservation  
in Western National Parks*

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Southwest Center

[MakeWayForMonarchs.org](http://MakeWayForMonarchs.org)

and

Borderlands Habitat Network

2018



This publication is dedicated to the memory of Lincoln Brower (1931-2018), conservation champion of the monarch butterfly.

And to the extraordinary efforts of Ina Warren, Michael Powell, and Chip Taylor to conserve native plants needed by pollinators.

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# SUMMARY & STATEMENT OF PURPOSE

WITH THE precipitous declines of monarch butterflies, bumblebees and other nectar-feeding pollinators in North America over the last decade, the public has been encouraged to take actions to recover both pollinator and plant populations in their areas. The staff in many national parks, state parks, botanical gardens and zoos have decided to dedicate space to pollinator-attracting plant habitats, monarch way-stations and pollinator gardens.

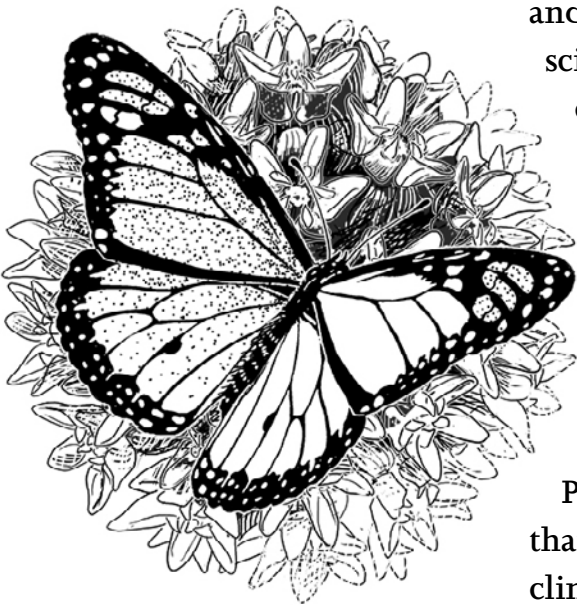
Objectives of such efforts are many. Projects can help:

- a. raise public awareness of solutions to reduce the risks of pollinator collapse;
- b. provide teaching gardens for students and other visitors to familiarize them with the life histories of pollinators, their larval hosts, nectar and pollen plants;
- c. establish waystations where citizen scientists can take data on the phenology and frequency of nectaring, egg-laying, larval development and adult visitation to flowers;
- d. offer licensed scientists and educators places to tag monarchs and other pollinators for research; and
- e. pilot plant mixes for local evaluation as trials for future habitat restoration efforts.

There are costs involved in planning, implementing, maintaining, promoting, interpreting and evaluating such efforts that should be understood by site administrators, resource managers, interpreters and maintenance crews prior to implementation. This guide discusses the unique opportunities for pollinator gardens in borderland parks as well as initial and recurring costs for consideration by decision makers and managers.

In addition, an appendix provides a list of potential native plant species to be propagated and transplanted out.

# INTRODUCTION



FOR THE first time in North American history, the numbers of bees, bats, butterflies, hummingbirds and other pollinators have fallen so low that there is scientific concern and public fear of a “pollinator collapse.” Such a “food chain collapse” might not only affect the health of wild species in our parks and refuges, but also our food security derived from agricultural landscapes. In particular, several bumblebee species, hummingbirds and monarch butterflies have suffered precipitous declines in forests, rangelands, fields and orchards.

For instance, the “eastern” (including Great Plains) migratory populations of monarch butterflies that overwinter in the mountains of Mexico have declined by more than 80% within the last two decades. One probable driving factor of this decline has been the loss of more than 1.3 billion stems of milkweed plants required by monarchs as larval host plants and as nectar sources to ensure their reproduction. Misuse and overuse of toxic herbicides—as well as land conversion and habitat fragmentation – are high among the many factors that have contributed to this decline.

The decline of several North American bumblebee species has been linked to the use of certain highly toxic neo-nicotinoid pesticides, to emergent diseases, to introduced parasites and to habitat loss triggered by climate change. A recently published analysis of historical specimen data for 21 North American bumble bee species found that 11 of the examined species have experienced populations declines of 50% or greater. A different set of factors may be involved with each other set of pollinators now considered at risk.





Monarch Butterfly with an identification tag applied on a spot that had its scales rubbed off. The butterfly was part of the Cape May Bird Observatory's program of tagging in Cape May, New Jersey. Photo taken at the Cape May Point State Park.

In *The Forgotten Pollinators*, we determined that “wildlife pollinators” and honeybees are responsible for 1 out of 3 bites of food we take each day, and yet pollinators are at a critical point in their own survival. While many factors have contributed to their recent declines, we know for certain that more nectar and pollen sources provided by more flowering herbs, shrubs, succulents and trees will help improve their health and numbers. Increasing the number of pollinator-friendly gardens and landscapes while controlling where pesticides and herbicides are used will tangibly help revive the health of bees, butterflies, birds, bats and other pollinators across the country.

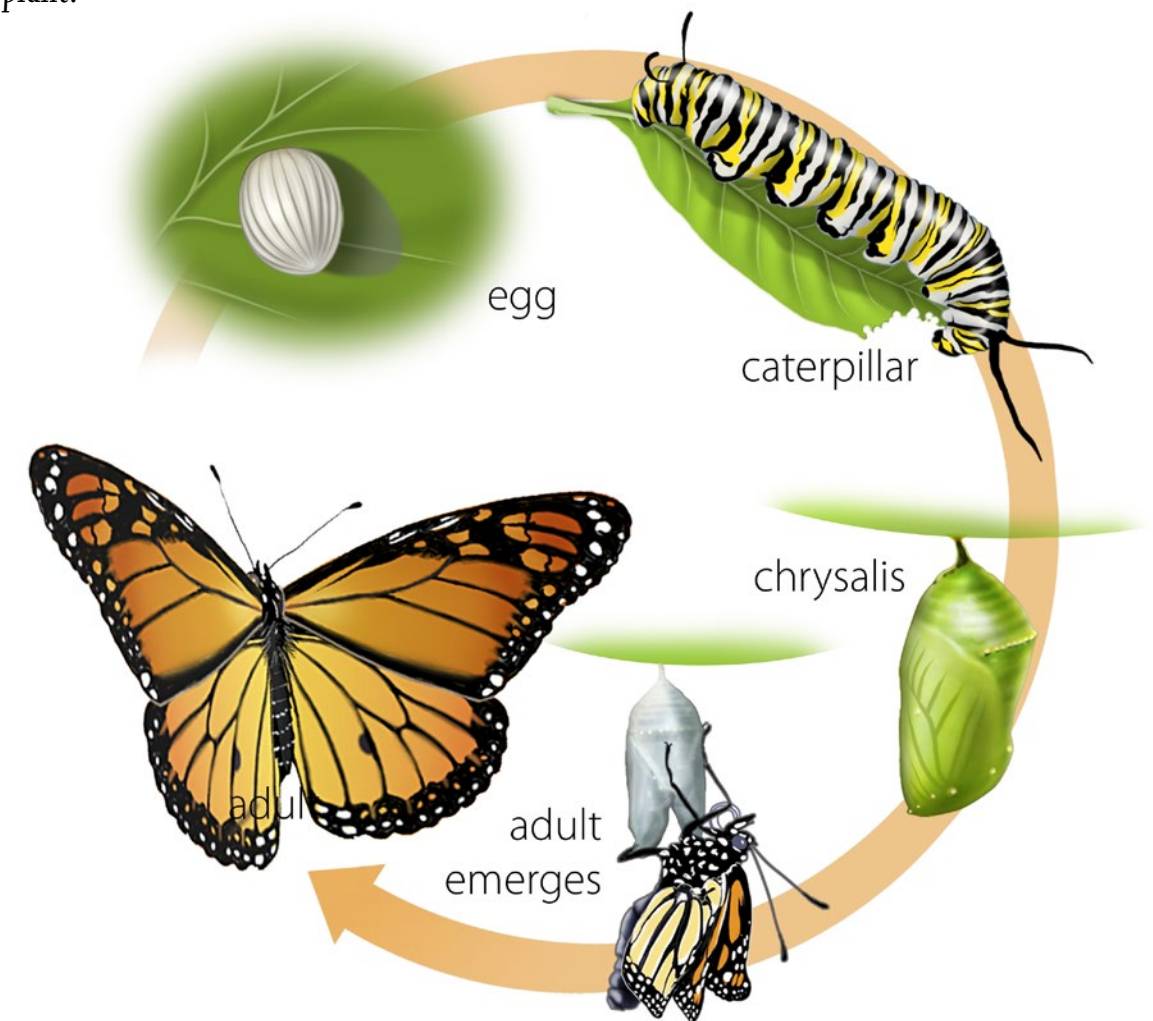
To advance real solutions, the White House Office of Science and Technology has called for “all hands [to be] on deck” to recover pollinator populations, to restore diverse habitats, to reduce agrichemical risks and to shield pollinators from them, and/or to educate the public about best practices for pollinator health. This call is obviously intended to engage park resource professionals and educators as much as it intended to engage farmers, ranchers and other private landowners.

Each park has the opportunity to match particular objectives—research, monitoring, habitat restoration, public education--- with the skills, resources and space available for its engagement. They need not design gardens at the same scale, with the same objectives, or the same focus on particular pollinators. Explore the unique expressions best suited to your own site!

Perhaps most important to note is that borderlands parks may play a pivotal role in helping monarch, bat and hummingbird biologists understand what these organisms require and where they travel along some of the least-known corridors used in their continent-wide migrations. Currently, there are very few data points for mapping migratory pollinators

in the area immediately south of the border, all the way across the deserts to the northernmost tropical habitats in Mexico. Likewise, there is a lack of clarity as to where the zone of division occurs between the “eastern monarch migration” southward to Mexico’s transvolcanic range and other montane habitats versus the “western monarch migration” to the Pacific coast. For instance, monarch butterflies tagged just north of the Mexican border between Coronado National Memorial and Tumacacori National Historic Park actually migrate in both directions! In short, there may be no region in North America where the monitoring efforts pollinators in gardens may be needed as urgently as in the borderlands region between Texas and California.

Life cycle of a Monarch butterfly. The entire right side of the cycle, within the orange arrow takes place on a Milkweed plant.



# TEN QUESTIONS TO ASK YOUR TEAM

## *Before Initiating a Pollinator Garden or Habitat Recovery Project*

**1 What are the potential goals for placing a pollinator garden or habitat restoration project in a borderlands park that would justify our park staff’s investment in such a project and what should our specific objectives be that fit our area?**

There is an urgent need to collect demographic, behavioral and phenological data on pollinators at risk in the borderlands, since there is very little data on these phenomena documented for the first hundred miles on either side of the U.S./Mexico border. However, goals and objectives of such efforts can be many, and can involve many facets of the public, including underserved constituencies (eg., neighboring farmer and farmworker families).

Different initiatives can help:

- a. raise public awareness of solutions to reduce the risks of pollinator collapse;
- b. provide teaching gardens for students and other visitors to familiarize them with the life histories of pollinators, their larval hosts, nectar and pollen plants;
- c. establish “waystations” where citizen

scientists can take data on the phenology and frequency of nectaring, egg-laying, larval development and adult visitation to flowers;

- d. offer licensed scientists and educators places to tag monarchs and other pollinators for research; and
- e. pilot plant mixes for local evaluation as trials for future habitat restoration efforts.

We encourage each park leadership team to match their site’s unique opportunities and constraints with the two or three objectives noted above that can be best addressed at its location.

**2 Given there may not be a lot of space or resources for maintenance of the site, will a small to medium-sized garden or restored habitat make any on-ground conservation difference for species at risk? What size is too small?**

From one perspective, even small sites can be effective teaching venues about pollinators. It is what you choose to do with the site that matters. In addition, continent-wide analyses indicate that urban

pollination conservation is as urgently needed as rural or wildlands conservation and restoration.

From a second perspective, it appears that the losses of pollinators have been greatest in habitats fragmented by the use of herbicides. Once the use of herbicides is minimized, these areas deserve to be restored by planting milkweeds and other wildflowers.

A Monarch Waystation can be certified even if it covers less than 200 square feet, but it should intensively planted with densities of at least 2-10 plants per square yard, including both annual and perennial nectar sources and larval hosts, including at least two regionally-appropriate native milkweed species.

By fencing some gardens with the dried flower stalks of agaves (century plants) and sotol (desert spoons), bee nesting habitat can be enhanced even in a small area.

Finally, remember to locate plants of the same species in clusters to create a critical mass, to include a variety of flower colors, shapes and blossoming times, and to include representatives of several different “pollination syndromes”—flowers adapted to nocturnal visitations by moths and bats, or diurnal visitations by bees and hummingbirds).

**3 Given that the garden will be useful, is it possible to plan a low-maintenance planting that does not place further stress on limited staff resources?**

There are three strategies to solve this problem. First, plant low-maintenance, drought-hardy perennials that do not need to be pampered. Second, water them with drip irrigation on a timer, and use weed-controlling ground covers (black plastic sheeting, mulch, or densely-layered decomposed granite) to suppress invasive non-native plants.

Third, have one of your resource managers or interpreters recruit a local garden club, school, birding or butterfly-watching group or senior center to do most of the seasonal maintenance.

**4 Who might become local or regional collaborators in acquiring seeds or plants, sowing or transplanting them, reducing weeds and doing routine maintenance?**

Local chapters of state native plant societies, butterfly associations, nurseries, botanical gardens, zoos and regional nature centers may be ideal partners, But don’t forget that many private nursery owners, NRCS Plant Materials Centers, state arboreta and highway beautification are already dedicated to this cause.

The Xerces Society, Monarch Watch, Bat Conservation International, Ladybird Johnson National Wildflower Center, Chihuahuan Desert Research Institute, Arizona-Sonora Desert Museum and Chihuahuan Desert Museum staff and volunteers can offer considerable expertise as well.



**5 How can we encourage visitors and students to take data on the flowering plants and pollinators, and with whom should that data be shared?**

- For school groups to share their data, connect with [Journey North](#).
- For roving natural history buffs, connect through [i-naturalist](#).
- For butterfly gardeners and monarch observers, report to [Monarch Watch at the University of Kansas](#).
- For scientists and skilled naturalists who take repeated data in one habitat site or garden, set up a log-in with the [USA National Phenology Network](#).

**6 Are there any urgent research needs that SWCA interns, local students or elderly volunteers can help address, and how could they be trained to do so?**

Yes, there are. We need to better establish where monarchs are breeding and laying eggs on milkweed stems, not merely passing through. This simply requires frequent checking of milkweed stems and the undersides of their leaves frequently in late spring and summer for eggs.

There are visual aids on many websites (eg., <https://www.monarchwatch.org/>) that can help you distinguish monarch eggs,

larvae and adults from the other related butterflies which occur in the borderlands.

There are also visual aids and collecting kits to help you determine whether monarch health is being affected by diseases, and parasites including protozoan micro-parasites such as one nicknamed “OE” that affects monarch pupae (<http://www.monarchparasites.org/>).

**7 What interpretive messages are best to offer about pollinators and their plants to tourists visiting from elsewhere, to the elderly, to young students or to the surrounding farm and ranch communities?**

We want to communicate the positive message (especially to students) that individuals of all ages, cultures, races and walks of life can play a positive role in pollinator conservation. We also want to communicate to nearby landowners that community-based collaborative restoration of habitats across borders is essential to the conservation of monarch butterflies, two nectar-feeding bat species, sixteen hummingbird species, and hundreds of native bee species that occur in the U.S./Mexico border states.

We need to remind farmers and ranchers that more than 70,000 food producers in the U.S. and Mexico have been trained in restoring pollinator habitats, but these efforts will not be effective if we continue to overuse or inappropriately use pesticides and herbicides, as was done in the past.

Finally, we need to remind visitors from other regions that the U.S./Mexico border states are the richest in pollinator biodiversity of any region in North America, and deserve to be made a priority for species recovery, habitat conservation, study and appreciation of pollinators and flowers through participatory environmental education.

**8 What are the best means and times of the year to do in-garden interpretation for visitors and students?**

In general, pollinator gardens need to be established by March to ensure visitation by monarchs, hummingbirds and bats, which will then begin to migrate southward by mid- to late-August, with subsequent waves passing through as late as mid-September.

Start looking for eggs, larvae and pupae of monarchs early on in summer, and make repeated visits to the same plants. For bats, the chances of catching nocturnal pollination are highest between mid-June and mid-August, depending upon the agave or cactus species.

Finally, you may find “teachable moments” to enlighten students and other visitors about the life cycles of pollinators and their associated plants year-round, but especially from Spring Equinox to Autumnal Equinox.

**9 How often will we need to rogue, prune or replant?**

Different species, especially with respect to native perennials vs. annuals, have distinct seasons for seed sowing, transplanting, pruning and roguing. Consult the staff at seed companies, nurseries and local university botanists. In general, transplants in arid- and semi-arid landscapes survive best when placed into the ground with the onset of summer rains, or if placed on drip irrigation, after the last frost. Finally, many herbaceous perennials like milkweeds may become erratic or senescent after the first three or four years following establishment, so that other transplants should be integrated into the garden or restored habitat to take their place. Hopefully, some of the seed progeny of the first plantings will have also become established by then. In short, gardening and restoring habitats can never be a one shot deal.



**10 What native plant nurseries and seed companies can our staff go to for obtaining pollinator-attracting plants from the border states?**

### Borderlands Restoration, Patagonia, AZ

Borderlands Restoration specializes in propagating native, locally-sourced perennials to sell for transplanting in order to support pollinators and seed dispersers. All plants are grown from seeds collected from particular “seed transfer zones” within the Sky Islands region.

### Native American Seed, Junction, TX

Native American Seed specializes in native, bioregionally-appropriate wildflowers and grasses suited to the semi-arid and sub-humid habitats of West and Central Texas, with strong emphasis on allegiant customer service and consulting to make restoration efforts successful.

### Curtis & Curtis Seed, Clovis, NM

Curtis & Curtis Seed is a for-profit seed company that consults with farmers, ranchers and mine reclamation companies on the use of native grasses, wildflowers and small grains adapted to the High Plains of New Mexico and West Texas. It can custom mix multiple species and scale offerings to diverse needs.

### Desert Survivors, Tucson, AZ

Desert Survivors non-profit plant nursery sells several hundred species of plants native to the Sonoran Desert, Chihuahuan Desert, and Mohave Desert, with a primary focus on plants of southern Arizona. It also helps provide meaningful employment for adults with disabilities.

### Hydra Aquatic, Albuquerque, NM

Hydra Aquatic’s plant nursery grows container plants of native wetland, aquatic and riparian plants native to the Southwest. This includes many pollinator plants of wet meadows.

### Long Mountain Native Plants, Silver City, NM

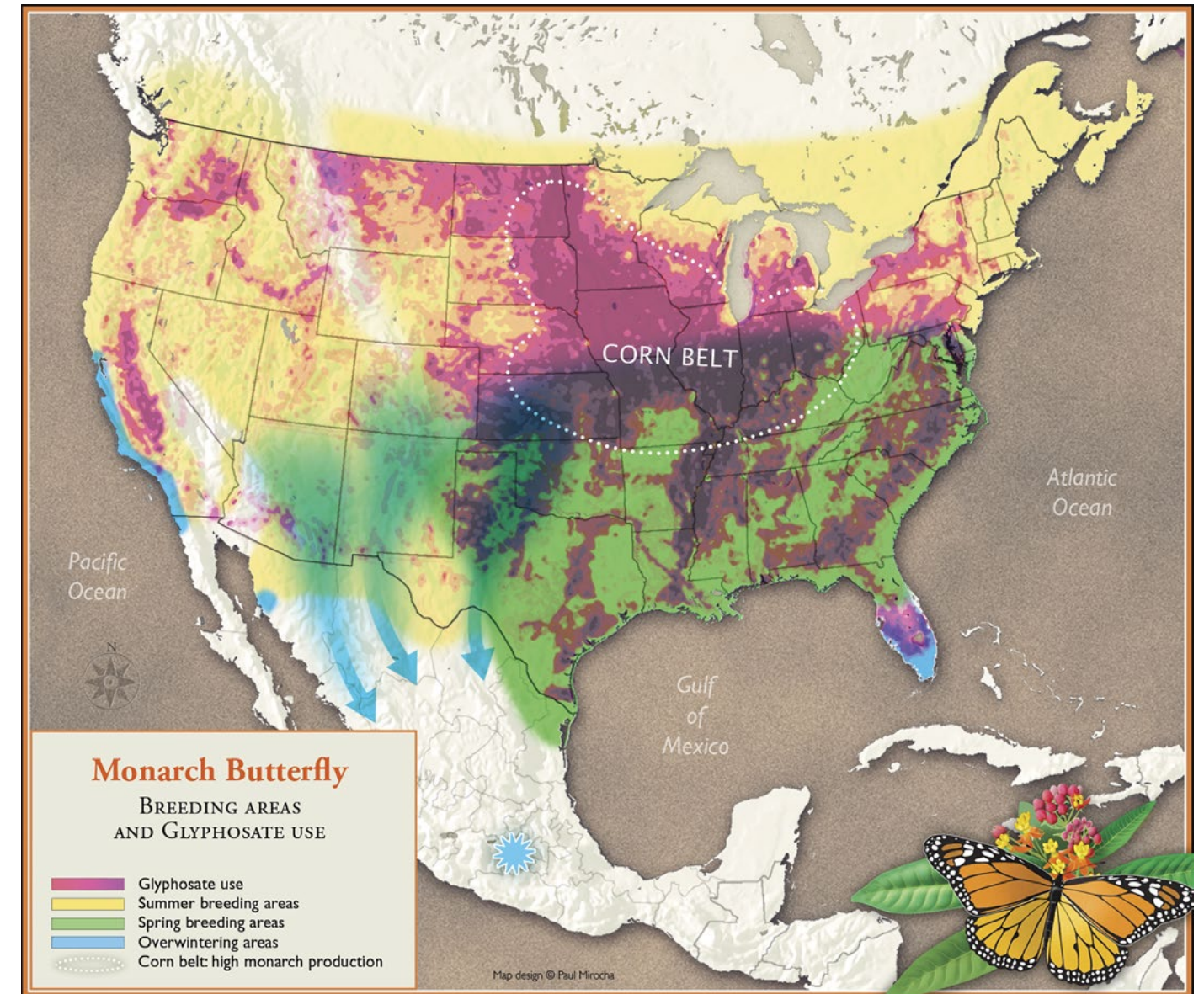
Lone Mountain Native Plants grows and sells native plants and seeds

### Plants of the Southwest, Albuquerque and Santa Fe, NM

Plants of the Southwest carries native seed and containers of native wildflowers, grasses, shrubs, and trees, including many pollinator-attracting plants of semi-arid grasslands and woodlands.

### Wild Seed, Tempe, AZ

Wild Seed offers seed of many native desert wildflowers, sold on an individual basis and in seed mixes. To determine with Sonoran and Chihuahuan Desert pollinator plants they have available each year, request the latest species list by telephone.



This new map corrects and updates those of the Monarch Joint Venture, Monarch Watch and Xerces Society by showing the migratory corridors for monarchs as they extend southward from Arizona, New Mexico and Texas toward the two Sierra Madre cordilleras which eventually converge southward with the Transvolcanic Belt where monarch overwintering grounds are protected by Mexico’s CONANP.

Note that monarchs from southeastern Arizona also move to California USA, north of Santa Barbara and south of Pismo, and may travel to the Sonoran coast near Bahia Kino and to Ensenada, Baja California Norte as well.

# NECTAR & LARVAL HOST PLANT RECOMMENDATIONS

To Attract Pollinators to Gardens, Restored Habitats & Monarch Waystations in National Parks & Museums in the U.S./Mexico Borderlands

Scientific Name	Common Name(s)	Annual or Perennial	Seed or Live Plants Available
<i>Agastache rupestris</i>	Thread-leaf giant Hyssop	p	seed
<i>Agave deserti</i>	Desert agave	p	plants
<i>Agave havardiana</i>	Havard maguey	p	plants
<i>Agave neomexicana</i>	New Mexico mescal	p	plants
<i>Agave palmeri</i>	Palmer’s agave, Lechuguilla	p	plants
<i>Agave parryi</i>	Parry’s agave	p	plants
<i>Anisacanthus thurberi</i>	Thurber’s honeysuckle	P	plants
<i>Aristolochia watsonii</i> (& <i>A. wrightii</i> )	Indian piperoot, Hierba del indio	p	plants
<i>Asclepias angustifolia</i>	Arizona milkweed	p	plants

Flowering Season	Nectar Source for Pollinators?	Larval Host for Pollinators?	Habitat	States
summer	hummingbirds		Open forests and canyons in Ponderosa, oak woodlands	AZ, NM
summer	Costa’s & other humming-birds		desert flats & ridges	AZ, BCN, CA
summer			rocky grass slopes	COA, CHIH, TX
spring, summer			rocky mt. slopes	NM, TX
summer	bats, Black chinned, Costa’s & other humming-birds, Orioles	giant skippers	grassy slopes, wood-lands	AZ, CHIH, NM, SON
summer	bats , Broad-billed, Magnificent & other hummingbirds	giant skippers	grass- & oak wood-lands	AZ, CHIH, NM
spring, summer	butterflies, hummingbirds		deserts, oak woodlands in rocky canyons	AZ, NM, SON, CHIH
summer-fall	flies	pipevine swallow-tail	moist grass-lands	AZ, NM (& TX)
summer	tarantula wasps	monarchs	canyons, washes	AZ, NL, SON



Scientific Name	Common Name(s)	Annual or Perennial	Seed or Live Plants Available
<i>Asclepias asperula</i>	Green antelope horn Milkweed	p	seed, plants
<i>Asclepias linaria</i>	Pineleaf milkweed, Hierba del cuervo	p	plants
<i>Asclepias oenotheroides</i>	Hierba de zizotes, Primrose milkweed	p	plants
<i>Asclepias speciosa</i>	Showy milkweed, Lecherón	p	seed, plants
<i>Asclepias subulata</i>	Desert rush milkweed	p	plants
<i>Asclepias tuberosa</i>	Butterfly-weed	p	seed, plants
<i>Baccharis salicifolia</i>	Batamote, Jara, Seep willow	p	plants
<i>Carnegiea gigantea</i>	Saguaro	p	plants
<i>Conoclinium greggii</i>	Palmleaf throughwort, Boneset	P	Plants
<i>Cirsium arizonicum</i>	Arizona thistle, Cardo santo	p	seed
<i>Datura wrightii</i>	Sacred thorn-apple	p	seeds

Flowering Season	Nectar Source for Pollinators?	Larval Host for Pollinators?	Habitat	States
summer	Tarantula wasps	monarchs	well-drained soils in open habitats	AZ, CHIH, COA, NL, NM, TAM & TX
summer	Tarantula wasps	monarchs	dry slopes, canyon	AZ, SON
spring-fall	Tarantula wasps	monarchs, queens, soldiers	sunny exposed flats	AZ, CHIH, COA, NL, NM, TX
summer	Costa's hummingbirds & Tarantula wasps	monarchs	exposed sites on plains	AZ, CA, NM, TX
summer	Tarantula wasps	monarchs	desert flats	AZ, CA, SON
summer	Tarantula wasps	monarchs	exposed, well-drained sandy loam soils	AZ, CHIH, COA, NL, NM, TX
summer-fall	many moths & butterflies	metal-marks	washes	AZ, CA, CHIH, NM, TX
spring-summer	bats, bees, White-winged doves		bajadas	AZ, CA, SON
Spring-summer	butterflies, bees		Washes, ditches, dry to rocky soil	AZ, NM, TX, CHIH, COA, SON
spring-autumn	many moths & butterflies, plus Anna's, Berylline, Black-chinned, Blue-throated, Broad-billed, Lucifer, Magnificent, & White-eared hummingbirds		washes, roadside banks, ditches	AZ, CA, CHIH, COA, NM, TX
spring-fall	Tobacco horn worm, White-lined sphinx moth	Tobacco horn worm, White-lined sphinx moth	washes, roadside banks, fields	AZ, BCN, CA, CHIH, COA, NM, TX

Scientific Name	Common Name(s)	Annual or Perennial	Seed or Live Plants Available
<i>Ericameria nauseosa</i> (& <i>E. laricifolia</i> )	Rubber rabbit-brush	p	seed, plants
<i>Eupatorium perfoliatum</i>	Common boneset	p	seed
<i>Fouquieria splendens</i>	Ocotillo, Albarda, Coachwhip	p	plants
<i>Gaillardia pinnatifida</i>	Red dome blanket-flower	p	seed
<i>Glandularia gooddingii</i>	Southwest mock vervain	p	plants
<i>Helianthus petiolaris</i>	Prairie sunflower	a	seed
<i>Heterotheca subaxillaris</i>	Camphor weed, Gordolobo	a	seed
<i>Leucophyllum frutescens</i>	Texas ranger, Purple sage	p	plants
<i>Lobelia cardinalis</i>	Cardinal flower	p	plants
<i>Monarda citriodora</i>	Lemon beebalm, Wild bergamot	a	seed
<i>Passiflora foetida</i>	Fetid passion flower	p	plants

Flowering Season	Nectar Source for Pollinators?	Larval Host for Pollinators?	Habitat	States
summer-fall	native bees, many moths & butterflies		valleys, plains, road-sides	AZ, NM, CHIH, SON, TX
summer-fall	many moths & butterflies	metal-marks	wetlands, stream banks and thickets	TX, TAM, NL
spring, summer	butterflies, hoverflies, finches, Anna's, Black-chinned, Broad-billed Broad-tailed, Costa's, Lucifer, Rufous, & Violet-crowned hummingbirds orioles, tanagers, & warblers		rocky slopes & bajadas	AZ, BCN, CA, COA, CHIH, NM, SON, TX
spring-fall	native bees, Monarchs		dry open plains	AZ, NM, TX
winter-spring	butterflies, moths		wood-lands, forests	AZ, CA, NV, UT, NM, CO, TX, OK, CHIH, SON, COA
spring-summer	many butterflies	checker-spots	valley floor, hills	AZ, NM
fall	many butterflies & moths, bees		stream-sides, ditches	AZ, CA, CHIH, NM, SON
fall, spring, summer	many native bees		rocky slopes	COA, NL, TA, TX
summer-fall	Sulphur & Swallowtail butterflies, Anna's, Black-chinned, Broad-tailed, Costa's, Lucifer, Ruby-throated & White-eared hummingbirds		moist meadows & stream banks	AZ, CA, NM, TX
spring-fall	native bees, many butterflies		limestone-rich soils	AZ, CHIH, COA, NM, TX
summer-fall	Fritillaries		thicket	AZ, NM, SON, TX



Scientific Name	Common Name(s)	Annual or Perennial	Seed or Live Plants Available
<i>Peniocereus greggii</i>	Desert night-blooming cereus	p	plants
<i>Penstemon superbus</i>	Superb penstemon	p	seed
<i>Phacelia crenulata</i> (& <i>P. tanacetifolia</i> )	Cleft-leaf wild heliotrope	a	seed
<i>Solidago nemoralis</i>	Gray goldenrod	p	seed
<i>Sphaeralcea fendleri</i> (& <i>S. ambigua</i> )	Fendler's globe-mallow, Mal de ojo	p	seed
<i>Stachys coccinea</i>	Scarlet betony	p	plants
<i>Tecoma stans</i>	Trumpet-bush, palo de arco	p	plants
<i>Verbesina encelioides</i>	Golden crown-beard	a	seed

Flowering Season	Nectar Source for Pollinators?	Larval Host for Pollinators?	Habitat	States
summer	Lesser long-nosed bat; Tobacco hornworm, White-lined sphinx moth		bajadas & washes	AZ, BCN, CA, CHIH, COA, NM, TX
spring	Black-chinned, Broad-billed, Costa's, Lucifer, & Violet-crowned hummingbirds		grassy or pinyon-juniper slopes & pine forests	AZ, CHIH, NM, SON
spring-fall	many native bees, Pollen wasps	syrphid flies	dry hills, flats	AZ, CA, NM, SON
summer-fall	many butterflies		meadow & road-ways	TX
spring-summer	many butterflies	checkered skippers	creeks	AZ, CHIH, NM, SON, TX
spring-fall	butterflies, Anna's, Berylline, Black-chinned, Blue-throated, Broad-billed, Broad-tailed, Calliope, Costa's, Magnificent, Rufous, Violet-eared & White-eared hummingbirds		springs, seeps, canyon bottoms	AZ, CHIH, NM, SON
spring-fall	bumblebees, Black-chinned, Broad-billed & Lucifer hummingbirds		canyons, rocky slopes	AZ, CHIH, NM, SON, TX
spring-fall	Monarchs		plains, road-sides	AZ, BCN, CA, CHIH, COA, NL SON, TX



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