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Friend or foe? Conservation and management of common milkweed (*Asclepias syriaca*)

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Intriguing world of weeds

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Abstract

Common milkweed is a creeping perennial weed that is problematic in row crops and pastures. Its ability to readily reproduce via adventitious root buds enables it to persist, and full control often requires several growing seasons of management. Although it is a troublesome agricultural weed, common milkweed is ecologically important due to its use as a food source for many arthropod species. Declines in common milkweed populations in North America have been correlated with and blamed for declines in monarch butterfly populations. This review summarizes available information on the biology, ecology, and management of common milkweed, as well as its potential uses and provisioning of ecosystem services.

Introduction

Common milkweed (*Asclepias syriaca* L.) is perhaps one of the most well-known of more than 200 species in the genus *Asclepias* in the family Apocynaceae (POWO 2025). This species is a creeping perennial native to North America that reproduces vegetatively from adventitious root buds on creeping rootstocks, but it can also reproduce from seed (Bhowmik and Bandeen 1976; Georgia 1919; Pammel LH Fogel ED, 1909). The entire plant contains a milky latex sap containing toxic cardenolides that can cause poisoning when consumed by cattle (*Bos taurus* L.) and other animals (Agrawal et al. 2012; Burrows and Tyrl 2001; Cramer and Burnside 1982; McGuirk and Semrad 2005). Common milkweed is problematic where intensively managed field crops such as corn (*Zea mays* L.), sorghum, and soybean [*Glycine max* (L.) Merr.] are grown; and in less intensively managed pastures, roadsides, and wastelands (Blatchley 1912; Britton and Brown 1896; Georgia 1919; Kay and Lees 1913; Vasey 1888). Mechanical control of the weed can be difficult due to its ability to reproduce clonally, and it is tolerant to multiple herbicides (Bhowmik 1994; Georgia 1919). Despite its toxicity, common milkweed has been eaten, and used medicinally and as a source of fiber (Anonymous 1820; Gaertner 1979; Moerman 1998; Porcher 1863; Rafinesque 1828). Additionally, plants in the genus *Asclepias* are required for larval development of the iconic monarch butterfly (*Danaus plexippus* L.), with most monarchs in the eastern United States using common milkweed, which has caused common milkweed to attract significant interest from conservationists and the public (Harris et al. 2023; Malcom et al. 1993; Pleasants 2017).

Distribution and Habitat

Common milkweed is native to eastern North America (Fernald 1950; Georgia 1919; Vasey 1888). In the United States, it is widespread throughout the Great Plains region to the eastern seaboard, and it extends as far south as Texas, although it does not grow along the Gulf Coast (Bhowmik 1994; Stevens 2000). In Canada, common milkweed grows east of Saskatchewan, concentrated mainly in Ontario and Québec (Bhowmik 1994). The species was brought to Europe in the 17th century as an ornamental plant and has since escaped containment and become widespread (Bagi & Botta-Dukát, 2008; Dodge 1897; Follak et al. 2021; Whiting 1943 and references therein) (Figure 1). Since 2017, it has been listed as an "Invasive Alien Species of Union Concern" in the European Union, and land managers are legally required to remove it (Tsiamis et al. 2019). It is now widespread in central Europe, and has spread along road networks, especially unpaved roads bordered by forests and grasslands (Follack et al. 2018). In Slovakia, it is especially abundant in abandoned vineyards (Pauková et al. 2013).

Common milkweed is adapted to a wide range of habitats, and is often found in cropland, disturbed areas, pastures, and roadsides (Bhowmik 1994; Blatchley 1912; Georgia 1919; Timmons 1946; Vasey 1888). It prefers warm, well-drained, calcareous soils with a loamy texture (Bhowmik 1994; Bhowmik and Bandeen 1976; Stevens 2000). Common milkweed requires a minimum of 50 cm of rainfall in the summer months but can withstand moisture stress (Bhowmik 1994; Bhowmik and Bandeen 1976). It is limited to regions with mean

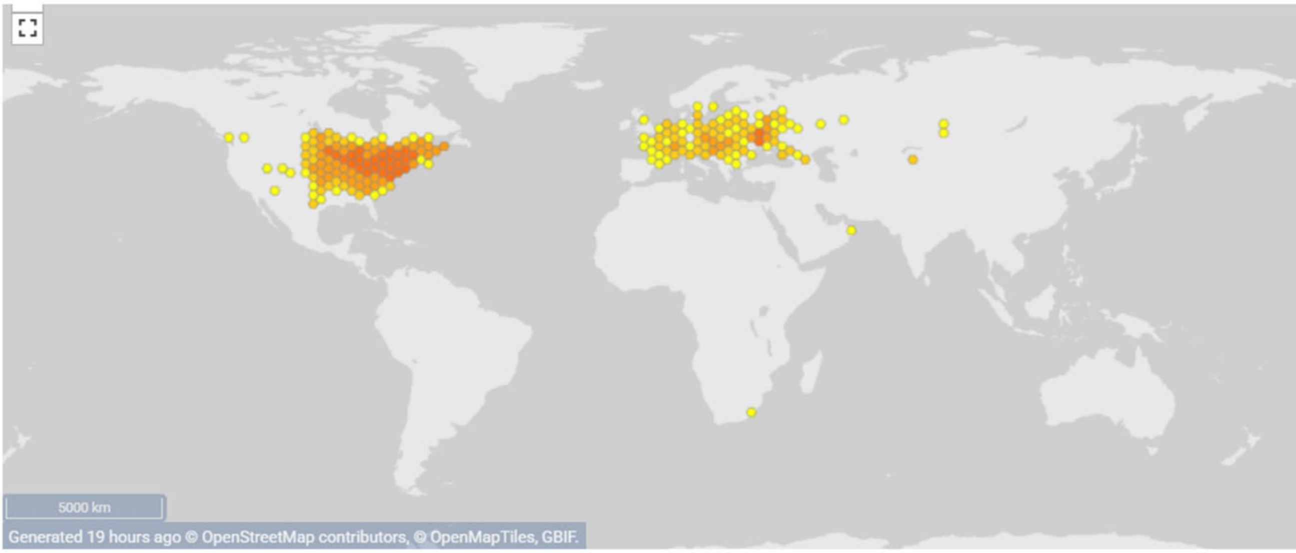

Figure 1. Current distribution of common milkweed (figure generated by GBIF 2025).

Figure 2. Flowering stage of mature common milkweed. Photo credit: Randy Prostak.

Figure 3. Common milkweed inflorescence. Photo credit: Scott Morris.

temperatures between 18 and 32 C in July, and it prefers partial shade to full sun (Bhowmik and Bandeen 1976).

Biology and Ecology

Common milkweed is a creeping perennial herb with large, waxy, opposite leaves that can reach 1 to 2 m in height at maturity and produces a milky latex in all parts of the plant (Blatchley 1912; Britton and Brown 1896; Georgia 1919; Kay and Lees 1913; Vasey 1888) (Figure 2). The inflorescence is shaped like an umbel, with many small flowers with five purple-to-white petals (Bhowmik and Bandeen 1976; Stevens 2000) (Figure 3). Pollen dispersal occurs over short distances (Pleasants 1991). In eastern North America, seedlings and vegetative shoots from adventitious root buds emerge in April or May, and flowering occurs from late June to early August (Bhowmik 1994; Sauer and Feir 1974). Plants reach reproductive maturity after 2 yr when produced from seeds and typically the first year when produced vegetatively (Bender et al. 2000; Gerhardt 1929 as cited by Whiting 1943; Meitzen 1862 as cited by Whiting 1943). Most short-distance reproduction occurs from rootstocks, and most long distance reproduction occurs from seed dispersal (Bhowmik 1978). Viable seeds are produced as early as 5 to 6 wk following the onset of flowering (Evetts and Burnside 1973a). Each plant produces an average of five pods, which contain an average of 226 seeds, although the actual number varies and can range between 100 and 425 (Sauer and Feir 1974; Bhowmik and Bandeen 1976; Willson and Rathcke 1974). Common milkweed seeds are released synchronously when seed pods (follicles) dehisce in September or October and are dispersed by wind (Bhowmik 1994; Sauer and Feir 1974) (Figure 4). Seeds are initially dormant, with dormancy released by a period of cold moist stratification (Baskin and Baskin 1977; Bhowmik 1978; Burnside et al. 1996; Jeffery and Robison 1971). Following this period of stratification, most germination occurs at day/night temperature cycles of 20/10 C to 35/20 C, and maximum seedling emergence occurs at a temperature of 27 C (Baskin and Baskin 1977; Bhowmik 1978). The majority of common milkweed seeds readily germinate within 2 yr, provided environmental conditions are suitable, but around 5% can persist in the soil for up to 5 yr (Burnside et al. 1996).

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Figure 4. Dehiscing common milkweed follicle (pod). Photo credit: A. DiTommaso.

Weediness

Common milkweed is known to reduce crop yields, notably sorghum [*Sorghum bicolor* (L.) Moench], soybean, and corn (Bhowmik 1994). It is not competitive with annual weeds during early developmental stages, so control of annual weeds may favor common milkweed within crop fields (Evetts and Burnside 1975). Common milkweed can be especially problematic in spring wheat and early planted corn because the shoots emerge after tillage operations have been completed (Mohler et al. 2021) (Figure 5). Seedling density was greater under conservation tillage than in conventionally tilled fields in Minnesota because conventional tillage causes soil to warm more quickly in spring, leading to greater emergence from seed and the destruction of seedlings during later tillage operations (Yenish et al. 1997a). In another study performed in Minnesota, high densities of 12 milkweed shoots per square meter led to a 47% reduction in wheat (*Triticum aestivum* L.) yield (Yenish et al. 1997b). Infestations in Nebraska led to yield losses of 2% to 10% of corn, 4% to 29% of sorghum, and 12% to 19% of soybean (Cramer and Burnside 1982). Evetts and Burnside (1973b) found that infestations of common milkweed resulted in an average 21% decrease in sorghum, even at low population densities. Aqueous extracts from common milkweed can have allelopathic effects on sorghum, leading to reduced seed germination (Cramer and Burnside 1982; Rasmussen 1975).

Figure 5. Common milkweed stands after corn silage harvest in central New York state. Photo credit: C. Pelzer.

Vegetative reproduction occurs from root buds located either on lateral roots or near the crown, and parent roots can survive for multiple years under favorable soil conditions such as well-drained soils or infrequent tillage operations (Bhowmik and Bandeen 1976; Polowick and Raju 1982). Lateral root buds form within 25 d of plant establishment and are well developed by the time the plant is 3 mo old (Polowick and Raju 1982; Stamm-Katovich et al. 1988). The growth of root buds is inhibited by the parent shoot, but regrowth can occur when parent shoots are removed (Jeffery and Robison 1971; Stamm-Katovitch et al. 1988).

Common milkweed is also problematic in pastures. It has been listed as a plant that can cause clinical emergencies in cattle due to its neurotoxic effects (McGuirk and Semrad 2005). It contains cardenolides such as asclepiadin, gomphoside, and afroside, which can be toxic to mammals, including humans, when consumed (Agrawal et al. 2012; Simpson et al. 2013). Despite this, a study by Dickson et al. (2023) found that cattle in Nebraska regularly grazed common milkweed in low amounts with no adverse effects. Out of 11 pasture weeds studied in Mississippi, Carlisle et al. (1980) found that common milkweed had the most digestible dry matter, the

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Table 1. Examples of herbicides that have been successfully used to control common milkweed.

Treatment	Rate	Control achieved and trial type	Reference
	kg ai ha^{-1}		
Amitrole	1.1	Reduction of stands for a 4-yr period (field trial)	Bhowmik 1982
Amitrole	0.2	Reduced milkweed regrowth rates after 6 wk (greenhouse trial)	Cramer & Burnside 1981
Amitrole + dicamba	0.3 + 0.2	Reduced milkweed regrowth rates after 6 wk (greenhouse trial)	Cramer & Burnside 1981
Amitrole + 2,4-D	0.3 + 0.2	Reduced milkweed regrowth rates after 6 wk (greenhouse trial)	Cramer & Burnside 1981
Amitrole + glyphosate	0.3 + 0.2	Reduced milkweed regrowth rates after 6 wk (greenhouse trial)	Cramer & Burnside 1981
Atrazine	0.84	Achieved at least 80% control of milkweed seedlings (greenhouse trial)	Vangessel 1999
Clomazone	0.84	Achieved at least 80% control of milkweed seedlings (greenhouse trial)	Vangessel 1999
Cloransulam	0.03	Achieved at least 80% control of milkweed seedlings (greenhouse trial)	Vangessel 1999
Dicamba	0.2	Reduced milkweed regrowth rates after 6 wk (greenhouse trial)	Cramer & Burnside 1981
Flumetsulam	0.04	Achieved at least 80% control of milkweed seedlings (greenhouse trial)	Vangessel 1999
Fomesafen	0.28	Milkweed injured, but not killed at rates under 0.28 kg ai ha^{-1} (greenhouse trial)	Lizotte-Hall & Hartler 2019
Glyphosate	2.2	Reduction of stands by 90% or more (field trial)	Bhowmik 1982
Glyphosate	2.24 or 3.36	Killed top growth with no greater than 10% regrowth in the following year (field trial)	Bhowmik & Bandeen 1976
Glyphosate	0.2	Reduced milkweed regrowth rates after 6 wk (greenhouse trial)	Cramer & Burnside 1981
Glyphosate + 2,4-D	0.3 + 0.2	Reduced milkweed regrowth rates after 6 wk (greenhouse trial)	Cramer & Burnside 1981
Glyphosate + dicamba	0.3 + 0.2	Reduced milkweed regrowth rates after 6 wk (greenhouse trial)	Cramer & Burnside 1981
Mesotrione	0.12	Germination in loam reduced to 35.3% at recommended field rates (greenhouse trial)	Radivojevic et al. 2016
Metribuzin	0.28	Achieved 97% control of milkweed seedlings (greenhouse trial)	Vangessel 1999
Metribuzin + chlorimuron	0.18 + 0.03	Achieved 99% control of milkweed seedlings (greenhouse trial)	Vangessel 1999
Oxyfluorfen	0.96	Germination in loam reduced to 25% at recommended field rates (greenhouse trial)	Radivojevic et al. 2016
Picloram	0.6	Reduction of stands for a four-year period (field trial)	Bhowmik 1982
Sulcotrione[a]	0.90	Up to 95% injury rates (greenhouse trial)	Umiljendic et al. 2017
Terbuthylazine	0.75	Germination in loam reduced to 27.5% at recommended field rates (greenhouse trial)	Radivojevic et al. 2016

[a]The sulcotrione treatment included an adjuvant.

smallest canopy diameter, and the shortest height. These results indicate that low densities of common milkweed in pastures may be acceptable to livestock.

Common milkweed is tolerant to water stress, although water stress reduces growth and defensive traits (Couture et al. 2015; Matzner et al. 2025). Plants exposed to increased day/night temperature cycles of 30/23 C displayed increased growth compared with reference temperatures of 25/18 C (Couture et al. 2015). The species is sensitive to tissue loss, and photosynthesis can be substantially reduced in plants that have been severely damaged by insect herbivory (Delaney et al. 2008). Competition with grasses has been shown to decrease common milkweed growth due to increased selective herbivory from insects (Agrawal 2004). In its invasive range in Europe, common milkweed has detrimental effects on native plant communities in grasslands and natural areas. Much of this research has been conducted in grasslands of central Hungary. Tölgyesi et al. (2024) found that the presence of common milkweed resulted in the depletion of soil moisture reserves. Another study found that plant communities invaded by common milkweed actually had higher Shannon or Simpson diversity than uninvaded communities (Meinhardt et al. 2024). The low-density milkweed stands allowed native plants to persist and may also have facilitated invasion by other weeds such as Indian blanket (*Gaillardia pulchella* Foug.), which would also have contributed to diversity (Meinhardt et al. 2024). Csiszár et al. (2013) reported that common milkweed suppressed native plant species due to its allelopathic effects. Common milkweed also reduced the cover of smaller native plant species due to shading effects (Kelemen et al. 2016).

Chemical Control

The herbicide most used to control common milkweed is glyphosate. Glyphosate applied at a rate of 2.24 or 3.36 kg ai ha^{-1} has been found to kill top growth with no more than 10% regrowth in the following year (Bhowmik and Bandeen 1976) (Table 1). In a field study in Guelph, Ontario, Canada, glyphosate applied at 2.2 kg ai ha^{-1} reduced stands of common milkweed for 2 to 3 yr (Bhowmik 1982). Satisfactory control was obtained with the same rate in a separate field trial in Lincoln, Nebraska (Cramer and Burnside 1981). Bakacsy and Bagi (2020) found that a single glyphosate application at 0.72 kg ae ha^{-1} resulted in some translocation of the herbicide to the dormant root buds, but that the stand was able to slowly regenerate over time. Waldecker and Wyse (1985a) were able to increase glyphosate absorption by root buds in a controlled environment by applying a cytokinin, 1 mM 6-benzyl-aminopurine, prior to herbicide application.

Glyphosate is not the only postemergence-applied herbicide that has been studied for its potential to control common milkweed. Shoot control in this plant can be achieved with early applications of 2,4-D (Bhowmik 1994; Bhowmik and Bandeen 1976) (Table 1). However, common milkweed is generally less susceptible to 2,4-D than to glyphosate, due to the plant's rapid metabolism of 2,4-D (Bhowmik 1985; Wyrill and Burnside 1976). Amitrole-T applied at a rate of 1.12 or 2.24 kg ai ha^{-1} was mostly effective, with a regrowth rate of 5% to 10% occurring in the next growing season (Bhowmik and Bandeen 1976). Both 1.1 kg ai ha^{-1} of amitrole and 0.6 kg ai ha^{-1} of picloram reduced stands for 4 yr in a field experiment in Guelph, Ontario (Bhowmik 1982). In a greenhouse study, Cramer and Burnside (1981) found that common milkweed regrowth was reduced by the following treatments: amitrole, dicamba, and glyphosate at 0.2 kg ai ha^{-1}; amitrole + dicamba, amitrole + 2,4-D, amitrole + glyphosate, glyphosate + 2,4-D, and glyphosate + dicamba, all at 0.3 + 0.2 kg ai ha^{-1}.

Common milkweed has been reported to be tolerant of certain herbicides. This can be useful information for growers when they endeavor to control a different weed in an area where milkweed is not considered weedy. Common milkweed is more tolerant than other weeds of glufosinate applied at rates up to 0.25 kg ai ha^{-1}, although the activity of glufosinate was enhanced by adding ammonium sulfate (Pline et al. 2000). The relatively low absorption of glufosinate in common milkweed compared with other weeds might be a result of the plant's waxy cuticle (Pline et al. 1999). Umiljendic et al. (2017) found that common milkweed was moderately susceptible to sulcotrione at a rate of up to 0.90 kg ai ha^{-1}. Common milkweed was injured, but not killed, by fomesafen applied at rates up to 0.28 kg ai ha^{-1} in a greenhouse study near Ames, Iowa (Lizotte-Hall and Hartler 2019). Dunham lists common milkweed as being resistant to 2,4-D, MCPA, and simazine. Vangessel (1999) found that linuron applied at 0.37 kg ai ha^{-1} only partially controlled common milkweed. At low rates of 1.1 kg ai ha^{-1} or less, dicamba, fenac, alachlor, atrazine, and bentazon have been found to provide less than 50% control of common milkweed (Bhowmik 1994; Cramer and Burnside 1981).

Common milkweed can be controlled in agronomic crops with soil-applied herbicides such as atrazine, EPTC, and metribuzin (Bhowmik 1994). Oxyfluorfen, terbuthylazine, and mesotrione have been shown to inhibit germination and reduce seedling size in a greenhouse study (Radivojevic et al. 2016). In another greenhouse study, Vangessel (1999) found that clomazone applied at 0.84 kg ai ha^{-1}, atrazine at 0.84 kg ai ha^{-1}, flumetsulam at 0.04 kg ai ha^{-1}, and cloransulam at 0.03 kg ai ha^{-1} provided at least 80% control of common milkweed seedlings. Metribuzin applied at 0.28 kg ai ha^{-1} and a combination of 0.18 kg ai ha^{-1} metribuzin and 0.03 kg ai ha^{-1} chlorimuron provided 97% and 99% control of common milkweed seedlings, respectively (Vangessel 1999). As with any weed, the efficacy of herbicide applications to control common milkweed varies based on application timing, application methods, and environmental conditions. Most foliar-applied herbicides are most effective in June, during the early bud stage of development, rather than during early growth or after flowering (Bhowmik 1994, 1982; Bhowmik and Bandeen 1976; Zalai et al. 2017). Wyrill and Burnside (1977) tested various surfactants and surfactant combinations to enhance glyphosate control of common milkweed. They reported that surfactant performance was variable, difficult to predict, and not related to the angle at which the herbicide mixture contacted the leaves. Glove, roller, and broadcast applications have all been found to be effective in controlling common milkweed (Cramer and Burnside 1981). Water stress has been shown in greenhouse studies to decrease the efficacy of glyphosate due to reduced absorption and translocation (Waldecker and Wyse 1985b).

Cultural and Mechanical Control

Common milkweed emerges primarily in late spring to early summer, and competing summer annual crops limit growth (Evetts and Burnside 1975; Mohler et al. 2021). Timmons (1946) found that crop rotations that included alfalfa (*Medicago sativa* L.) led to a decrease in the density of common milkweed populations. Rotations that include winter wheat (*Triticum aestivum* L.) have also been used to control common milkweed (Bhowmik 1994).

Due to the ability of the plant to reproduce from lateral root buds, tactics such as standard moldboard plowing or the removal of individual stalks may not be effective methods for controlling established common milkweed populations unless these tactics are repeated over time (Bhowmik and Bandeen 1976). Zalai et al. (2017) found that mowing plants for two growing seasons was ineffective and that populations experienced vigorous regrowth. However, common milkweed cover and shoot number have been observed to decrease after two consecutive years of shoot removal, possibly due to the depletion of carbohydrate reserves (Berki et al. 2023; Georgia 1919). Repeated tillage during a single fallow period starting in spring and ending in late summer, when the root buds become dormant, can also reduce populations (Mohler et al. 2021). Inversion tillage has also been found to place seeds in soil that is too deep for seedlings to emerge (Yenish et al. 1996). Another method of control is to expose the roots to dry and freezing conditions by plowing at a depth greater than 20 cm in the fall (Bhowmik 1994).

Historical and Current Uses

Common milkweed is a culturally important food source to many Indigenous groups in the United States (Duke 1992; Gaertner 1979; Gonella and Kindscher 2024; Knudsen and Sayler 1992; Medsger 1939; Moerman 1998; Stevens 2000). Typically, the parts of the plant that are eaten are early spring shoots, young pods, and unopened inflorescences (Gonella and Kindscher 2024). Common milkweed is safe to eat when properly prepared, which involves boiling it for 2 to 4 min and then discarding the water or parboiling it (Duke 1992; Gaertner 1979; Gonella and Kindscher 2024).

Common milkweed stems have been used in recent centuries as a source of fiber for making ropes and cloth (Dodge 1897; Knudson and Sayler 1992; Porcher 1863; Stevens 2000; Vasey 1888; Whiting 1943). During World War II, floss from common milkweed seed pods was used to fill life jackets (Gartner 1979; Knudson and Sayler 1992; Whiting 1943). In recent years, there has been renewed interest in common milkweed as a sustainable fiber crop due to the unique structure of its fibers (Hassanzadeh and Hasani 2017; Karthik and Murugan 2016). Fibers derived from common milkweed stems are lightweight, hollow, and hydrophobic, and can be used in applications such as sorption of oil and insulation (Hassanzadeh and Hasani 2017; Karthik and Murugan 2016). The U.S. Department of Agriculture has also conducted research into the use of common milkweed oil as a sunscreen and as a potential source of latex for rubber production (Suszkiw 2009; Whiting 1943).

Conservation Efforts

Common milkweed has received significant interest from conservation groups (Harris et al. 2023). Monarch butterfly larvae need to feed on common milkweed or other plants in the genus *Asclepias* to complete their life cycle; they also use the cardiac glycosides produced by the plants as a form of chemical defense (Pleasants 2017; Stevens 2000) (Figure 6). Proper larval development most likely occurs in patches of two to four closely spaced milkweed plants, as opposed to single plants (Fisher et al. 2020). The widespread adoption of herbicide-tolerant field crops has dramatically reduced agricultural milkweed populations and thereby contributed to the decline of monarch butterfly in North America (Belsky and Joshi 2018; Brower et al. 2012; Malcolm 2018; Saunders et al. 2018; Wilcox et al. 2019). There is some controversy over the importance of this breeding habitat loss, relative to other threats to the monarch (Agrawal and Inamine 2018; Inamine et al. 2016). However, many authors consider the loss of agricultural breeding habitat to be the primary driver of monarch population declines in recent decades (Flockhart et al. 2015; Stenoien et al. 2018; Thogmartin et al. 2017a). This argument implies that monarchs were dependent on agricultural breeding habitat before herbicide-tolerant crops were introduced. Indeed, it is likely that agricultural (primarily corn and soybean) habitats formerly produced more monarchs than any other habitat type in the midwestern United States (Oberhauser et al. 2001; Pleasants 2017). Corn and soybean fields hosted many monarchs because they cover large land areas and contained milkweeds that were

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Figure 6. A monarch butterfly larva feeding on common milkweed. Photo credit: R. Stup.

highly suitable for monarch oviposition (see the discussion in *Biology and Ecology*). Most corn and soybean fields now contain few milkweeds because they are treated with nonselective, postemergence herbicides (Hartzler 2010; Pleasants 2017). In the Midwest, it is estimated that milkweed populations declined by approximately 40% between 1999 and 2014, leading to an estimated 70% loss in monarch support capacity (Pleasants 2017). The difference between 40% and 70% reflects the fact that milkweed loss was concentrated in agricultural habitats, and more monarch eggs are laid per stem on milkweeds in an agricultural setting (Oberhauser et al. 2001; Pitman et al. 2018; Pleasants & Oberhauser, 2015; Pleasants and Oberhauser 2013). Monarch population size has declined by an estimated 80% over a similar time frame (Pleasants 2017; Pleasants and Oberhauser 2013). Based on these findings, milkweed populations need to increase by an estimated 1.6 billion plants to support a stable monarch population (Pleasants 2017). In light of severe habitat loss and population declines, the U.S. Fish and Wildlife Service in 2024 proposed listing monarch butterflies as threatened under the Endangered Species Act (USFWS 2024).

Many milkweed restoration efforts have focused on replacing the milkweeds lost from agricultural habitats with milkweeds in nonagricultural habitats, including roadsides, conservation areas, and gardens (Pleasants 2017; Zaya et al. 2017). One popular conservation method is the use of "monarch waystations," which are pollinator gardens containing milkweed that are intended to provide patches of habitat for monarch butterflies (Landis 2014). Management of existing patches of milkweed can also help conserve monarch butterfly populations. A study in upstate New York found that mowing twice in July promoted regrowth of milkweed, which led monarchs to lay more eggs and extended their breeding period (Fischer et al. 2015).

While these programs are valuable, they sometimes struggle to overcome barriers such as 1) high cost, 2) limited available land area, or 3) low monarch support capacity. Consequently, some authors have concluded that successful milkweed and monarch conservation will require the use of agricultural habitats. For example, Thogmartin et al. (2017b) tested 218 possible scenarios for restoring milkweed to the midwestern United States. In these scenarios, milkweeds would be restored in protected area grasslands, land designated as being part of the Conservation Reserve Program (CRP; a U.S. Department of Agriculture program that pays farmers to take environmentally sensitive land out of agricultural production), powerline, rail and roadside rights of way, urban/suburban lands, productive cropland, and/or marginal cropland. They found that it was not possible to reach 1.3 billion stems without converting some cropland to "CRP-like" areas that would support milkweed. However, it was possible to reach the goal by converting all marginal cropland in corn and soy agriculture (50,329 km^2) to this CRP-like land use. Fifteen other successful scenarios involved converting half of the marginal cropland and also including contributions from three or more additional sectors. Landis (2017) agreed with the conclusion that changes in the agricultural sector will be crucial to monarch conservation, but noted that it might be difficult to encourage conversion of marginal croplands. Semmens and Ancona (2019) suggested that retiring cropland adjacent to rivers and streams could contribute to milkweed restoration in addition to providing other ecological benefits. Farmers may also want to consider allowing low densities of milkweed in their cropland to remain, because they provide habitat for beneficial insects in addition to the monarch butterfly. Common milkweeds often harbor aphids that attract parasitic wasps that control populations of the European corn borer (*Ostrinia nubilalis* Hübner) (DiTommaso et al. 2016).

Conclusion

Common milkweed is a unique plant species in that it is both a challenging agricultural weed and a species of considerable conservation value. Although it is not an especially competitive weed, common milkweed can be difficult to control, and integrated weed management strategies will likely be necessary to do so (Bhowmik 1994). Due to the increased focus on milkweed conservation in recent decades, much of the information about chemical control of this weed in the United States dates from the 1970s and 1980s. However, research into chemical control of common milkweed is ongoing in its invasive range in Europe. Due to its ecological importance and provision of ecosystem services, growers should consider allowing low densities of this species to remain in their croplands if they do not negatively affect yields (DiTommaso et al. 2016).

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