

Create a Pollinator Garden at Your Nursery: An Emphasis on Monarch Butterflies

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We realize that this type of article is a departure for FNN readers but feel that it is important for forest, conservation, and native plant nurseries to be good environmental stewards. In addition, establishing a pollinator garden at your nursery can be good for business, too. Demonstrating the role and beauty of native plants and their pollinators, particularly in a small garden setting, might be a way to improve sales. The plight of pollinators has been in the news a lot lately, and many species of bees, butterflies and other insect pollinators, as well as bats and birds that pollinate, are in serious trouble.

1. The decline of pollinators

The causes behind the decline in pollinators are many, but most can be related either directly or indirectly to human activity. Habitat loss is always near the top

of the list—habitat destruction or fragmentation into small, disperse patches threatens all types of insect pollinators (Mader and others 2011). For European honeybees, Colony Collapse Disorder (CCD) has been causing serious problems since 2006. Annual losses have averaged about 33% with a third of these losses attributed to CCD (USDA ARS 2014). A nationwide survey of bumblebees found that several species have declined substantially during the past 2 to 3 decades and are completely missing from entire regions where they had occurred historically (Stokstad 2014). Monarch butterflies (*Danaus plexippus* L.) are an interesting example of pollinator decline because, unlike many other organisms that decline or become extinct because they rely on one specialized habitat, monarchs are generalists that thrived all across North America—that is, until recently.

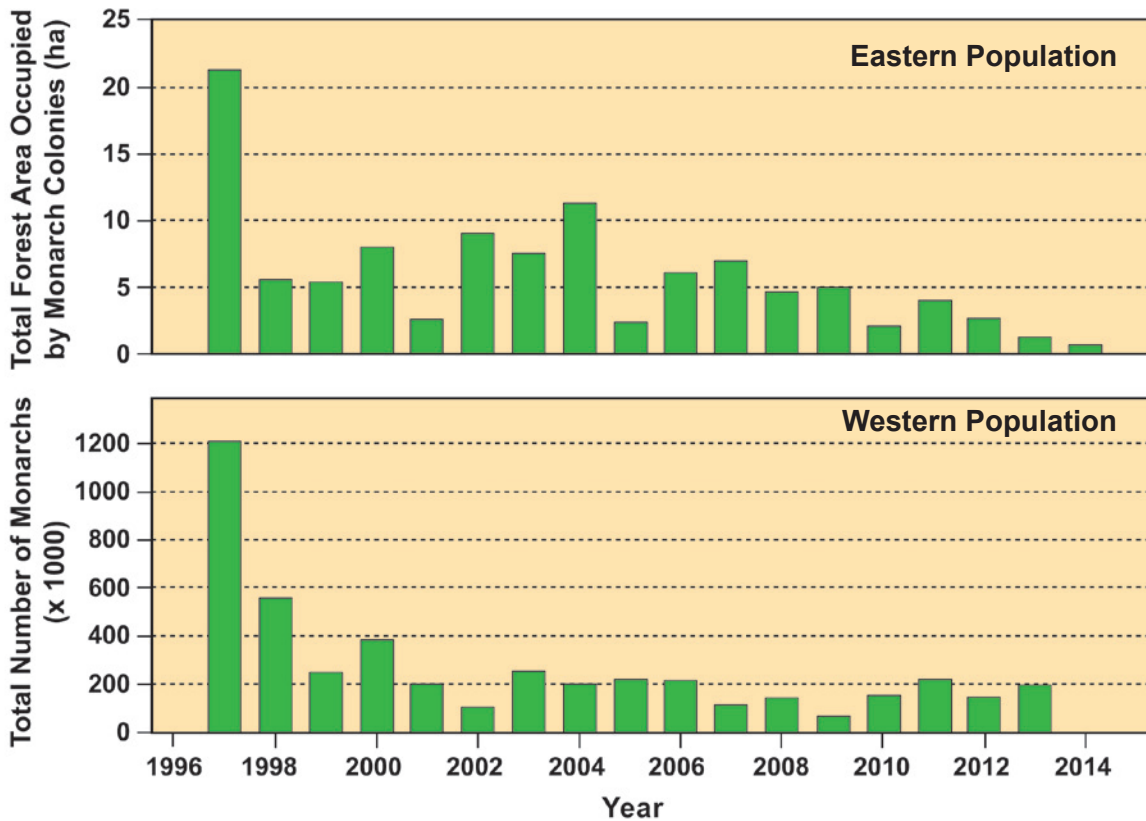


Figure 1 - Although monarchs used to be among the most common butterflies in the United States, overwintering counts of the eastern (upper) and western populations (lower) have declined drastically during the last 2 decades (A, modified from Rendon-Salinas and Tavera-Alonso 2013; B, modified from Jepsen and others 2010).

1.1 The population crash of monarch butterflies

With its large size and striking orange and black coloration, the monarch butterfly has been considered the most well-known butterfly in the world (Commission for Environmental Cooperation 2008). The monarch is a tropical butterfly that has been able to colonize much of temperate North America through annual migrations. Indeed, their long distance migrations to overwintering sites in Mexico and California are among the most unique and spectacular biological phenomena in the world (Luna and Dumroese 2013).

Like many school children, we learned one of our first biology lessons from capturing monarch caterpillars and watching their magical transformation into beautiful butterflies. In fact, in southern Kansas where Tom grew up, monarchs were so common that he remembers wishing he could find some other butterflies to collect for his Boy Scout merit badge. Unfortunately, things have

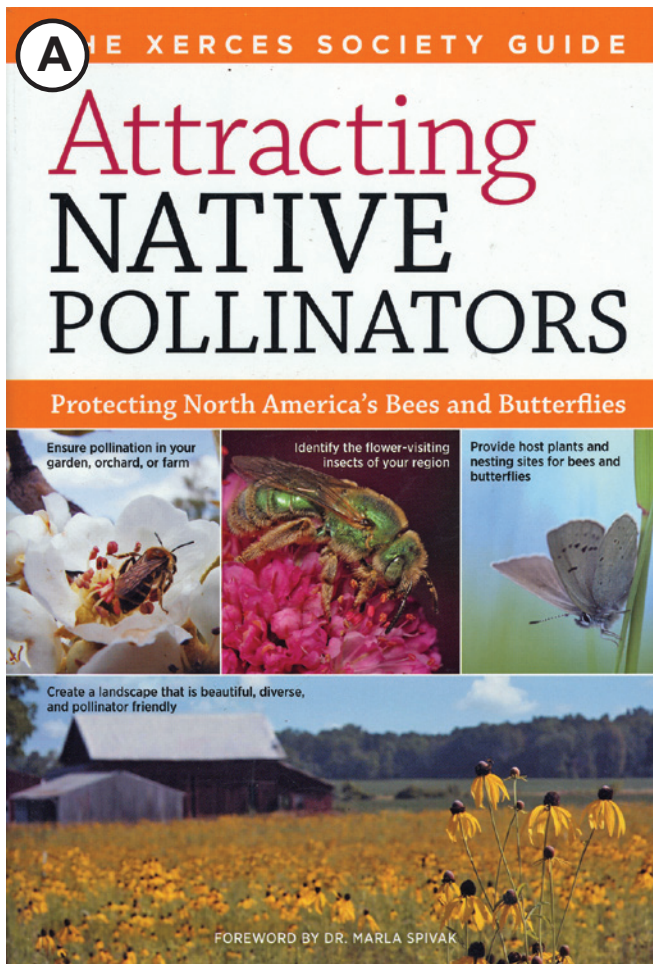
changed. Surveys taken at overwintering sites confirmed our observations that monarch populations had experienced a major collapse in recent years; and, what is more alarming is how quickly this happened. Population levels of the eastern and western groups have crashed in during the past 2 decades (Figure 1). From 1999 through 2010, the eastern monarch group plummeted 81% (Pleasants and Oberhauser 2013). Similarly, annual surveys of the western group overwintering on the California Coast have revealed a nearly 90% percent decline during the last decade (Jepsen and others 2010).

2. Creating and maintaining pollinator gardens

Many organizations and, most notably the Xerces Society, have been advocating for better protection of all types of native pollinators, and how to create beneficial habitat (“pollinator gardens”) with native

International Effort to Ensure Conservation of Monarch Butterflies and Other Pollinators

On 19 February 2014 in Toluca, Mexico, President Barack Obama, President Peña Nieto, and Prime Minister Stephen Harper issued a joint statement on behalf of the countries of North America. Of particular interest was this: *“We will continue to collaborate in the protection of our region’s biodiversity and to address other environmental challenges... Our governments will establish a working group to ensure the conservation of the Monarch butterfly, a species that symbolizes our association”* (our emphasis). As a follow-up, President Obama issued a Presidential Memorandum on 20 June 2014 to create a federal strategy to promote pollinator health. This memorandum established a Pollinator Health Task Force to be co-chaired by the Department of Agriculture (USDA) and Environmental Protection Agency with representation by many federal agencies, including the Department of the Interior (USDI). This task force has 180 days to produce a Research Action Plan that specifically includes two notable items: 1) *“assessments of the status of native pollinators, including the Monarch butterfly and bees, and modeling of native pollinator populations and habitats”* and 2) *“strategies for developing affordable seed mixes, including native pollinator-friendly plants, for maintenance of honey bees and other pollinators, and guidelines for and evaluations of the effectiveness of using pollinator-friendly seed mixes for restoration and reclamation projects.”* The task force is also preparing a public education plan, recommending methods to develop public-private partnerships, and identifying methods for increasing and improving pollinator habitat. Specifically, the USDA and USDI have just 90 days to *“develop best management practices for executive departments and agencies to enhance pollinator habitat on Federal lands.”* Currently, the Forest Service is responding to the memorandum in several ways, including development of *“The Conservation and Management of Monarchs on the Nation’s National Forests and Grasslands: A Strategic Framework.”* Supporting documentation to the President’s memo included this specific language about monarch butterflies: *“Population declines have also been observed for other contributing pollinator species, such as Monarch butterflies, which migrate from Mexico across the United States to Canada each year, returning to overwinter in the same few forests in Mexico. The Monarch butterfly migration, an iconic natural phenomenon that has an estimated economic value in the billions of dollars, sank to the lowest recorded levels this winter, with an imminent risk of failure.”* This memorandum from President Obama is extensive and detailed, and looks like it could be a boon for those of us in the native plant business.



plants (Figure 2A). Entire books have been devoted to the need for pollinator habitat and how native plants can be used to support all types of wildlife (Tallamy 2013). Like all animals, monarchs and other pollinators need specific habitats (food, shelter, and water) for breeding and, for migrants like monarchs, during overwintering. Much has been written about the need for protection of monarch overwintering sites and the restoration of these critical habitats (Commission for Environmental Cooperation 2008). Although most of us cannot directly control overwintering habitat, forest, conservation and native plant nurseries can increase breeding habitats for all pollinators by converting their marginal lands and landscapes into pollinator gardens (Figure 2B). Just about every nursery we visit has an ugly, weedy “bone yard” in a back corner that could be used for a pollinator garden. Of course, a garden in a prominent location visible to guests and customers is even better. And, fortunately, pollinator gardens will support a wide variety of pollinators, including monarch butterflies. Pollinator gardens provide these essential characteristics: 1) a balance of sun and shelter; 2) a variety of native plants that

Figure 2 - Pollinator gardens are a popular way to create habitat for bees, butterflies, and other insects (A). Forest, conservation, and native plant nurseries can serve their communities by establishing pollinator gardens, such as this monarch waystation (B) (A, from Mader and others 2011).



serve as food for larvae; 3) pollen and nectar food plants for adults; 4) water; and 5) a pesticide-free zone.

2.1 Sunlight and shelter

Because all insect pollinators are cold-blooded pollinator gardens should be located in a sunny location and receive direct sunlight for at least 6 to 8 hours a day. Monarchs (and most pollinators) are most active above 50 °F (10 °C), and only fly during daylight hours (Oberhaeuser and Solensky 2006; Journey North 2014). Southeast aspects are ideal because they receive morning sun for a quick warm-up but do not get too hot during summer afternoons. Pollinator gardens should also be sheltered from prevailing winds by woody trees and shrubs. Conifers or evergreen hedges are ideal because they provide both wind protection and a place for pollinators to rest overnight. Position woody plants so that they do not shade your pollinator plants, however, as most need full sunlight.

2.2 Native plants as food

Adult butterflies and their caterpillar larvae use plants for food, and it is important to distinguish between native plants (originally found in your local area) and introduced garden plants or cultivars (cultivated varieties). The caterpillars of most butterflies use only one plant genus for food, and these are known as host plants; a few butterflies can utilize several plant genera (Table 1). By contrast, adult butterflies can use a wide variety of native and introduced plants for food. Although backyard pollinator gardens can use native and introduced plants, pollinator gardens at nurseries and elsewhere in the natural environment should only use natives to prevent the possibility of

introduced plants escaping and becoming invasive weeds. It is best to plant species in groups or clumps because this makes them more attractive to pollinators. Scatter these clumps randomly rather than planting in rows to make the site appear more natural (Mader and others 2011). Small groups of plants, such as milkweeds, are best because large plantings attract predators and parasites (Taylor, as quoted in Conniff 2013)

2.3 Nectar plants

Pollinators obtain energy from the pollen and nectar of a wide variety of flowering plants. Nectar is high in sugars but also contains other important food components, such as amino acids (Nicolson and others 2007). Lists of good non-native nectar plants can be found on-line (for example, Monarch Watch 2014a) and in books (for example, Mader and others 2011; Holm 2013). It is much more difficult, however, to find information on the best native nectar species for a specific region. The California Horticultural Society has published “California Native Nectar Plants for Butterflies and Day-flying Moths” that lists common insect-plant associations (Caldwell 2014). We realize that some native plant nurseries already have good lists: for example, the Doak Creek Nursery lists “The Top 20” native butterfly host and nectar plants for the Lane County (Oregon) garden (Newhouse 2012).

When selecting nectar plants for your pollinator garden, choose perennials over annuals and consider small-statured shrubs that can provide nectar as well as shelter. Just because a native flower is blooming, however, does not mean that it is a good nectar producer. An example is the very common California poppy (*Eschscholzia californica*), which produces no nectar (Thorp 2014).

Table 1 - Caterpillars of butterflies are obligate feeders on specific host plants.

Common name	Scientific name	Host plants	Source
Monarch butterfly	<i>Danaus plexippus</i>	<i>Asclepias</i> spp., milkweed	Neill (2001)
Pale swallowtail butterfly	<i>Papilio eurymedon</i>	<i>Ceanothus</i> spp., ceanonthus; <i>Alnus</i> spp., alders; <i>Rhamnus</i> spp., buckthorns	Neill (2001)
Western white butterfly	<i>Pieris occidentalis</i>	Brassicaceae, mustard family	Neill (2001)
Mourning cloak butterfly	<i>Nymphalis antiopa</i>	<i>Salix</i> spp., willows	Neill (2001)
Regal fritillary	<i>Speyeria idalia</i>	<i>Viola</i> spp., violets	Nyberg and Haley (2014)
Oregon silverspot	<i>Speyeria zerene hippolyta</i>	<i>Viola</i> spp., violets	Bartow (2014)
Spicebush swallowtail	<i>Papilio troilus</i>	<i>Persea borbonia</i> , redbay; <i>Lindera</i> spp., spicebush	Hughes and Smith (2014)
Painted lady	<i>Vanessa cardui</i>	<i>Cirsium</i> spp., thistles; <i>Urtica</i> spp. nettles	Janz (2005)
Silver-spotted skipper	<i>Epargyreus clarus</i>	<i>Robinia pseudoacacia</i> , black locust; Fabaceae, legumes	Weiss and others (2003)

Some native host plants, including milkweeds, are also very good nectar producers (Figure 3A&B). The timing of flowering and therefore nectar production is of critical importance, so select a suite of plants that will provide flowers during the entire season when pollinators are active (Table 2). The CalFlora website contains a wealth of information on nectar plants including a handy pie-chart showing when each species is in bloom (Figure 3C&D; CalFlora 2014).

2.4 Water

Like all organisms, insect pollinators need water for hydration but also for a source of dissolved minerals. Some pollinators, such as several species of mason bees (*Osmia* spp.), require water to make mud structures to rear their larvae (Cane and others 2007). Monarchs and other butterflies obtain water by “puddling” so a source of shallow water should be provided. A recent study found a strong correlation between years of drought

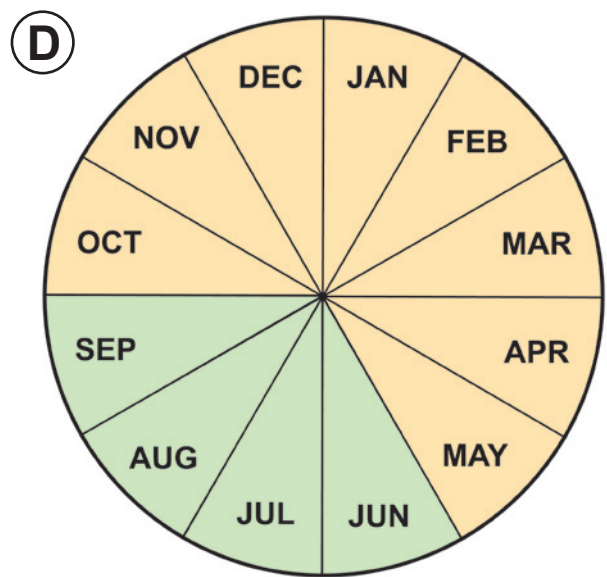
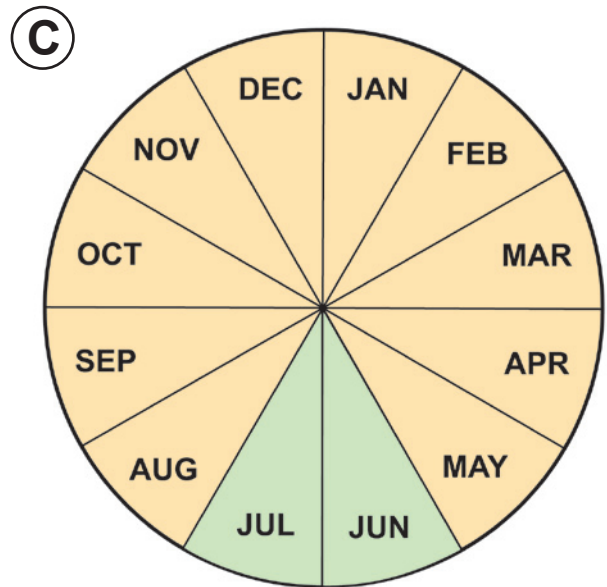
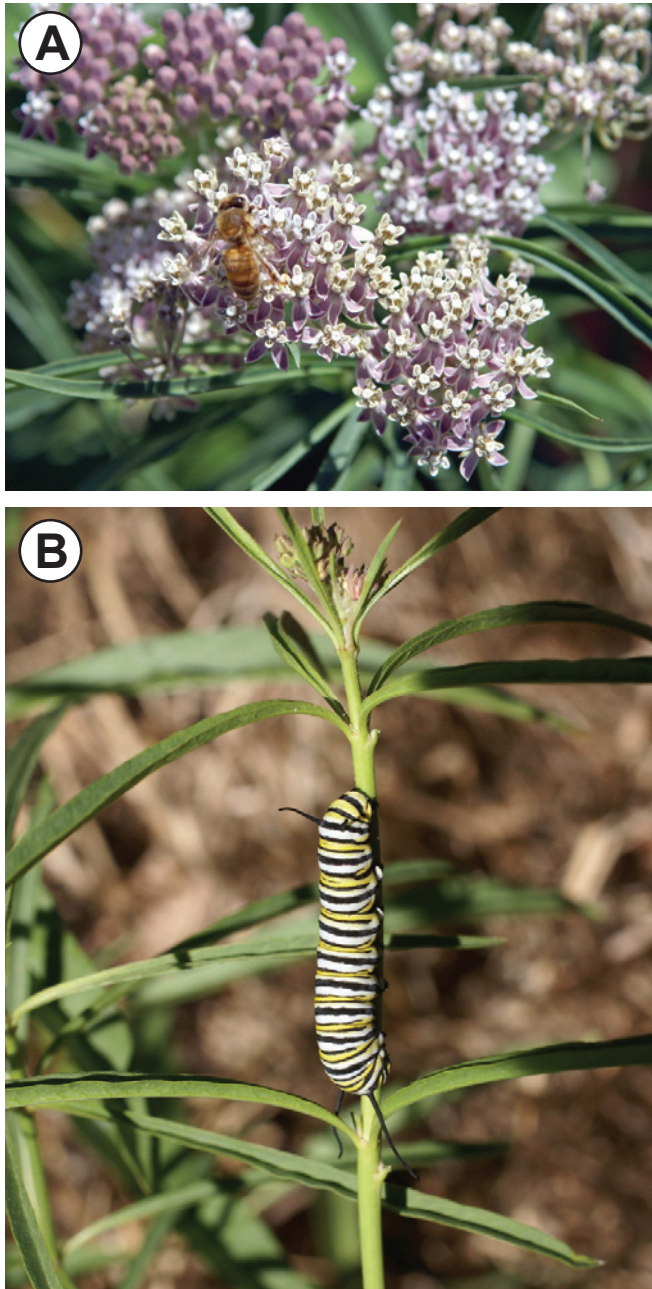


Figure 3 - Some native plants are both host and nectar plants. The flowers of native milkweeds, such as narrowleaf milkweed (*Asclepias fascicularis*), produce nectar (A) but the leaves also provide food for monarch caterpillars (B). The flowering period for these species varies considerably, however, from 4 to 6 weeks for showy milkweed (*A. speciosa*) (C) to around 4 months for narrowleaf milkweed (D).

Table 2 – It is important to match the flowering periods of native plants with the activity of pollinators, especially butterflies. Here is an example for the Rogue Valley of south-central Oregon.

Month	Presence of butterflies	Host plants		
		<i>Collinsia grandiflora</i>	<i>Monardella odoratissima</i>	<i>Ericameria nauseosa</i>
January				
February				
March				
April				
May				
June				
July				
August				
September				
October				
November				
December				

and monarch butterfly population levels in California (Stevens and Frey 2010). Therefore, be sure to provide a water feature in your pollinator garden. Bury a shallow bird bath basin or the saucer of a large pot just below the rim and add some soil and smooth rocks. If you have drip irrigation available, insert a low flow nozzle that will fill the basin until it overflows.

2.5 No pesticides

All pollinators are especially sensitive to any type of pesticide, so keep your pollinator garden strictly organic. Common household pesticides can be deadly to beneficial insect pollinators. For example, “bio-friendly” pesticides containing *Bacillus thurigiensis* should be avoided as they have been linked to monarch mortality (Hellmich 2001). Monarch mortality can be significant in suburban areas with mosquito abatement programs (Oberhauser and others 2006). Neonicotinoids are relatively new systemic insecticides that were thought to be safe for pollinators, but several recent accidents have caused widespread concern. An estimated 50,000 native bumblebees were killed when a neonicotinoid insecticide was applied to control aphids even though the label warned against use during pollination periods (Darcy 2013).

3. Monarch waystations are specialized pollinator gardens

The monarch waystation concept originated with the Monarch Watch program at the University of Kansas (Monarch Watch 2014b,c). Monarch waystations provide

milkweed plants to serve primarily as food plants for caterpillars, nectar plants to sustain adult butterflies and other pollinators. Shelter and water (Figure 4A) also promote monarch butterfly breeding and sustain them through their migrations. As of the end of 2013, almost 7,400 waystations have been established and certified by Monarch Watch. Every state except Alaska has certified waystations, but most are in the eastern US (Figure 4B). With the exception of California, most western states need many more waystations. Monarch Watch has also developed a Facebook page for “Milkweeds for Monarch Waystations,” which is a great way to keep track of the latest developments.

3.1 Host and nectar plants

Monarch butterflies require two suites of plants: host plants to feed caterpillars and nectar plants to feed adults. Monarch caterpillars feed exclusively on milkweeds (*Asclepias* spp. [Asclepidaceae]) that are named for their milky sap, whereas the adults are generalists, visiting many types of flowering plants to feed on nectar (Brower and others 2006). Information on about 100 milkweed species that are native to North American can be found on the PLANTS database website (USDA NRCS 2014). All milkweed (and a few other genera in the Asclepiadaceae) are potential food plants for caterpillars although some species are less desirable (Oberhauser and Solensky 2006). For eastern monarchs, the most important northern host plant is common milkweed (*A. syriaca*) whereas in the south, zizotes milkweed (*A. oenotheroides*), green antelopehorn milkweed (*A. viridis*) and spider milkweed

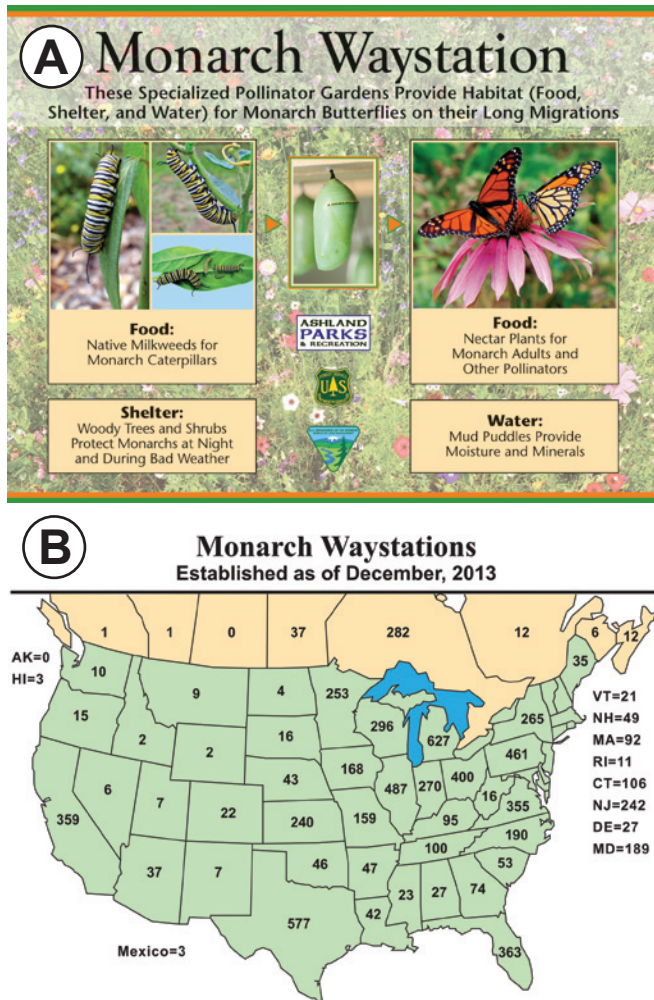


Figure 4 - Monarch waystations are specialized pollinator gardens that provide habitat (food, shelter, and water) for monarch butterflies and other pollinators (A). Monarch Watch originated the Waystation concept and maintains a registry across North America (B). B, from Monarch Watch (2014b).

(*A. asperula*). Western monarch caterpillars are able to feed successfully on showy milkweed and narrowleaf milkweed.

All milkweeds are good nectar producers but their flowering period can vary considerably. Showy milkweed flowers during a relatively short 4 to 6 week period in spring or early summer (Figure 3C), whereas narrowleaf milkweed flowers continually from later spring until early fall (Figure 3D). Nectaring is particularly important during the late summer and fall when the super generation of monarchs begins their long migration south to their overwintering sites. Butterflies convert the sugar to body fat that has to sustain them not only during migration but also at the overwintering sites when most flowering plants are dormant (Alonso-Mejia and

others 1997). Joe-pye weed (*Eutrochium maculatum*) is a good choice for much of the US but this genus is not found in Far West or Deep South. Gray rabbit-brush (*Ericameria nauseosa*) is a very common nectar producer that blooms late in the season throughout the western states (Turner 2014). Other important nectar sources during the fall migration include late-flowering genera of the Asteraceae, such as goldenrods (*Solidago* spp.), asters (*Symphyotrichum* and *Eurybia* spp.), gayfeathers (*Liatris* spp.), and coneflowers (*Echinacea* spp.) in the north, and frostweed (*Verbesina virginica*) in Texas (NAMCP 2008).

3.2 Register your waystation

Monarch waystations can provide valuable information for the efforts to restore monarch butterfly populations so please register on the Monarch Watch website (Monarch Watch 2014b). The organization publishes a yearly update on a state-by-state basis, which shows that we have a lot of work to do in some regions, such as the Pacific Northwest (Figure 4B).

4. Propagating nectar plants and milkweeds

Most pollinator plants are grown from seeds, but some can be propagated vegetatively. Some forbs, including milkweeds, can be propagated using “rootstock,” which are either fleshy taproots or rhizomes (Dumroese and others 2000). Propagation protocols for many host and nectar plants can be found in the Native Plants Journal and on the Native Plant Network Website (www.nativeplantnetwork.org).

Milkweeds are rhizomatous species and so are particularly well-suited to vegetative propagation; we have discovered that milkweed plants propagated from rhizomes grow much faster and produce larger plants during the first couple of years than those from seeds. This is probably due to the fact that shoots from rhizomes can draw upon moisture and nutrients stored in the rhizome. The details of both seed and vegetative propagation are well documented although some species are much easier to propagate than others (Luna and Dumroese 2013; Landis 2014; Borders and Lee-Mäder 2104). The remainder of this section focuses on milkweed propagation.

4.1 Seed source and seed production areas

Monarch Watch recognizes 73 species of native milkweeds in the United States, but monarchs are only known to use about 30 of these species as host plants. So,

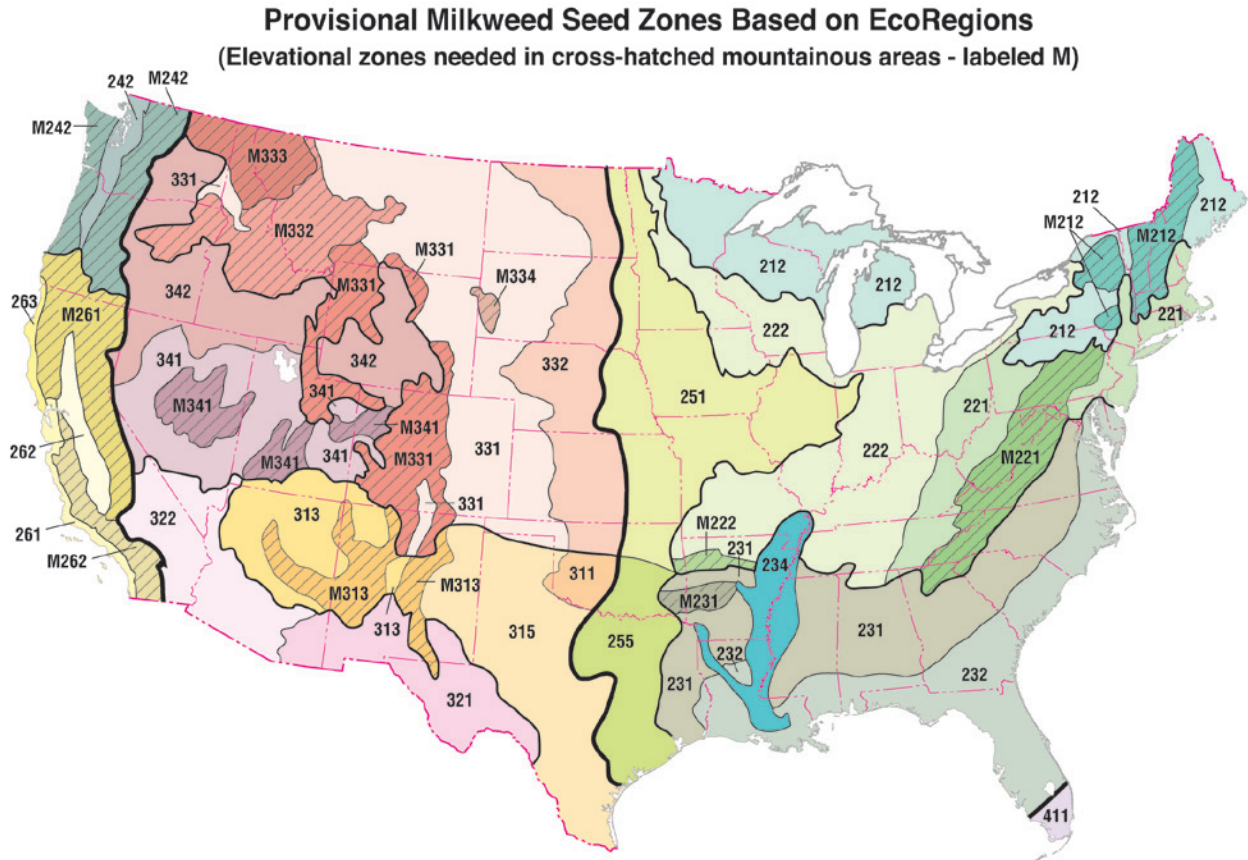


Figure 5 - Provisional milkweed seed zones (Monarch Watch 2014c) based on ecoregions (Bailey 1994).

the first step is to determine which of these milkweed host species occur in your area; helpful state-by-state maps are available on the PLANTS database (<http://plants.usda.gov>); clicking on the state will take you to the county level. A helpful table with all the milkweed species and the states in which they occur in provided in Appendix 1 of “Milkweeds: A Conservation Practitioner’s Guide” (Borders and Lee-Mäder 2014).

Finding source identified, locally adapted milkweed seeds has been a serious obstacle in the past, but efforts

are underway to improve this situation. One objective of the Xerces Society’s Project Milkweed is to develop local milkweed seed sources (Xerces Society 2013), and they offer a Milkweed Seed Finder feature on their website (<http://www.xerces.org/milkweed-seed-finder/>). Monarch Watch also has a Milkweed Market that sells seed packets (Table 3) and nursery plants of several species of milkweed (Monarch Watch 2014c). They have developed a milkweed seed zone map for the continental US based (Figure 5), which is based upon ecoregions (Bailey 1994). Milkweed seed sources can also vary with eleva-

Table 3 - Milkweed (*Asclepias*) species and seed zones currently available from monarch watch (2014c).

Milkweed species	Seed available for seed zones in Figure 5
Swamp milkweed, <i>A. incarnata</i>	221, 222, 231, 315
Common milkweed, <i>A. syriaca</i>	222, 231
Butterfly milkweed, <i>A. tuberosa</i>	222
Green antelopehorn, <i>A. viridis</i>	Western 231, 255
Showy milkweed, <i>A. speciosa</i>	331, M331, 342

tion in mountainous areas, which are cross-hatched in Figure 5. For forest trees, elevational seed zones of 500 feet (150 m) are commonly used but nothing is known about the proper elevational zones for milkweeds. For example, along a 30 mile (48 km) transect in southern Oregon, showy milkweed can be found from Gold Hill at an elevation of 1,100 (335 m) feet to Hyatt Lake at 5,100 (1,555 m) feet elevation.

Forest, conservation, and native plant nurseries are well acquainted with the concept of seed zones, and could provide a significant service by establishing seed production areas for local milkweed species on marginal lands around the nursery. By partnering with the Xerces Society and Monarch Watch, this would ensure a long-term supply of source-identified, locally-adapted milkweed seeds. Useful information on establishing and managing milkweed seed production fields can be found in “Milkweeds: A Conservation Practitioner’s Guide” (Borders and Lee-Mäder 2014).

4.2 Seed propagation

Although seeds of some milkweed species will germinate without treatment, stratification (cold, moist conditions) improves germination speed and uniformity (Luna and Dumroese 2013). Plants are most commonly grown by direct seeding in containers, although sowing germinants that sprout during stratification would increase seed efficiency and shorten crop cycles (Landis 2014). Propagation protocols for 11 different milkweed species are provided in the Native Plant Network database (for example, Schultz and others 2001). Most nurseries produce milkweeds as container plants, although bareroot beds can yield seeds and rootstock. Direct seeding is best for bareroot production whereas miniplug transplants are an effective way to start bareroot and container stock. Due to their large fleshy rhizomes, milkweed plants do not produce many fibrous roots and will not develop a firm root plug in containers (Figure 6A).



Figure 6 - Due to their rhizomatous nature, milkweeds do not develop many fibrous roots and their root plugs often fall apart during transplanting (A). Therefore, Jiffy® pellets (B) or containers with other types of stabilized growing media are recommended (B).

Sowing seeds into Jiffy® pellets or containers with other types of stabilized growing media is recommended because these products keep the root plug intact regardless of root growth, and allows young plants to be easily transplanted or outplanted (Figure 6B).

4.3 Vegetative propagation

Most milkweed species can be propagated from root cuttings but the process is much more productive for rhizomatous species, such as common and showy milkweed (Luna and Dumroese 2013). Rhizomes have the most stored energy when they are collected during the dormant season but we have had good success propagating from rhizomes during the growing season (Landis 2014). Little has been published about rooting stem cuttings of milkweed but the Live Monarch Foundation reports good success rooting stem cuttings in water with or without rooting hormones. Rooting in Jiffy® pellets also works well with some species (Singer 2014).

5. Summary

Forest, conservation, and native plant nurseries can provide a valuable public service by growing milkweed and other flowering nectar plants that will help create pollinator habitat. Even forest nurseries who primarily grow tree seedlings can convert some marginal land into pollinator gardens. These pollinator gardens could even be expanded to create seed production areas that would provide source-identified, locally adapted seeds for their local communities. Tom has been giving “milkweeds and monarchs” workshops in southern Oregon and the positive public response has been amazing. So, creating monarch waystations and other pollinator garden is a “white hat” activity that can only reflect positively on your nursery, and may create other marketing opportunities. To those of us who care deeply about the environment, it is nice to have a project where we can truly make a difference. So many times, we end up thinking “but, what can one person do?” Growing milkweeds and other native plants and establish pollinator gardens is a simple, but effective way to do something positive for our world.

“I have to believe that we can have an impact if we get the gardeners in this country to help us out by planting milkweed and putting in native plants to stabilize native pollinator communities.”

— Chip Taylor as quoted in Conniff (2013) —

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Cite this article as:

Landis TD, Dumroese RK, Horning ME. 2014. Create a pollinator garden at your nursery: an emphasis on monarch butterflies. Fort Collins (CO): USDA Forest Service, Rocky Mountain Research Station. *Forest Nursery Notes* 34(1&2): 4–15.