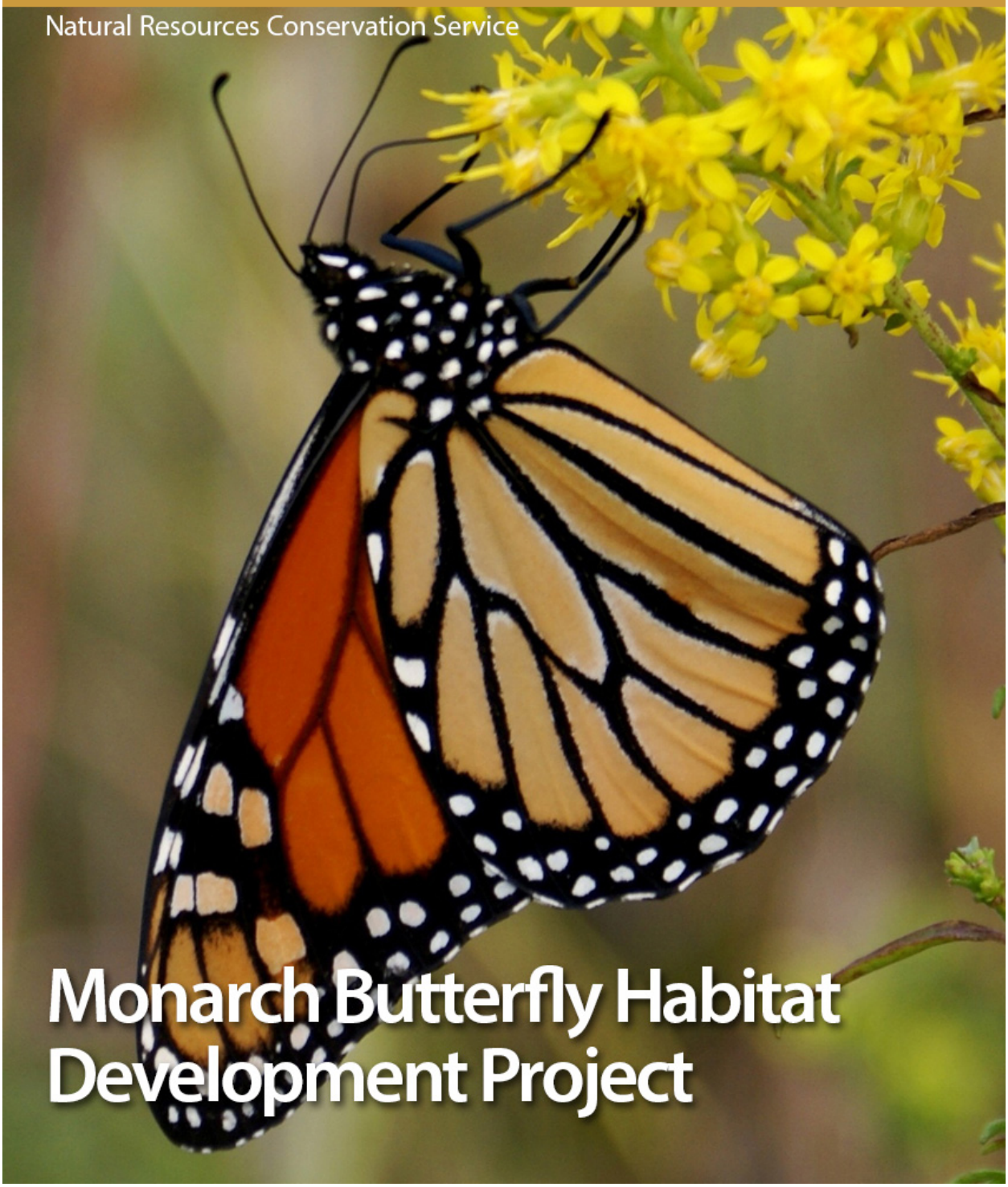
USDA United States Department of Agriculture

Natural Resources Conservation Service



Monarch Butterfly Habitat Development Project

EXECUTIVE SUMMARY

Monarch conservation will require trilateral action (Commission for Environmental Cooperation 2008), including conservation habitat consideration on all landuses within the United States (USFWS 2015). USDA's Natural Resources Conservation Service (NRCS) is uniquely positioned to assist landusers in the United States to implement monarch habitat efforts on private lands.

Photo 1: A monarch butterfly. Photo by Gene Barickman, NRCS.

Populations of the monarch butterfly (*Danaus plexippus*) have experienced alarming reductions during the past 20-plus years. The decline in the subspecies (*Danaus plexippus plexippus*) that breeds east of the Rocky Mountains has been identified as being of particular concern (Jepsen et. al., 2015)[1]. On Feb. 19, 2014, following the 2014 North American Leaders' Summit, a joint statement was released by President Obama, President Peña Nieto of Mexico and former Prime Minister Stephen Harper of Canada to "establish a working group to ensure the conservation of the monarch butterfly, a species that symbolizes our association." Interior Secretary Sally Jewel tasked U.S. Fish and Wildlife (FWS) Director Dan Ashe with leading this working group for the United States. The group – called the Monarch Butterfly High Level Working Group – includes NRCS.

In further support of the monarch, President Obama issued a presidential memorandum[2] on June 20, 2014 creating a Pollinator Health Task Force to write a federal strategy to promote the health of honey bees and other pollinators (Obama 2014). President Obama assigned Agriculture Secretary Tom Vilsack and Environmental Protection Agency Administrator Gina McCarthy to co-chair this task force. The task force was directed to develop a National Pollinator Health Strategy with special emphasis on the health of honey bees and the decline of the monarch butterflies. On May 19, 2015, the *National Strategy to Promote the Health of Honey Bees and Other Pollinators* was released[3]. This document provided three overarching goals, including one specific to monarch butterflies:

> *Increase the Eastern migratory population of the monarch butterfly to 225 million butterflies occupying an area of approximately 15 acres (6 hectares) in the overwintering grounds in Mexico through domestic/international actions and public-private partnerships, by 2020.*

[1] In August 2014, a petition to list the monarch under the Endangered Species Act was provided to the U.S. Fish and Wildlife Service (FWS). FWS is currently conducting a 12 month review provided by the Endangered Species Act. A listing petition does not change the status or consideration of a species by NRCS.

[2] https://www.whitehouse.gov/the-press-office/2014/06/20/presidential-memorandum-creating-federal-strategy-promote-health-honey-b

[3] https://www.whitehouse.gov/blog/2015/05/19/announcing-new-steps-promote-pollinator-health.

Monarch Butterfly Habitat Development Project

Through Farm Bill conservation programs and technical assistance, NRCS will work with partners and clients to increase monarch habitat on private lands in all states where the monarch butterfly occurs. Unique to most species proposed for listing under the Endangered Species Act, the monarch occurs not only in all states except Alaska but also in virtually all counties in those 49 states. This makes targeting NRCS' limited resources difficult.

As a member of the Monarch High Level Working Group, and in response to the Presidential Memorandum and the National Strategy, NRCS has developed the framework of a Monarch Butterfly Habitat Development Project through which NRCS will work cooperatively with private landowners to increase monarch habitat in a 10-state region. Special monarch fund allocations will be provided through the Environmental Quality Incentives Program (EQIP) and the Agricultural Conservation Easement Program (ACEP). The 10 states include Iowa, Illinois, Indiana, Kansas, Minnesota, Missouri, Ohio, Oklahoma, Texas and Wisconsin. NRCS anticipates expanding the effort in upcoming years. In states not within this project area, NRCS will work within existing Farm Bill programs to increase monarch habitat on private lands.

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PROJECT SCOPE

The NRCS Monarch Butterfly Habitat Development Project focuses on the Eastern population of the monarch butterfly, which occurs in all states east of the Rocky Mountains. FWS has identified the migratory corridor from Texas to the upper Midwest as a key region for monarch habitat efforts (U.S. FWS 2015). The project focuses on two subregions within this key portion of the migratory corridor, each with differing ecology and land use (Figure 1). A unique implementation strategy was developed for each subregion.

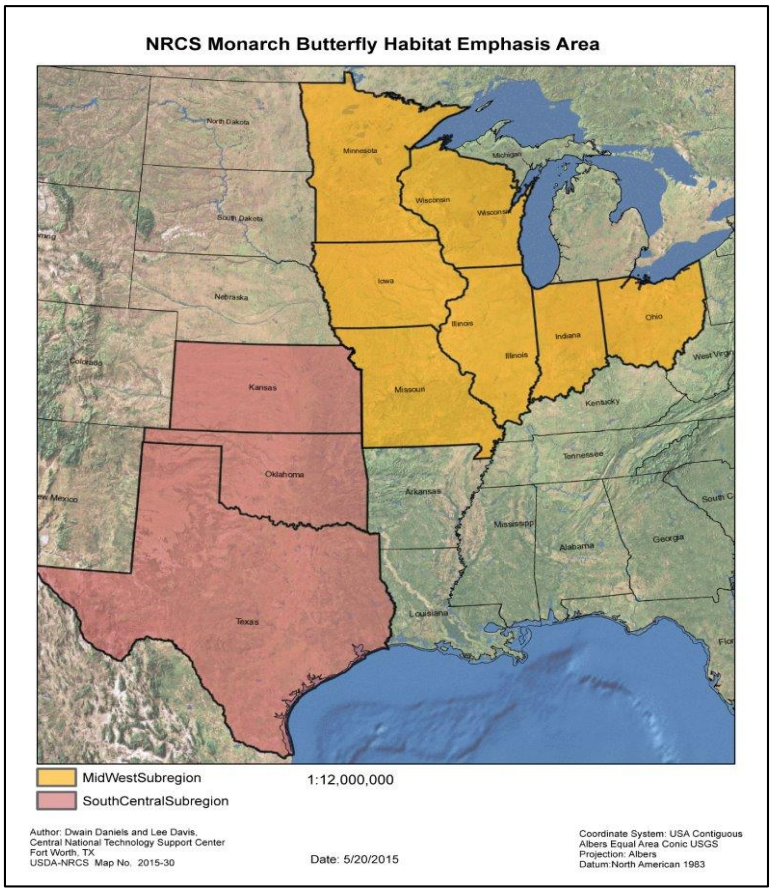

Figure 1. Targeted monarch butterfly subregions.

The southern Great Plains subregion includes Kansas, Oklahoma and Texas. Most of the adult monarchs that wintered in Mexico produce the first generation of monarchs in the southern Great Plains. The central parts of these states are also home to the monarch migration each fall. The primary milkweed species to be targeted in this subregion are spider milkweed (*Asclepias asperula*), zizotes milkweed (*A. oenotheroides)* and green antelope horn (*A. viridis)*. (USDA NRCS 2015). In contrast to common milkweed (*Asclepias syriaca)* found in the Midwest, the species of milkweeds found in this subregion are not tolerant of tillage and are not commonly found in cropland. Each of these species is relatively low growing (1-2 feet tall), highly shade intolerant and are commonly found on grazing lands. NRCS will primarily target grazing lands in this subregion. Other habitat improvement opportunities aim to promote periodic soil and plant disturbance (i.e. light disking, summer burning) to increase milkweeds and high-nectar forbs on lands under NRCS conservation easements.

The Midwest monarch subregion includes the second through fifth generational monarch summer habitat. Loss of monarch habitat in this subregion has been high in recent years (Pleasants and Oberhauser 2012). Common milkweed will be the key host plant species to target in this region, but other species may have a significant role. The recent drop in grain prices may provide opportunities for NRCS to target monarch habitat efforts on less productive crop lands. Additionally, the use of NRCS easement lands has been identified as a significant opportunity in this subregion. The Conservation Reserve Program (CRP), administered by USDA Farm Service Agency, has been identified as another program that may provide the needed distribution of habitat across the landscape, critical to migrating monarchs.

GENERAL MONARCH BIOLOGY

Monarch butterflies occur in North America, as well as other regions of the world. The most significant populations occur in North America and Mexico where they are generally divided into two populations, east and west of the Rocky Mountains. The western population is smaller, and those monarchs spend their winters along the California coast. The much larger eastern population winters in a single region – the forested mountains of central Mexico. Additionally, a very small non-migratory population winters in Florida.

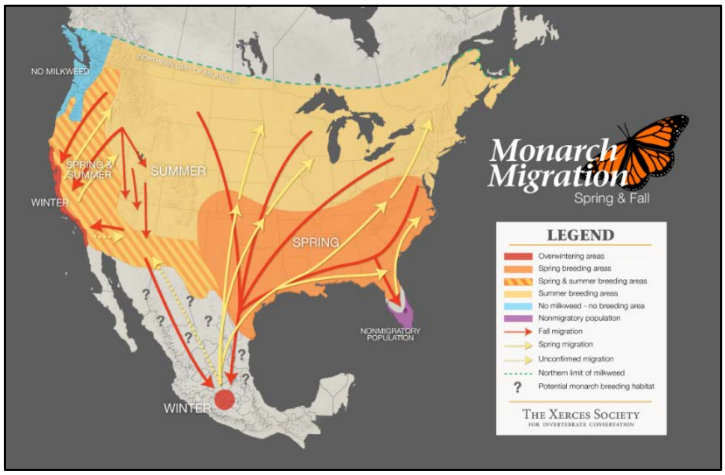

Figure 2. Monarch migration patterns in North America.

In March, the first adults from the eastern population leave Mexico and begin their northern and multi-generational migration. Adult monarchs forage on nectar contained in flowers of milkweeds, as well as many other flowering plants. They lay eggs only on milkweed plants in the genus *Asclepias*[4]. The adults that wintered in Mexico primarily lay eggs on milkweed plants in northern Mexico, Texas, Oklahoma and Louisiana, but many travel to other southern states.

Individual females lay about 400 eggs and typically lay no more than two eggs on any single milkweed plant. The egg-laying process can last as long as 30 days (Edson 2006). The eggs hatch in 9-12 days, and larva feed exclusively on the leaves of milkweed plants. The poisons contained in the milkweed afford the larva some protection from predators. Upon pupation, the new adults (the second generation) continue migration to the north and east. Depending on climatic conditions along the migration routes, the eastern monarchs may have as many as five generations during spring and summer. This multi-generational migration results in the eastern population spreading to all states east of the Rocky Mountains and into southern Canada. In the fall, individuals from the final summer generation migrate south to the wintering grounds in central Mexico, and the annual cycle is repeated the following spring.

[4] For the remainder of this document, the term milkweed refers to those species in the genus *Asclepias*. There are approximately 110 species of *Asclepias* in the U.S.

MONARCH POPULATION DECLINES

The North American monarch population has experienced declines since 1994 when monitoring of the eastern North American population's wintering habitat first began (Monarch Joint Venture 2015). These declines align with reductions in wintering habitat in Mexico and summer habitat in the United States and Canada.

The low monarch wintering numbers in 2013 and 2014 resulted in an April 2014 statement of shared concern by leaders of the United States, Mexico and Canada. The monarch butterfly was specifically included in the 2014 Presidential Memorandum on pollinator conservation. Additionally, the FWS is conducting a status review to determine if protection under the Endangered Species Act (ESA) is warranted for monarchs.

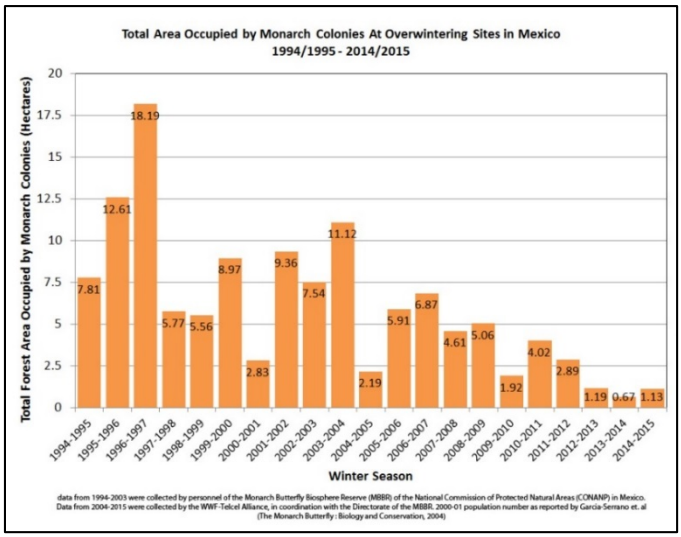

Figure 3. Total area occupied by monarch colonies at overwintering sites in Mexico 1994-2015 (data from World Wildlife Fund–Mexico and MBBR.)

BASIC MILKWEED INFORMATION

Monarchs use milkweed as the sole food source of their larva, and also as a source of nectar for adults. There are about 110 species of *Asclepias* in North America. For this project, which focuses on large-scale habitat enhancement for the eastern population, NRCS is focusing on six species of *Asclepias*. All are perennials.

Three of these species occur in the southern Great Plains (*Asclepias asperula*, *A. oenotheroides* and *A. viridis)* and three in the Midwest (*A. syriaca*, *A. incarnata*, and *A. tuberosa*). In addition to these species, several others are increasingly available in the commercial native seed industry, including *A. verticillata*, *A. purpurascens*, and *A. sullivantii.*

Photo 2: A monarch caterpillars feeds on the leaf of common milkweed. Photo by Mace Vaughan, The Xerces Society.

DEVELOPMENT OF SUBREGIONAL STRATEGIES

To launch this project, NRCS organized two strategy development sessions in 2015 where NRCS staff in the states constructed a monarch habitat strategy for each subregion. Staff from each of the 10 states participated in these sessions by providing critical technical and farm bill program information. The strategy sessions had 68 participants representing NRCS, FWS, state agencies, universities and non-government organizations (NGOs). NRCS Farm Bill program managers in each subregion were asked to work cooperatively with their colleagues to assure that expertise for each program was available during the strategy sessions. The primary Farm Bill programs identified as having potential to increase monarch habitat were the Environmental Quality Incentives Program (EQIP), Conservation Stewardship Program (CSP), the former Wetland Reserve Program (WRP), and the current Wetland Reserve Easement program (WRE) but other programs were discussed.

Photo 3: Common milkweed. Photo by Kelly Gill, The Xerces Society.

As the basis for the conservation planning process, NRCS staff will apply the applicable *USDA NRCS Monarch Butterfly (Danaus plexippus plexippus): Wildlife Habitat Evaluation Guide* to identify monarch habitat development potentials. Separate versions of this WHEG have been developed for each subregion. If vegetative establishment is selected by the client, then seeding specifications will be developed based on regional plant lists (e.g. see nrcs.usda.gov/monarchs, NRCS Plant Materials Program website, or state NRCS pollinator lists revised to target milkweed and monarch nectar sources).

The FWS provided NRCS the results of a draft monarch habitat priority modeling effort. NRCS will use these data to assist with screening and ranking decisions for Farm Bill conservation programs. NRCS' Landscape Conservation Initiatives team will provide the states with the monarch butterfly screening and ranking decisions through the NRCS directive system.

TRACKING GAINS IN MONARCH HABITAT

NRCS will track gains in monarch habitat within the capacity of current agency planning and contracting software. Funds allocated to the Monarch Butterfly Habitat Development project will be tracked in Protracts, the NRCS contracting software. These data will be supplemented with the new *monarch identified priority feature* built into the practice planner portion of the agency's Conservation Planning Toolkit software.

The Monarch WHEG will provide baseline data on field conditions prior to implementation of a monarch habitat development plan or contract.

MIDWEST MONARCH HABITAT STRATEGY

This project's Midwest subregion includes Illinois, Indiana, Iowa, Minnesota, Missouri, Ohio and Wisconsin. These seven states account for 58 percent of corn and 54 percent of soybeans grown in the United States (USDA NASS 2015). This area is also home to the "summer recharge zone" for the wintering population of monarchs. Based on 1996 data, 50 percent of wintering monarchs in Mexico were born in the Midwest (see Figure 4, Wassenaar and Hobson, 1998). This subregion has experienced the greatest habitat loss for monarchs because of multiple causes, but predominantly agriculture (Hartzler 2010; Pleasants and Oberhauser, 2012).

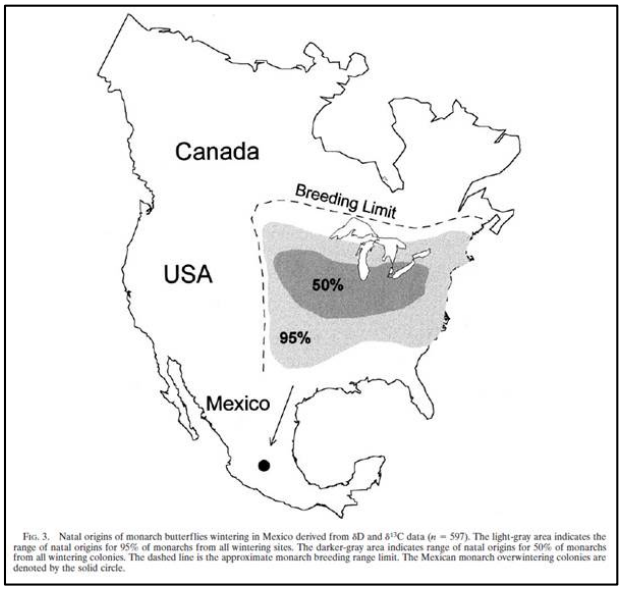

FIG. 3. Natal origins of monarch butterflies wintering in Mexico derived from δD and $\delta^{13}C$ data (n = 597). The light-gray area indicates the range of natal origins for 95% of monarchs from all wintering sites. The darker-gray area indicates range of natal origins for 50% of monarchs from all wintering colonies. The dashed line is the approximate monarch breeding range limit. The Mexican monarch overwintering colonies are denoted by the solid circle.

Figure 4. Natal origins of monarch butterflies in Mexico during winter 1996 (Wassenaar and Hobson 1998).

The subregion is home to many milkweed species, but monarch experts agree three have greater significance. They are:

- **Common milkweed (*A. syriaca*):** This large species is very common to disturbed lands in the Midwest and eastern United States, and will be the most important species for monarch restoration or habitat enhancement. Prior to the development of glyphosate herbicide, this species was very common in cropland fields as other herbicides were not effective in control. Common milkweed is rhizomatous, aggressive and can be difficult to control without the proper use of herbicides. It appears to prefer moderately well and well drained soils and spreads rapidly after plowing in spring. Summer plowing appears to reduce the vigor and population. Winter cropping (cash or cover crop) reduces the occurrence of common milkweed. Tissue analysis of monarchs wintering in Mexico during 1995-1996 demonstrated that 85-92 percent of monarchs fed on common milkweed (*A. syriaca*) growing in the central, northern and eastern United States (Wassenaar and Hobson, 1998).
- **Swamp milkweed (*A. incarnata*):** This tall rhizomatous species occurs in open lands in wetlands and along wetlands edges. Being rhizomatous, it tends to occur as colonies, rather than individuals.
- **Butterfly milkweed (*A. tuberosa*):** This non-rhizomatous species occurs sporadically in open lands on sandy, well-drained soils.

The aggressive growth habits and milky sap of *A. syriaca* prohibit acceptance of milkweed in cropland. The milky sap interferes with crop harvesting machinery. While livestock avoid feeding on milkweed in pastures, when cut and cured with hay, it becomes more palatable and poses a greater risk of making cattle sick. Thus hay producers have a low tolerance to milkweed (Shane 2008). For these reasons, NRCS anticipates that the largest gains and interest will be on lands not being used for agricultural production in this subregion.

NRCS identified the highest potential for gains in habitat in the Midwest subregion to be on lands in various USDA cropland retirement programs, particularly lands currently enrolled in WRP and lands to be enrolled in a wetland easement through the Agricultural Conservation Easement Program (ACEP). The

Conservation Reserve Program (CRP), administered by the Farm Services Agency, was identified as having significant potential, with CP-42 Pollinator Habitat being identified as having the most potential for the monarch. There are opportunities for the development of larger blocks of habitat on lands enrolled in both of these programs. Because the current land uses in this subregion are cropland and intensively managed pastures and hay fields, NRCS anticipates less potential of habitat gains with the EQIP and CSP programs. Nonetheless, quality habitat in small blocks is anticipated with the use of these programs.

The most immediate potential is for habitat enhancement on lands currently enrolled under WRP. WRP enables NRCS to work with landowners to implement measures on the land that increase wildlife habitat. NRCS pays 100 percent of the cost for these efforts on permanent easements. Targeted funding will be made available in fiscal year 2016 to implement monarch habitat efforts on existing WRP easements. Staff will apply the *USDA NRCS Monarch Butterfly (Danaus plexippus plexippus): Wildlife Habitat Evaluation Guide WHEG: Monarch Butterfly Midwest subregion* to selected lands currently under easement. Based on the results of the WHEG, each NRCS state office will request funds to implement various habitat improvement activities on existing WRP easement lands. The most common activities anticipated include prescribed burning or disking, followed by planting of milkweed and monarch nectar plants.

The following core and supporting National Conservation Practices will be used to develop monarch habitat in the Midwest subregion using all Farm Bill conservation programs.

Core National Conservation Practices:

- Conservation Cover (327)
- Prescribed Burning (338)
- Early Successional Habitat Development/Management (647)

Core National Conservation Practices anticipated to be applied to a lesser degree:

- Field Border (386)
- Riparian Herbaceous Cover (390)

Supporting National Conservation Practices:

- Brush Management (314)
- Fire Break (394)
- Fence (382)
- Herbaceous Weed Control (315)
- Integrated Pest Management (395)
- Upland Wildlife Habitat Management (645)
- Wetland Wildlife Habitat Management (644)

SOUTHERN GREAT PLAINS MONARCH HABITAT STRATEGY

The project's southern Great Plains subregion includes Kansas, Oklahoma and Texas. This area provides critical habitat for monarchs arriving from Mexico in the spring. Additionally, it provides critical nectar plants for migrating monarchs in the fall of the year. Recent data (Flockhart et al. 2013) suggest that fall monarch reproduction in the southern Great Plains may contribute to the wintering population in Mexico at a higher proportion than demonstrated by the 1996-1997 data (Wassenaar and Hobson 1998). Although the contribution of the wintering population with a natal origin of the southern Great Plains remains in question, data from Flockhart et al. (2013), coupled with data from the Monarch Larva Monitoring Project (Prysby and Oberhauser 2004) and Baum and Sharber (2012) suggests that opportunities to increase fall monarch breeding habitat in the southern Great Plains may warrant further consideration (e.g. research, consideration during the conservation planning process).

During the fall migration, the vast majority of the eastern population of monarchs funnel through the central part of these three states. Multi-year monitoring from citizen observational data (Journey North 2015) support that the location of this fall migration funnel is somewhat dynamic dependent on prevailing winds during the migration. These data demonstrate the critical importance of fall nectar sources in central portions of these three states.

The FWS has identified three species as being the most critical for the monarch recovery in the Southern Plains (Best 2015). They are:

- **Spider milkweed (*Asclepias asperula*):** This narrow-leafed species is particularly common to central Texas and is most adapted to shallow calcareous soils common to the Edwards Plateau of central Texas. It also occurs in OK and KS, but to a lesser degree. It occurs primarily on grazed lands but also on areas maintained by periodic mowing and shallow soils that are not grazed. It appears to prefer shallow soils that range from slightly alkaline to calcareous.
- **Zizotes milkweed (*A. oenotheroides*):** This wide-leaf species is common in northern Mexico, southern, central and north-central Texas. It also occurs in Oklahoma. Zizotes milkweed is well adapted to deep, neutral to moderately alkaline clays and clay loam soils, and occurs primarily on grazed lands as well as on areas maintained by periodic mowing. Introduced grasses common to southern Texas may be contributing to the decline of this milkweed species.
- **Green antelope horn (*A. viridis*):** This wide-leaf species is common to central Texas, Oklahoma and Kansas. Because of the larger range, many consider this species to be the key species for first generational monarchs. It occurs almost exclusively on grazed lands and non-agricultural areas periodically mowed, such as roadsides, parks and urban lands. It appears to prefer deep loams and fine sandy loam soils but tolerates deep finer textures soils. This species prefers soils that are slightly acid to slightly alkaline. Unlike *A. asperula*, it rarely occurs on shallow soils.

Each of these species are one to two feet tall and shade intolerant. Thus, these milkweed species are not well adapted for hayland or cropland. Rather, they evolved under patchwork grazing by bison (*Bison bison*) (Gates and Aune 2008) and burned conditions common in the southern Great Plains. They flourish on lands that are grazed. Commercial seed propagation and the cultural practices for establishment of these three species are very limited. Anecdotal observations (Goodwin, personal communications) suggest that this region may have ample milkweed for the first generation of returning monarchs. NRCS will not allocate significant resources for planting of milkweed in this subregion. Rather resources will be

allocated to protect and enhance existing stands of milkweed and to promote an increase in nectaring species.

Monarchs limit lipid intake during migration and use a "fuel as you go" approach. As they near Mexico, monarchs begin to build lipid reserves needed to overwinter (Brower et al. 2006) in the cool and damp climate. Failure to build fat reserves would impact survival during the long winter dormancy period. For these reasons, NRCS will concentrate on increasing availability and distribution of fall nectaring habitat in the southern Great Plains subregion. It is important to note that *Asclepias* species are an excellent source of nectar. Prescribed burning during summer has increased availability of milkweed for the fall migration (Baum and Sharber 2012). Similarly, summer mowing appears to increases availability of milkweed nectaring resources in the fall (Davis, personal communications). NRCS will allocate resources in an attempt to increase availability of fall nectaring plants in the southern Great Plains subregion.

Monarch survival rates to the fifth instar (the final larval/caterpillar stage prior to pupation) are generally between 15 and 20 percent (Prysby and Oberhauser, 2004). The red imported fire ant (*Solenopsis invicta*) has been identified as potentially having a significantly negative impact to the monarch population (Calvert 2004a). Following observations in 1996, Calvert initiated as study that demonstrated that the red imported fire ant reduced survival of monarchs in central Texas to the fifth instar from 20 percent to 0.2 percent, a 100 factor decline (Calvert 2004). Fire ant population densities are related to soil type. Shallow, droughty soils support lower densities, as do deep sands. NRCS will attempt to target habitat development efforts in southern Oklahoma and Texas in areas with lower fire ant densities. Additionally, NRCS will consider the development of a fire ant control pilot study on WRP easements, similar to the efforts by the FWS on the Attwater Prairie Chicken National Wildlife Refuge (Morrow et al. 2015).

NRCS identified the highest potential for gains in habitat in the southern Great Plains subregion to be on private grazing lands, particularly sites supporting native grass. Conversion from introduced monoculture grass systems to species rich native grasslands will be a high priority as will implementation of grazing systems that maximize plant species richness. These habitat gains will be implemented primarily though the EQIP.

Most of the CRP contracts in this subregion are in the western portions of the state and are not heavily used by monarchs in most years. For this reason, the potential for CRP in these three states is considered lower than in the Midwest.

The NRCS conservation planner will apply the *WHEG: Monarch Butterfly Southern Great Plains subregion* to identify various habitat improvement activities that would increase habitat. The most common national conservation practices to be applied to increase monarch habitat in the southern Great Plains subregion are identified below.

<u>Core National Conservation Practices:</u>

- Brush Management (314)
- Conservation Cover (327)
- Early Successional Habitat Development/Management (647)
- Field Border (386)
- Prescribed Burning (338)
- Prescribed Grazing (528)
- Range Planting (550)

Core National Conservation Practices anticipated to be applied to a lesser degree:

- Riparian Herbaceous Cover (390)
- Upland Wildlife Habitat Management (645)

Supporting National Conservation Practices:

- Fire Break (394)
- Fence (382)
- Heavy Use Area Protection (561)
- Herbaceous Weed Control (315)
- Integrated Pest Management (595)
- Livestock Pipeline (516)
- Pond (378)
- Pumping Plant (533)
- Water Well (642)
- Watering Facility (614)
- Wetland Wildlife Habitat Management (644)

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