

---

# Oklahoma Monarch and Pollinator Collaborative

# Statewide Monarch Conservation Plan

---

<b>Oklahoma Monarch and Pollinator Collaborative</b>	0
<b>1. Executive Summary</b>	3
1.1 The Challenge at Hand	3
1.2 Response: The Oklahoma Monarch and Pollinator Collaborative (OMPC)	3
Origin	3
Vision	3
Mission	3
Collaboration Principles	4
1.3 Oklahoma Monarch Conservation Plan Overview	4
Development and Timeline	4
Expected Outcomes	4
Sample Goals & Strategies	5
<b>2. Monarch Species Background &amp; Status</b>	7
2.1 Life History	7
Life Cycle	7
Nutritional Needs	7
Milkweeds	7
Nectar Plants	8
Breeding and Migration (including 5th generation)	8
Overwintering	9
2.2. Trends in Habitat, Population, and Distribution	10
Monarch Habitat	10
Historical Distribution	10
Current Habitat and Population Trends	10
2.3. Known Threats	10
Habitat Destruction/Modification and/or Range Curtailment	11
Overutilization	12
Disease and Predation	12
Other Natural or Manmade Factors	13
Insecticides	13
Invasive Species	13
Extreme Weather Events	14
Climate Change	14
2.4 Link with National Conservation Efforts	14

MAFWA's Mid-America Monarch Conservation Plan	14
Monarch Conservation Science Partnership	15
<b>3. Essential Habitat in Oklahoma</b>	16
3.1 Conservation Lands	17
Public Lands	17
Private Conservation Lands	18
Tribal Lands	18
3.2. Agricultural Lands and Rangelands	19
Rangelands	19
Croplands	20
3.3. Rights-of-Way	20
Roadsides	20
Utilities	21
3.4. Urban and Municipal Lands	22
<b>4. Oklahoma Monarch Habitat Conservation Goals</b>	22
4.1 Statewide Stem and Acreage Goals	23
4.2 Conservation Lands	23
4.3 Private Agricultural Lands and Rangelands	24
4.4 Rights-of-Way	24
4.5 Urban and Municipal Lands	25
4.6 Seed and Plant Production	26
<b>5. Monitoring, Management, and Research</b>	26
5.1. Quantifiable Monitoring and Performance Objectives	26
5.2 Data and Plan Management	27
5.3 Key Research Needs	28
5.4 Timeline for Implementation	30
<b>6. Communications and Outreach Strategy</b>	30
<b>7. Funding &amp; Partnerships</b>	32
7.1 Funding mechanism(s)	33
7.2 Prospective partnerships to amplify success	34
<b>Literature Cited</b>	35
<b>Appendix A: Nectar and Host Plant Lists</b>	39
OMPC Native Nectar and Host Plant List for Monarchs in Oklahoma	39
Oklahoma City Metro Monarch Network: Nectar & Host Plant List	41
<b>Appendix B: A Sampling of Current Activities in the State</b>	43
Mapping the Territory Highlights	43
Detailed local monarch success story examples:	45
<b>Appendix C: Partners and Audiences</b>	48

Current Partners

Below is a list of current collaborative partners.

48

Prospective Partners

48

**Appendix D: Draft 2018 Launch Campaign Timeline**

48

---

# **1. Executive Summary**

## **1.1 The Challenge at Hand**

In the last decade, due to habitat loss and other factors, monarch butterfly populations have plummeted at an alarming rate. In 2014, the US Fish and Wildlife Service (USFWS) was petitioned to consider the monarch as a threatened species. This has spurred national monarch conservation collaboration efforts, with over 16 states developing statewide action plans and a coordinated Mid-American Monarch Conservation Strategy for conserving habitat (both milkweed for caterpillars and nectar plants for butterflies) for this amazing migratory butterfly. These coordinated, 'all-hands on deck', cross-sector, state-by-state actions are expected to influence the USFWS decision (to be made in 2019), and are our best hope of boosting monarch populations.



## **1.2 Response: The Oklahoma Monarch and Pollinator Collaborative (OMPC)**

### **Origin**

The first-ever Oklahoma Monarch Summit was held in November 2016, bringing together stakeholders interested in monarch conservation, science, and education to address the steps needed to stem the dramatic decline in the monarch butterfly population. During a day and a half of meetings, this working group first reviewed existing monarch conservation activities in the state and region and then engaged in visioning and planning for a larger collaborative effort, with the goal of bringing together the people and resources needed to facilitate the recovery of the monarch population and those of all pollinator species. A steering committee and workgroups were formed at the summit to develop the plan by Fall of 2017. To further inclusivity and participation, a larger listserv was developed to engage all interested parties in monarch conservation efforts in the state, and the Oklahoma Monarch and Pollinator Collaborative (OMPC) was formalized as the name for this statewide collaborative effort.

### **Vision**

Oklahomans working together to ensure our landscapes and gardens support thriving pollinator populations and monarch migrations for generations to come.

### **Mission**

To educate, engage, and support Oklahomans in the creation, protection and enhancement of suitable habitat (including milkweed, other host plants and nectar sources) for monarchs and pollinators throughout Oklahoma.

## Collaboration Principles

We asked all participants at the November 2016 Monarch Summit to share best practices for collaborative success based on their experience. The collective input of participants was distilled into the following core collaboration principles. These principles will help guide the growing collaborative needed to meet the goals of this plan.

- Put shared purpose first (check logo & ego at door!)
- Practice transparent, respectful, responsive communication
- Look for win-wins - think outside the box to find aligned interests and shared impact
- Value diverse views & learning from each other - we're smarter together!
- Leverage strengths to achieve more together
- Bring a brick-by-brick mindset (i.e. hold a big vision while taking regular bite-sized actions)
- Practice generosity - share ideas, expertise, resources, time
- Bring our full attention when we're working together
- Avoid jargon - focus on inclusion and communicating the value of our work

## 1.3 Oklahoma Monarch Conservation Plan Overview

### Development and Timeline

In early 2017, a steering committee was formed to work to turn the thinking from the November 2016 summit into a draft statewide plan by fall of 2017. With targeted support from work groups focused on research, habitat monitoring, and education and outreach, and an interim coordinator to guide the process, the steering committee worked to co-create this cross-sector, multi-decade, comprehensive and adaptive plan throughout 2017.

Coordination for implementation of the plan began in late 2017, with a formal launch planned for April 2018. Early actions are expected to focus on fundraising, the development of education and outreach materials and campaigns, as well as baseline habitat tracking, data management system development, and implementation of best management practices and trainings on available lands. Long-range activities will include a focus on more difficult and/or costly land management, culture, and policy change to support monarch friendly habitat and culture in the state for decades to come.

### Expected Outcomes

Expected outcomes of this effort include a website clearinghouse for materials, events, research, data, and action updates, as well as best management practice lists and toolkits, trainings and education materials and support, and updated monarch friendly plant lists for the state. The plan has a strong emphasis on outreach and education to support an 'all hands', all sector approach throughout the state, and we also expect this effort to lead to increased statewide education/engagement in monarch conservation activities, including: funding, tagging, planting, monarch-friendly land management, collaborative data tracking and monitoring.

This plan is designed to facilitate, coordinate, and track actions amongst OMPC members and partners. It is meant to help coordinate and support existing efforts, catalyze new actions to enhance

awareness and habitat in the state, and to support coordinated statewide action and monitoring for national monarch conservation efforts. The final version of the full list of plan actions have been set into a spreadsheet for review and refinement by new 'implementation' work groups to launch in late 2017, and the plan and Okies for Monarchs website and outreach campaign will formally launch in April 2018 with the spring monarch migration.

## Sample Goals & Strategies

The plan is divided into four primary land-type 'sectors', with goals and strategies for each land type:

Primary Goal	Sample Actions	What you can do to help!
<b>Conservation Lands</b>		
Maintain, restore, and enhance a diverse array of nectar source plants and milkweeds on potential conservation lands, (both public and private) through management and restoration.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Compile a list of all entities that own such lands in the state (woodlands, wetlands, rangelands, prairie, etc.)</li> <li><input type="checkbox"/> Engage key contacts on participating in OMPC efforts.</li> <li><input type="checkbox"/> Inventory lands.</li> <li><input type="checkbox"/> Encourage monarch-friendly land management.</li> </ul>	<p><b>Help us make new connections with these lands and landowners in the state. Email us to help make an introduction.</b></p> <p>→ email us at <a href="mailto:okiesformonarchs@gmail.com">okiesformonarchs@gmail.com</a></p>
<b>Private Agricultural and Rangelands</b>		
Conserve, restore, and enhance rangelands, pastures, hay meadows, and croplands to support more monarchs and pollinators.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Engage farmers, ranchers, and other ag specialists in cropland and rangeland working groups to identify agricultural land types most compatible with monarch conservation and develop best management toolkits.</li> <li><input type="checkbox"/> Offer education and training to interested ag and ranch land managers.</li> </ul>	<p><b>Join a working group if you work with farm or ranch lands. Help connect us with others in the agricultural community who may want to get involved.</b></p>
<b>Rights of Way</b>		
Maintain and increase available habitat for monarchs and other pollinator species on both public and private rights-of-way.	<ul style="list-style-type: none"> <li><input type="checkbox"/> Identify rights-of-way and utility managers and conduct targeted best management practice education and outreach.</li> <li><input type="checkbox"/> Quantify existing ROW habitat.</li> <li><input type="checkbox"/> Identify and address policy and cultural</li> </ul>	<p><b>Contact your local roadside managers and utilities and let them know you support them supporting monarch habitat on roadside and</b></p>

	barriers to more monarch-friendly ROW management.	<b>right of way lands.</b>
Primary Goal	Sample Actions	What you can do to help!
<b>Urban and Municipal Lands</b>		
Conserve, restore, and enhance monarch and pollinator habitat on public and private lands in urban and suburban areas.	Engage 25+ municipalities and urban-based corporate campuses to: <ul style="list-style-type: none"> <li><input type="checkbox"/> Identify existing habitat in high priority geographic areas for enhancement and restoration.</li> <li><input type="checkbox"/> Identify and address policy (ordinance) and cultural barriers.</li> <li><input type="checkbox"/> Develop outreach toolkits for municipalities and citizens.</li> </ul>	<b>Visit <a href="http://www.okiesformonarchs.org">www.okiesformonarchs.org</a> to take the monarch pledge, register a garden, and sign up to stay informed!</b>
To support action across land types, the plan also includes supporting goals focused on cross-sector work needed for successful implementation of the plan. Example goals in these areas include:		
<b>Seed and Plant Production</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Create lists of important plant species in each region of the state.</li> <li><input type="checkbox"/> Disseminate plant lists to native seed and plant producers and ask them to increase locally-sourced milkweed and nectar plant seed and plant production.</li> </ul>	
<b>Communications and Outreach</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Establish a website clearinghouse for information about monarch and pollinator conservation in the state (<a href="http://www.okiesformonarchs.org">www.okiesformonarchs.org</a>, full site launching in Spring 2018!)</li> <li><input type="checkbox"/> Identify core target audiences and develop messaging for each.</li> <li><input type="checkbox"/> Develop online pledge, action toolkits, and social media outreach to support the sector-based monarch conservation plan goals.</li> </ul>	
<b>Research and Data Monitoring</b>	<ul style="list-style-type: none"> <li><input type="checkbox"/> Engage local researchers in national research efforts to ensure the OMPC benefits from and contributes to best available science.</li> <li><input type="checkbox"/> Establish a statewide information management work group to develop and maintain a coordinated data management system for measuring habitat baseline and enhancements.</li> <li><input type="checkbox"/> Ensure types of data collected through the the statewide effort can be integrated (to every extent practical) into the national U.S. Fish and Wildlife Service's Monarch Conservation Database (MCD) (<a href="https://www.fws.gov/savethemonarch/MCD.html">https://www.fws.gov/savethemonarch/MCD.html</a>).</li> </ul>	

## Governance and Management

- ☐ Hire a statewide coordinator for managing implementation activities and partnerships for the OMPC plan.
- ☐ Maintain quarterly meetings of OMPC steering committee and work group leads to share information and move actions forward.
- ☐ Share quarterly email updates to a broad stakeholder listserv.
- ☐ Conduct an annual webinar and/or annual summit to bring partners together to celebrate successes and plan actions for the next year.

## 2. Monarch Species Background & Status

### 2.1 Life History

#### Life Cycle

Female monarchs typically lay eggs singly on milkweed plants, although it is not uncommon to find multiple monarch eggs on a single milkweed plant. The eggs hatch and go through five instar (or caterpillar) stages, molting between each stage. The length of the front and back tentacles (also sometimes referred to as filaments or projections) is the best way to distinguish between instar stages, as overall length can be variable (see <https://monarchlab.org/?/biology-and-research/biology-and-natural-history/breeding-life-cycle/life-cycle#larva>). As the fifth instar nears the end of its development, it will move off of the milkweed plant and find a place to pupate, forming the chrysalis from which the adult butterfly will emerge 10 to 14 days later. The entire process (from egg to adult butterfly) takes approximately one month to complete, although the timing varies depending on temperature and other factors. Male and female monarch butterflies can be distinguished from one another by the presence of a black spot located along a vein on the hind wings of male monarchs that is not present in females, and females have thicker veins on their wings (see <http://www.monarchwatch.org/biology/cycle1.htm>). During the summer breeding period adult monarchs live two to five weeks, but the final generation that migrates to the overwintering grounds in Mexico can live up to 9 months. Milkweeds are the sole host plant for immature monarchs; adult monarch butterflies require nectar.

#### Nutritional Needs

##### Milkweeds

Milkweeds (primarily *Asclepias* species, but also species of *Cynanchum* (honeysuckle), *Funastrum* (twinnine), *Gonolobus* (anglepod) and *Matelea* (milkvine)) are the only native host plants for monarchs. In Oklahoma, there are 26 species of native *Asclepias* (Oklahoma Vascular Plants Database 2017), 2 species of *Funastrum*, 1 species of *Cynanchum*, 4 species of *Matelea*, and 1 species of *Gonolobus* (Tyrl et al. 2015). All five genera have one or more species that have been recorded as monarch host plants. Of the 34 native species in the Family Apocynaceae, Subfamily Asclepiadoideae in Oklahoma, monarchs are known to use at least 24 of them as host plants, and might use all<sup>1</sup>. Based on its distribution, abundance, and known use by monarchs, green antelopehorn

<sup>1</sup> List compiled from Borders and Mader 2014, James a. Scott, 1986, Texas Parks and Wildlife [Magazine](#), and NRCS in-house research data.



(*A. viridis*) is likely the most important milkweed species for monarchs in Oklahoma. Most milkweed species contain one or more cardiac glycosides, which are bitter compounds that help to protect milkweeds from herbivory. Monarch larvae have strategies to cope with cardiac glycosides, including sequestering them within their tissues. Cardiac glycosides stay within monarchs through metamorphosis to pupa and adult stages, and help to defend monarchs from predation. In addition to being a host plant for larval monarchs, milkweeds can also be an important nectar sources for adult monarchs.

### Nectar Plants

Monarchs require nectar sources throughout the year, and nectar sources are thought to be particularly important for fueling the fall migration. Data for observations of monarchs nectaring on multiple plant species are available, but the list is incomplete. Therefore, it is necessary that observations are reported to the Xerces Society Monarch Nectar Plant Database (<https://docs.google.com/a/spspioneers.com/forms/d/e/1FAIpQLSfc85E-btqsGSrt16TSAogiCzLV2PvOlriD-un-m0jWjpJQkA/viewform>). Our current Monarch Nectar and Host Plant List can be found in [Appendix A](#), and is expected to grow as the work continues.

### Breeding and Migration (including 5th generation)

The eastern North American monarch butterfly population migrates from overwintering grounds in central Mexico to summer breeding grounds in the Upper Midwest and southern Canada each year (Figure 1). Monarchs migrate through Oklahoma (and the southern plains) in spring and fall, and also reproduce in the state during these two time periods. Monarchs start arriving in Texas in March, reaching Oklahoma in late April, and produce the first generation of monarchs (i.e., the offspring of individuals that overwintered in Mexico). Monarchs continue moving north and produce several more generations on their summer breeding grounds. A subset of the population returns to the southern region, including Oklahoma, a month or so before peak migration. These monarchs first arrive in Oklahoma in mid-August and are referred to as pre-migrants, late breeding monarchs, or fall breeding monarchs. These monarchs are reproductively active and their offspring are often referred to as the fifth generation, with many of these individuals emerging as adults around the time of peak migration. Recovery of monarchs tagged with Monarch Watch tags on the overwintering grounds indicates that fifth generation monarchs do migrate to Mexico (personal communication, K. Baum). Stable isotope analyses also indicate that approximately 11% of the overwintering population in Mexico originates from the south-central region, and thus are likely fifth generation monarchs (Flockhart et al. 2017). Peak fall migration in Oklahoma occurs in late September or early October (<http://www.monarchwatch.org/tagmig/peak.html>), although monarchs continue to move through Oklahoma into mid-October in most years. The timing of peak migration varies among years, with peak migration occurring across a few or many days depending on weather conditions. For example, the overall timing of peak migration has been “late” in recent years (e.g, 2015, 2016).

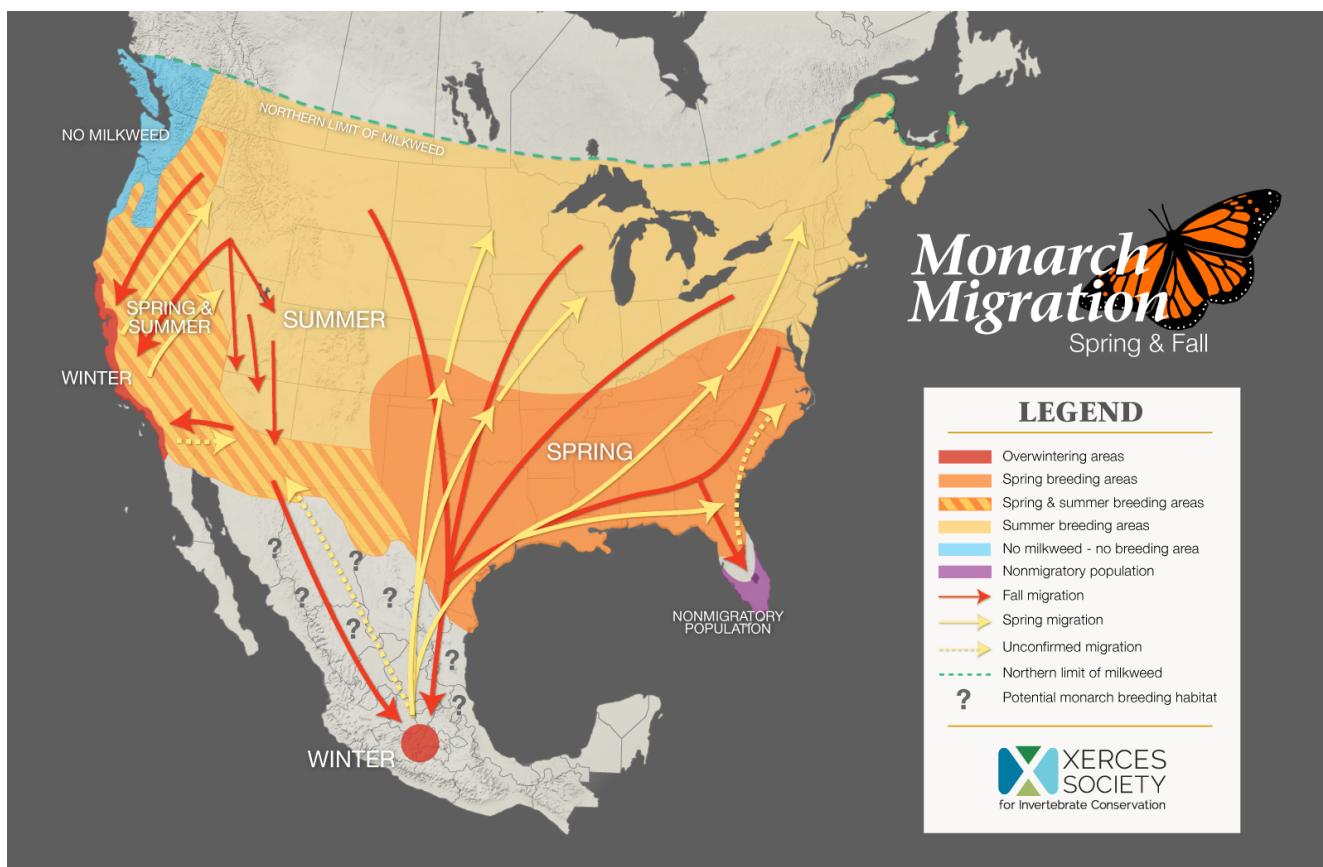


Figure 1. The migration route of the monarch butterfly during the spring (yellow arrows) and fall (red arrows). This plan focuses on the eastern migratory population represented by the spring (solid orange area) and summer (solid yellow area, but restricted to primarily East of the Rocky Mountains; see the “East” monarch conservation core areas in Figure 2). The fall breeding grounds are not represented on this map, and the geographic extent is not fully known, although may correspond to the spring breeding grounds.

## Overwintering

The overwintering grounds in Mexico are located in the high-elevation oyamel fir forests in the Transvolcanic Mountains of central Mexico in the states of Michoacan and Mexico. The first monarchs typically reach the overwintering grounds around November 1st of each year, where they form densely packed clusters. Because the monarchs are clustered into just a few areas, they are susceptible to substantial losses due to winter storm events. The size of these overwintering clusters have been measured every winter since the 1994-95 overwintering season, and this information has been used to estimate the size of the overall population and to document recent declines.

Monarchs have also been observed wintering along the Gulf Coast in recent years (Satterfield et al. 2015), with some individuals also exhibiting winter-breeding behavior in areas where tropical milkweed (*Asclepias curassavica*) is present. These winter-breeding monarchs possess relatively high levels of infection by *Ophryocystis elektroscirrha* (OE; see disease/predation section below). There is concern that interactions (e.g., breeding or laying eggs on the same milkweed plants) between winter-breeding and spring-breeding monarchs could increase OE infection levels in the overall population.

## 2.2. Trends in Habitat, Population, and Distribution

### Monarch Habitat

Across the species range, habitat for monarch butterflies is highly variable and may range from urban and agricultural systems to forests and grasslands. The habitat and availability likely differs both regionally and at different spatial and temporal scales. Monarchs are capable of occupying land cover types that may include areas with milkweeds, with nectar plants, or with both. According to the Xerces Society's Monarch Nectar Plant Guide for the Southern Plains (<https://xerces.org/monarch-nectar-plant-guide-southern-plains/>), monarch butterflies have been found to use at least 24 different species of plants in the Southern Plains as nectar sources. During fall migration, Monarchs will often use large forbs, shrubs, and trees as roosting sites. Given their highly mobile behavior during much of the spring, summer, and fall, monarchs can make use of small resource patches, and no minimum patch size has been identified. Therefore, patches of monarch habitat can vary along a gradient of different characteristics, with the value of a particular patch depending on numerous factors such as size, shape, resource abundance, resource quality, natural enemies, etc.

### Historical Distribution

The historical distribution of monarchs includes the lower 48 United States, the southern portion of multiple Canadian provinces, Mexico, some Caribbean islands, and possibly northern South America.

### Current Habitat and Population Trends

The current distribution of monarchs is much greater than it was 300 years ago. Since that time, monarchs have been introduced to the Azores, portions of northern Africa, Australia, and numerous Pacific Islands, including the Hawaiian Islands (Zhan et al. 2014 ).

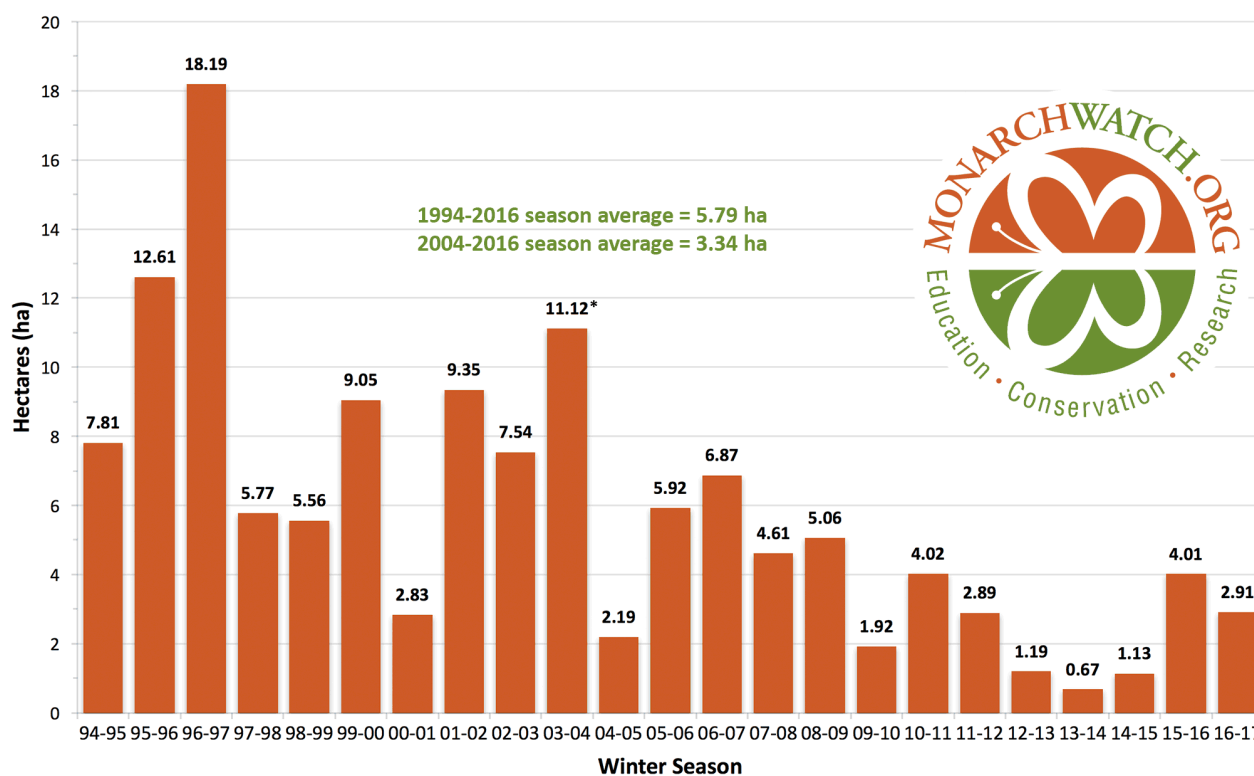
The first estimate of the size of the eastern North American monarch population was made in 1994, at the overwintering sites in central Mexico. Since the mid 1990s, monarch abundance has plunged (Figure 2).

## 2.3. Known Threats

The monarch butterfly decline has been attributed to several factors, including negative impacts to habitat such as fragmentation, loss, and degradation (including loss of milkweed, nectar, and overwintering sites); overutilization of individuals (e.g., commercial, educational, research uses); and monarch disease/predation. Other factors include climate change, weather extremes, invasive species, and pesticides. The greatest threats to the abundance of milkweed plants in Oklahoma are the conversion of native grassland to other land uses (agriculture, development, etc), woody plant encroachment, and direct mortality from the application of herbicides.

*For simplicity and because of the high degree of interconnection with this migratory species, this section covers threats both regionally and specific to Oklahoma monarch habitat.*

## Total Area Occupied by Monarch Colonies at Overwintering Sites in Mexico



Data for 1994-2003 collected by personnel of the Monarch Butterfly Biosphere Reserve (MBBR) of the National Commission of Natural Protected Areas (CONANP) in Mexico. Data for 2003-2016 collected by World Wildlife Fund Mexico in coordination with the Directorate of the MBBR.

\* Represents colony sizes measured in November of 2003 before the colonies consolidated. Measures obtained in January 2004 indicated the population was much smaller, possibly 8-9 hectares. CT

Figure 2. Historical monarch overwintering site acreage. Graph by monarchwatch.org, data collected by the Monarch Butterfly Biosphere Reserve (MBBR) and the World Wildlife Fund Mexico. Higher resolution image available [here](#).

## Habitat Destruction/Modification and/or Range Curtailment

Milkweed loss is a repercussion of extensive glyphosate use in croplands planted to glyphosate-tolerant corn and soy, and has been identified as a contributing factor in the decline of the monarch. A large percentage of the monarchs that reach Mexico in autumn are from the Midwestern corn and soy belt. Before the introduction of glyphosate-resistant crops, fields in this region supported vast numbers of common milkweed (*Asclepias syriaca*) stems, which are thought to have sustained the larval development of millions of monarchs each year. However, with the introduction of glyphosate-resistant crops and large-scale application of glyphosate to most corn and soybean fields, common milkweed abundance has drastically declined (Pleasants and Oberhauser 2012, Pleasants 2017). This is also important because milkweed plants in agricultural areas have higher densities of monarch eggs than plants in non-agricultural areas (Oberhauser et al. 2001, Pleasants and Oberhauser 2012).

Another contributing factor is habitat loss, which includes conversion of rangeland and grasslands to cropland, urban and suburban development (over 1 million acres/year), and intensification of agriculture (via the reduction or elimination of field margins). Between 2008-2011, 17 million acres of grasslands (primarily CRP) were converted to corn production. This was due to the economics of the renewable fuel standard: as the demand for corn-derived ethanol increased, corn prices rose to 11 dollars a bushel. Overwintering habitat in Mexico was lost due to deforestation from

1971 to 1999, and remaining forest was degraded by small-scale logging from 2002 to 2012 (Brower et al. 2012, Vidal et al. 2014). It is possible that illegal logging still occurs in the overwintering colonies, and might be an ongoing threat.

Nectar availability during fall migration has also been identified as important for supporting the monarch population, and successful establishment on the overwintering grounds (Brower et al. 2006, Inamine et al. 2016). The factors mentioned above for milkweed loss and habitat loss would also contribute to a decline in nectar resource availability. Climatic factors, such as temperature and precipitation, will also influence the timing of flowering and the availability of floral resources within and across years.

It is unclear how monarch habitat availability has changed in Oklahoma during the last 20 years. However, we speculate that monarch habitat has declined in Oklahoma due to urbanization, and due to loss of milkweeds and nectar sources in grasslands as those grasslands have been invaded by eastern redcedar (*Juniperus virginiana*) following fire suppression. Therefore, this plan focuses on conservation actions that enhance and restore monarch habitat.

### Overutilization

Some have expressed concern that the sale of live monarch butterflies (for weddings and other occasions) can harm monarchs through increased disease transmission and accumulation of genetic abnormalities (Center for Biological Diversity et al. 2014). For example, crowded or non-sterile rearing conditions can lead to OE infection. The Monarch Joint Venture has developed guidelines for responsibly rearing monarchs

([http://monarchjointventure.org/images/uploads/documents/monarch\\_Rearing\\_Instructions.pdf](http://monarchjointventure.org/images/uploads/documents/monarch_Rearing_Instructions.pdf)).

### Disease and Predation

Survival estimates for immature monarchs can be separated into egg to fifth instar survival, which incorporates predation, and fifth instar to adult survival, which reflects parasitism. Research indicates that survival from egg to fifth instar is less than 10% and survival from fifth instar to adult is 60 to 90%, although this is an overestimate and does not include pupal parasites (Nail et al. 2015). Predators of monarch eggs and larvae include spiders, wasps, lacewings (larvae), lady beetles (adults and larvae), true bugs, mites, and other invertebrates (Oberhauser et al. 2015, McCoshum et al. 2016). Imported fire ants, and red imported fire ants (RIFA) in particular, have been recorded as potentially important predators of monarch larvae (Calvert 1996, 2004). The imported fire ant quarantine zone ([https://www.aphis.usda.gov/plant\\_health/plant\\_pest\\_info/fireants/downloads/fireant.pdf](https://www.aphis.usda.gov/plant_health/plant_pest_info/fireants/downloads/fireant.pdf)) corresponds closely to the distribution of first generation monarch larvae, including much of southern Oklahoma. However, given the low survival of monarchs from egg to fifth instar throughout the monarch's range, it is not clear if RIFA have decreased monarch survival, or if RIFA have removed/replaced other predators (Calvert 2004).

Parasitoid insects, including tachinid flies and pupal wasps (*Pteromalus* spp), also contribute to monarch mortality. Tachinid fly (*Lespesia archippivora*; possibly other species; Oberhauser et al. 2017) parasitism can be locally very high (90%), but averages about 13% for the eastern North American monarch butterfly population (Oberhauser et al. 2007). *Ophryocystis elektroscirrha* (OE) is a spore-forming protist that decreases monarch survival and flight abilities (Altizer and Oberhauser 1999, Altizer 2001). OE infection levels are generally lowest in the spring (following overwintering) and build up over the breeding season (Altizer et al. 2000). The long-distance migration to the overwintering grounds likely decreases the OE infection level of the overall population, since heavily infected individuals will likely not survive the migration. In general, infection levels for the eastern migratory monarch population are usually less than 10% (Altizer et al. 2000). Predators of adult monarchs include birds, small mammals, wasps, spiders, and other invertebrates (Oberhauser et al. 2015).



## Other Natural or Manmade Factors

### Insecticides

The following has been excerpted verbatim from the Xerces Society report “Recommendations from the Xerces Society for Invertebrate Conservation on Designing State Pollinator Protection Plans, October 2016”, with the permission of the Xerces Society.

“There is a growing body of information that shows that systemic insecticides, namely neonicotinoids, could impact monarchs and other butterflies. Unlike bees, monarchs and other butterflies have the added concern of larval exposure while feeding on contaminated milkweed plants. A 2015 study assessed potential harm to monarch larvae from eating contaminated milkweed. The study suggests that field-realistic levels of the neonicotinoid clothianidin could act as a stressor to monarch populations (Pecenka and Lundgren 2015). Another study out of the United Kingdom used models to evaluate the associations between butterfly population levels and various factors including summer temperatures, spring rainfall, and neonicotinoid use. The researchers found a strong negative association between increasing neonicotinoid use and the decline of 15 of the 17 resident butterfly species studied. More specifically, the study found that the amount of clothianidin detected on milkweed plants adjacent to a field planted with clothianidin-coated seed overlapped with the exposure level that caused reduced monarch larval size (Gilburn et al. 2015). A similar study conducted in northern California found a negative association between neonicotinoid use and butterfly populations (Forister et al. 2016).”

A comprehensive understanding of insecticide use in Oklahoma and the effects of insecticides on monarchs in Oklahoma were identified as data gaps in the current version of this plan. However, at least one neonicotinoid insecticide (imidacloprid) was commonly applied in western Oklahoma in 2014 (the most recent year of data published on the USGS website), and two others (clothianidin and thiamethoxam) were used in smaller portions of the state that year (USGS 2017).

### Invasive Species

Numerous invasive plants indirectly threaten monarchs in Oklahoma, by outcompeting host plants and nectar sources. Some of the most problematic of these plants include yellow bluestem (*Bothriochloa ischaemum*) and other old world bluestem species, sericea lespedeza (*Lespedeza cuneata*) and Johnsongrass (*Sorghum halapense*) (Oklahoma Invasive Plant Council 2017). Once established, these species grow in dense stands that crowd out native milkweed and nectaring plants important for monarchs.

Eastern redcedar (*Juniperus virginiana*) is a species native to Oklahoma that has become extremely invasive throughout most of the state in the last several decades due to prolonged changing land use and fire suppression. In the past, frequent, naturally occurring fires restricted eastern redcedar to steep, rocky locations where fire could not go for lack of fuel. Although eastern redcedar was present in varying degrees in most of the habitats in Oklahoma (with the possible exception of the Panhandle), it has undergone an explosive increase in abundance resulting in unsuitable conditions for native milkweed and nectaring plants that support monarchs.

Two invasive milkweed vines introduced to North America from Europe might eventually threaten monarch populations in Oklahoma. Louise’s swallow-wort (*Cynanchum louiseae*) and European swallow-wort (*Cynanchum rossicum*) are problematic in that female monarchs lay eggs on them, even though larvae that consume these plants do not survive. Of the two, Louise’s swallow-wort is probably the more immediate threat to Oklahoma, as it has already been recorded in Montgomery County, KS, just a few miles north of the Oklahoma border, whereas the closest known record of

European swallow-wort is in Indiana (BONAP 2017). It is important to note that honeyvine (*Cynanchum laeve*; also referred to as blue vine), Oklahoma's only native species of *Cynanchum*, is a suitable host plant for monarch larvae and may be important to monarch reproduction in some areas.

### Extreme Weather Events

Periods of extreme weather can harm monarchs. In the overwintering grounds, heavy snowfalls have been known to kill millions of monarchs, which has led to a decline in the monarch population (Calvert et al. 1983, Brower et al. 2012). In Oklahoma, monarchs are probably most vulnerable to late frosts in spring and early frosts in autumn. Severe drought in late summer and fall, such as in 2012, can also reduce monarch abundance by increasing mortality of milkweeds and nectar sources upon which monarchs depend.

### Climate Change

Climate change poses a serious threat to monarchs, both in the Mexican overwintering grounds and in North America during both the breeding season and migrations. Monarchs at the overwintering grounds depend on consistently cool (but not cold) temperatures during the winter to reduce their metabolic rates and ensure their lipid reserves suffice through the winter. Climate change is expected to bring more extreme weather events, including winter storms. In the United States, an increase in summer temperatures is anticipated (IPCC 2013); the predicted increase could be enough to reduce monarch larval survival in the southern U.S. (Batalden et al. 2007), while it might increase larval survival in the northern U.S. (Jepsen et al. 2015).

## 2.4 Link with National Conservation Efforts

### MAFWA's Mid-America Monarch Conservation Plan

During the latter part of 2016, states within the Midwest Association of Fish and Wildlife Agencies (MAFWA) recognized the need to develop a multi-state strategy to address the rangewide decline of the eastern population of the monarch butterfly. In January 2017, MAFWA partnered with the National Wildlife Federation and hosted a regional conservation planning workshop near Austin, Texas. While strong evidence suggests that significant loss of milkweed in the core summer range (upper Midwest) has been the primary driver in the overall decline, MAFWA recognized the importance of engaging with states in the Southern Great Plains (primarily Kansas, Texas, and Oklahoma) as well (Figure 3).

In addition to 17 state wildlife agencies, representatives from Pheasants Forever, Monarch Joint Venture, the USDA-Natural Resource Conservation Service, and the National Wildlife Federation were invited as collaborators for the national effort. As such, a governance structure for plan development was approved by state wildlife agency directors in all 17 states. Development of the resulting Mid-American Monarch Conservation Strategy is ongoing, with rangewide conservation targets (in milkweed stems and/or acres of habitat) currently pending for release by the U.S. Fish and Wildlife Service and the U.S. Geological Survey (USGS). ***Once targets are set on the national level to recover the eastern population of the monarch butterfly, the Oklahoma State Plan will use a realistically attainable portion of this target as a long-range habitat goal for the state of Oklahoma.***

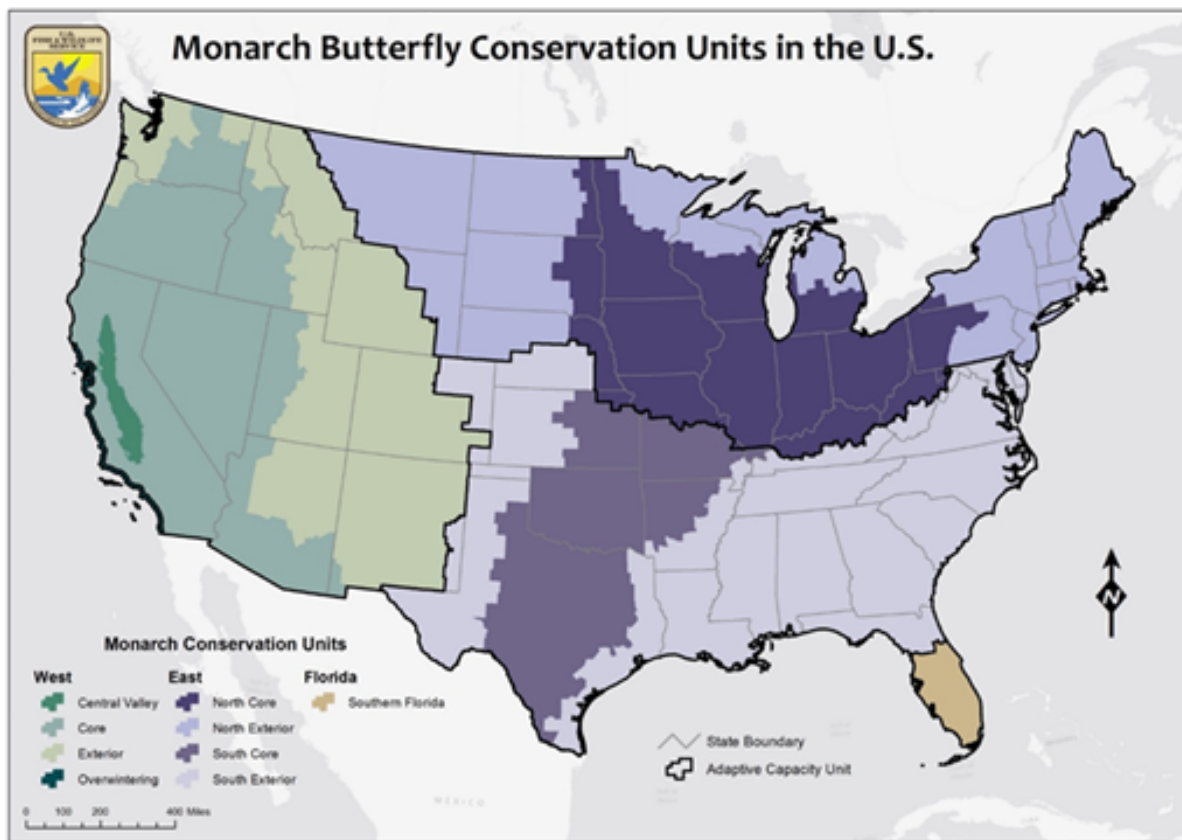


Figure 3. The USFWS has divided the range of the eastern population of the monarch butterfly into two core units (shown in dark purple). With the exception of the Oklahoma panhandle, the entire state is within the “South Core” unit.

### Monarch Conservation Science Partnership

In addition, the OMPC is engaged with the Monarch Conservation Science Partnership (MCSP), a collaborative of scientists and conservation professionals from government agencies, academic institutions, and other organizations. The MCSP has worked on a variety of projects to support monarch conservation, including developing monarch population models, conservation tools and best management practices, population and habitat goals, and monitoring protocols. The monitoring protocols provide an integrated framework for assessing monarch habitat and population trends. Protocols focus on monitoring adult monarchs, nectar plant use, milkweed species diversity and density, monarch egg and caterpillar density, relative abundance of blooming nectar plants, and immature monarch survival, and will be implemented throughout the monarch’s range.



### 3. Essential Habitat in Oklahoma

## Ecoregions of Oklahoma

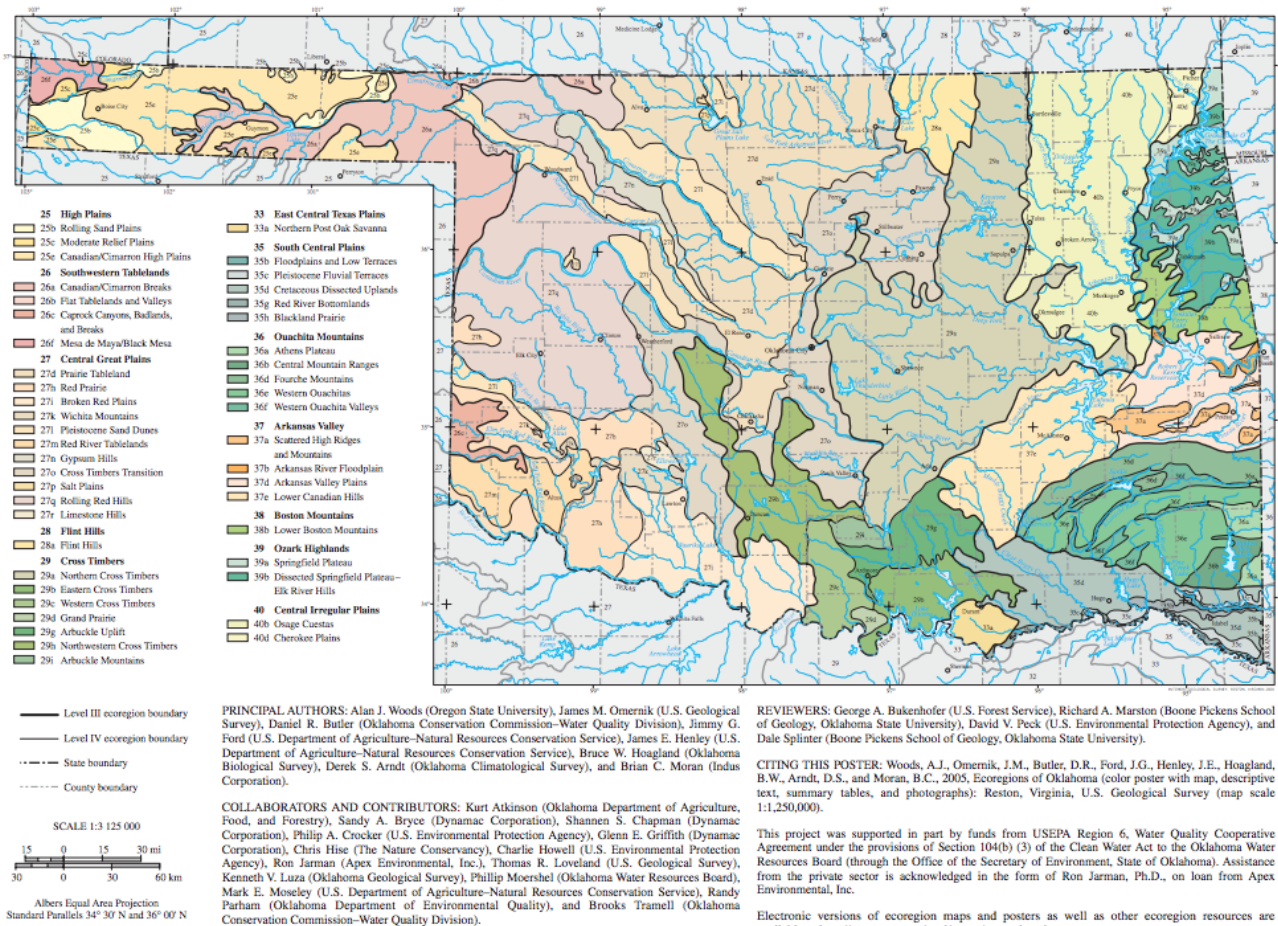


Figure 4. Ecoregions of Oklahoma. This map shows the Level III and IV Ecoregions across the state. It was created by the EPA. A full size version is available [here](http://www.epa.gov/wed/pages/ecoregions.htm).

The current extent and condition of monarch butterfly habitat in the state of Oklahoma is generally unknown, but thought to be in fair-to-good condition overall. Recent scientific research has indicated that the prevalence of milkweed plants may not be a current limiting factor within the state<sup>2</sup>. Of the 34 potential native host plants (i.e., Family Apocynaceae, Subfamily Asclepiadoideae) in Oklahoma, green antelopehorn is the one most commonly used as a host plant by monarch butterflies. This plant is most widely distributed throughout the central portion of the state, and can be found in native and exotic grasslands, forest edges, roadsides, and disturbed areas. Research has shown that green antelopehorn is adapted to periodic disturbance by grazing and fire, both of which have an effect on milkweed availability during monarch migration periods (Baum and Sharber 2012, Baum and Mueller 2015). Recent evidence has shown that appropriately timed mowing and burning can stimulate new growth on milkweeds, which may be a benefit to monarch fall reproduction and the

<sup>2</sup> [Zaya et al. 2017](#), [Stenoien et al. 2016](#), [Lemoine 2015](#), [Davis & Dyer 2015](#), [Flockhart et al. 2017](#).

fifth-generation<sup>3</sup>. Another milkweed species deemed critical for monarch butterflies in the Southern Great Plains, but perhaps to a lesser extent in Oklahoma, is spider milkweed (*A. asperula*).

For the purpose of monarch butterfly conservation planning, we have classified land in Oklahoma into categories aligned with regional planning efforts: Conservation Lands, Agriculture (Row Crop & Rangelands), Urban/Municipal Lands, and Rights-of-Way. Opportunities exist for monarch butterfly habitat in all four categories, and are detailed below. Conservation goals for each of these ‘sector’ categories are detailed in section 4.

## 3.1 Conservation Lands

### Public Lands

\_\_\_\_\_ Multiple opportunities exist to provide monarch butterfly habitat on public lands. Many state agencies own or lease several thousand acres of land, including the Oklahoma Department of Wildlife Conservation, Oklahoma Department of Tourism and Recreation, and Oklahoma Commissioners of the Land Office. Similarly, several thousand acres of natural lands are managed by federal agencies such as the U.S. Fish and Wildlife Service, the U.S. Forest Service, and the National Park Service.

- **The Oklahoma Department of Wildlife Conservation (ODWC)** manages over 1 million acres of land for the specific purpose of providing diverse habitat for game and nongame species alike. At present, several thousands of acres of high-quality habitat on ODWC lands is likely already suitable for monarch butterflies and other pollinator species. Wildlife Management Areas are routinely managed with prescribed fire, invasive plant species control, and selective thinning of trees (where deemed necessary) to encourage native herbaceous plants to flourish for high ecosystem productivity.
- **The Oklahoma Tourism and Recreation Department (OTRD)** maintains 33 parks across the state. While the agency’s primary goal is recreation and not ecosystem management, many parks contain a diverse array of native habitats that can be sources for suitable nectar and host plants for monarch butterflies. As of 2017, OTRD staff began assessing the distribution of milkweeds at selected state park lands, including Lake Eufaula State Park (McIntosh Co.), Lake Murray State Park (Carter Co.), and Lake Texoma State Park (Marshall Co.). In addition, OTRD has begun to establish milkweed plugs in gardens on state park lands. The total acreage of these parks is approximately 74,646 acres.
- **The U.S. Fish and Wildlife Service** maintains 9 National Wildlife Refuges (NWRs) within the state of Oklahoma that cover over 140,000 acres. Refuges such as the Wichita Mountains NWR (Comanche Co.), Washita NWR (Custer Co.), and Sequoyah NWR (Sequoyah Co.) likely have the greatest potential to provide a significant amount of monarch butterfly habitat.
- **The U.S. Forest Service (USFS)** owns and manages over 175,000 acres of land within the state of Oklahoma, including one national forest and two national grasslands. These include the Ouachita National Forest in southeast Oklahoma (McCurtain, LeFlore counties), the Black Kettle National Grassland in western Oklahoma (Roger Mills Co.) and the Rita Blanca National Grassland in northwestern Oklahoma (Cimarron Co.). All three of these properties have the

---

<sup>3</sup> Best management practices and timing for mowing and burning are dependent on location as well as consideration of impacts to other species that utilize roadside habitat. See <https://monarchjointventure.org/images/uploads/documents/MowingForMonarchs.pdf> for more information.

potential to provide a large amount of monarch butterfly habitat, especially the two national grasslands.

- **The U.S. Department of Defense (DOD)** owns several Army bases and military installations throughout the state, including Fort Sill (Comanche Co.); Tinker Air Force Base (Oklahoma Co.), Altus Air Force Base (Jackson Co.), Vance Air Force Base (Garfield Co.), and McAlester Army Ammunition Plant (Pittsburg Co.). DOD lands are often managed in such a way that many wildlife species can benefit, including monarch butterflies. The total land area owned and managed by these installations is approximately 181,000 acres (U.S. Department of the Interior 1994).

### Private Conservation Lands

Over 95% of the land in the state of Oklahoma is privately owned, and maintenance/recovery of monarch butterfly habitat will depend on private landholdings as well. This section focuses on privately owned lands that are not primarily managed for agricultural or ranching operations. (Agricultural lands are covered in the next section).

- **Conservation Lands.** The Nature Conservancy owns multiple preserves throughout the state, most of which provide or have the potential to provide milkweed and nectar plants. Some of these have large swaths of native prairie, including the Tallgrass Prairie Preserve (Osage Co.), the Four Canyon Preserve (Ellis Co.), the Oka' Yanahli Preserve (Johnston Co.), and the Pontotoc Ridge Preserve (Pontotoc and Johnston counties). The total acreage for these four preserves is a little over 50,000 acres.
- **Conservation Easements.** Conservation easements are agreements between private landowners and accredited land trusts in which the landowner conveys to the land trust some of the property rights for that land, either through sale or donation of those rights. The existence of a conservation easement places that property into a protected status as a conservation land for the period of the easement. The landowner retains ownership of the property, but mutually-agreed-upon restrictions (on subdivision, development, mining, logging, herbicide use, or other practices) may be placed on the use of the property to preserve conservation values there. The easement can be for a stated period of time or held in perpetuity. The provisions are attached to the land for the period of the easement, regardless of any change of ownership, and are enforceable in a court of law. Land Legacy currently holds about 20,000 acres in conservation easements and The Nature Conservancy currently holds about 10,000 acres in permanent easements. Other entities may also own conservation easements in Oklahoma.
- Many other partners own, manage, and support the establishment of additional conservation lands in the area - see [Appendix C](#) for a partnership list.

### Tribal Lands

There are over one million trust and restricted acres of Tribal lands in Oklahoma. Most of these lands have not been developed and sit idle and unimproved. The lands are managed by tribes and the Bureau of Indian Affairs, the Bureau of Land Management, the U.S. Fish and Wildlife Service and other federal agencies. Currently, there are at least 38 federally recognized tribes in Oklahoma. Monarch migration passes through tribal lands annually, and much of this land is important monarch breeding and feeding grounds. See map below (or [click here](#) for a more detailed view) of tribal jurisdictions across the state. These lands may offer vast growth areas for milkweed habitat through

collaboration with tribal, federal, and nonprofit partnerships. [The Intertribal Land Trust](#) is also working to utilize state and federal land trust laws to improve the landscape and character of tribal lands in Oklahoma.

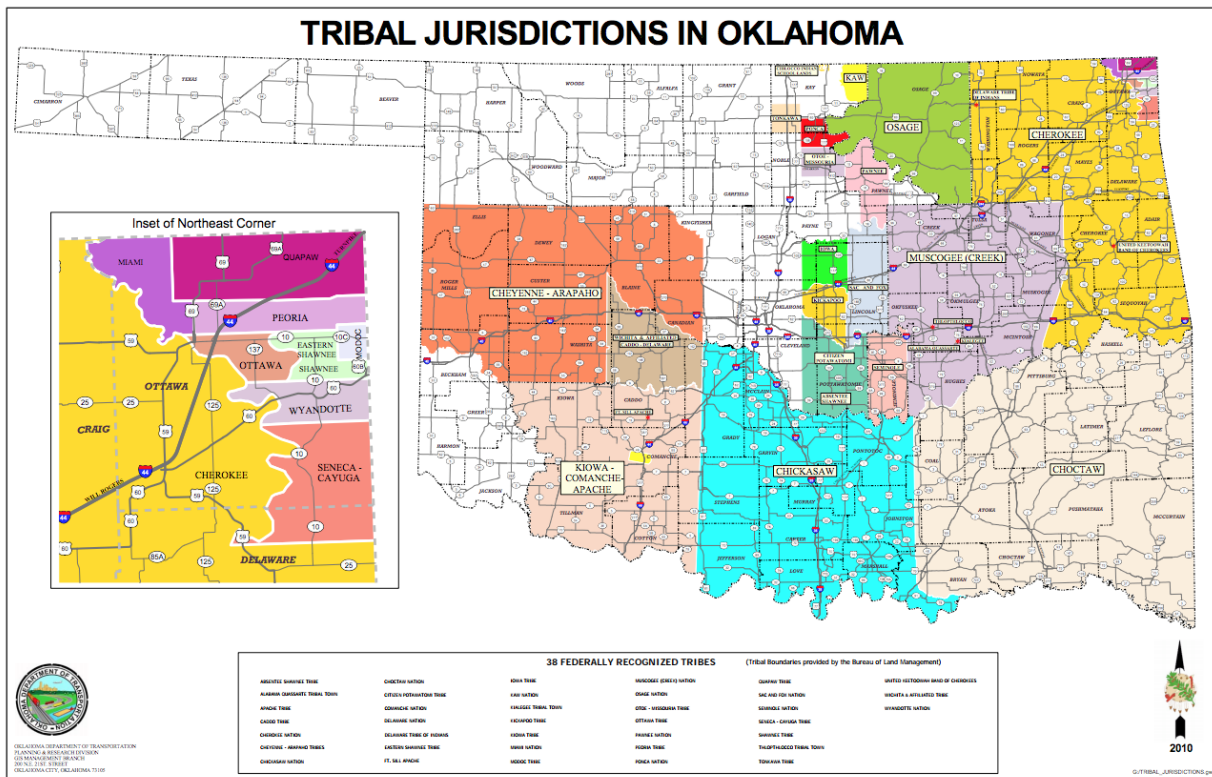


Figure 5. Tribal Jurisdictions in Oklahoma. **ADDD A SENTENCE & DIRECT LINK**

### 3.2. Agricultural Lands and Rangelands

Over 95% of the land in the state of Oklahoma is privately owned. Therefore, the maintenance/recovery of monarch butterfly habitat will depend on private landowners. Rural area landowners include farmers, ranchers, producers, any property owners outside of large urban or suburban areas and absentee owners that live away from their property and use it mostly for hunting and other recreational purposes.

Seventy-seven percent of Oklahoma's total surface area is farmland, which is split into various uses (USDA National Agricultural Statistics Service 2012). The most common farmland type is rangeland, which covers just over 50% of Oklahoma, followed by cropland (25%) and woodland (2%). Note that the millions of acres of forest lands in Oklahoma are not considered farmlands.

## Rangelands

Rangelands without dense cover of eastern redcedar or other invasive plants tend to have the open habitat structure that is ideal for many milkweed species as well as nectar plant species. That, combined with the vast acreage of rangelands in the state, make rangelands the most important land use type for monarchs in Oklahoma. The OMPC is working with the Oklahoma Farm Bureau, Oklahoma Cattlemen's Association, the Oklahoma Association of Conservation Districts (OACD), Pheasants and Quail Forever, The Nature Conservancy, Oaks and Prairie Joint Venture (OPJV), the



Gulf Coast Prairie Landscape Conservation Cooperative, the U.S. Fish and Wildlife Service's Partners for Fish and Wildlife Program, the USDA - Natural Resources Conservation Service, and other organizations to support partnerships with working rangelands. However, it is unclear at this time what percentage of Oklahoma rangelands provide suitable monarch habitat due to the difficulty to determining the quality of rangelands on a statewide level. Determining both the quantity and quality of rangelands will be an essential action for achieving monarch conservation goals in the state.

## Croplands

Croplands in Oklahoma include a variety of crops and land uses. The dominant crops (in order of their acreage, from greatest to lowest) are winter wheat, sorghum, corn, soybeans, and cotton. Each of these crops is typically grown in large-scale monocultures, and herbicides are commonly applied to eliminate competition from weeds. As a result, the majority of croplands in the state today do not serve as active milkweed or nectar source habitat.

Other land uses in croplands include being idle, cover cropping, and enrollment in conservation programs such as the Conservation Reserve (CRP), Wetlands Reserve (WRP), or Conservation Reserve Enhancement (CREP) Programs. As of 2012, approximately 790,000 acres were enrolled in these programs in Oklahoma. It is possible that much of that acreage serves as monarch habitat, though there is concern that changes in commodity prices could lead to a decrease in enrollment in these programs.

Around the country and in Oklahoma, partnership with farmers will be crucial for restoring the base of monarch habitat needed to rebuild the migratory population, as well as supporting other pollinators. Finding the right financial incentives so that farmers, monarchs, and pollinators can thrive will be a crucial part of this equation. Establishing best practices for habitat conversion will also be critical - creating monarch habitat adjacent to insecticide-treated croplands can lead to a net decrease in monarch populations without proper management practices<sup>4</sup>.

## 3.3.Rights-of-Way

Rights-of-Way in Oklahoma offer opportunities for monarch habitat along various transportation corridors for roads and railways, as well as electrical and utility lines. With monarch-friendly management practices, these open land areas can provide a significant boost to statewide monarch and pollinator habitat.

## Roadsides

**The Oklahoma Department of Transportation (ODOT)** maintains rights-of-way along highways that equate to several thousand acres of potential monarch butterfly and pollinator habitat. It is estimated that ODOT has approximately 142,000 "mowable acres", which includes 12,000 acres that are statutorily maintained by municipalities. ODOT maintains a safety zone of intense vegetative management immediately adjacent to roadway pavement that varies from 15' to 30' (wider in medians, intersections, and interchanges). The safety zone comprises about half of the mowable

---

<sup>4</sup> Those that seek to create monarch habitat in any areas with insecticide use are encouraged to read [NRCS Tech Note 9](https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=34828.wba) to learn about practices that can mitigate the harmful effects on monarch habitat. (<https://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=34828.wba>)

acreage resulting in about 65,000 acres that might be available for both nectar source plants and milkweed along highway rights-of-way in Oklahoma.

Excluding areas where invasive species are a concern, approximately 15,000 acres may be available as habitat. Milkweed, especially green antelopehorn, already occurs within many roadsides, and thus it may not be necessary to plant milkweed to increase monarch habitat on roadsides, but instead mowing regimes could be modified. In addition to those 15,000 acres, there are thousands of acres of roadside with low density milkweed populations scattered within dominant stands of invasive plants (bermuda grass (*Cynodon dactylon*), yellow bluestem (*Bothriochloa ischaemum*), etc.). These acres serve as poor monarch habitat at present, but their quality could be improved in the future through intensive invasive plant control.

In addition to ODOT lands, there are thousands of acres of public roadside rights-of-way along county roads in Oklahoma. These roads are managed by county commissioners. Just as with ODOT rights-of-way, county road rights-of-way can be managed to increase and maintain monarch habitat.

**The Oklahoma Turnpike Authority**, a separate agency from ODOT, also maintains 10 turnpikes in Oklahoma covering 606 miles. The width of rights-of-way on most of these routes is comparable to ODOT's free rural interstate system and contains similar vegetative conditions.

## Utilities

Utility lines across the state also offer opportunities for monarch and pollinator habitat partnerships. Some highlights include:

- **Power Lines and Electric Utility Rights-of-Way (ROW)** are used for the construction and maintenance of above-ground electrical power transmission and distribution lines. These ROWs can vary in size from several hundred feet wide for large transmission lines to much less for local distribution lines. The ROW property is typically owned by a private landowner, but that landowner grants an easement to the utility company for the placement and operation of the line, usually with a payment by the utility. After construction, the utility company normally restricts uses and activities in the ROW that may interfere with the suitability of the land for planned or emergency access to the power line for maintenance work. Utilities maintain an access road along the ROW for maintenance vehicles and manage vegetation (mechanically or chemically) in the ROW so that it does not inhibit access or grow to a height that might interfere with the line itself. Given that tall trees and obstructions are undesirable in the ROW, there may be opportunities to manage the land within certain ROWs to be suitable as monarch/pollinator habitat. This would require the approval and cooperation of the landowner and the utility company.
- **Underground Utilities.** Water, sewer and natural gas utilities have their lines beneath the ground surface, but their ROW procurement and use are otherwise similar to those for above-ground power lines. Easements for construction and maintenance access are similar. These ROWs could likewise be potential locations for suitable monarch/pollinator habitat, with the agreement and cooperation of the landowner and utility company.
- **Oil and Gas (pipelines) / Bureau of Land Management Lands.** A similar potential for monarch/pollinator habitat exists with oil and gas pipeline areas in the state, although partnerships and details at this time are still lacking.

### 3.4. Urban and Municipal Lands

Urban landowners are important not only for the gardens they may manage for monarchs, but also because they constitute most of the population in the state. Recent research has also shown that urban pollinator gardens can contribute significantly to monarch habitat<sup>5</sup>. Concentrations of people in urban areas are more easily reached through various communications strategies and media, creating the potential for monarch awareness and conservation initiatives to reach very large segments of the state's voters, philanthropists, corporate employees, etc., who can contribute greatly, either directly or indirectly, to monarch habitat.

- **Private Lands (Urban).** Small, backyard gardens and landscapes have the potential to provide a substantial amount of monarch butterfly habitat. Currently in Oklahoma, there are 149 officially designated urban and suburban Monarch Waystations registered through Monarch Watch. Based on the size categories listed for these waystations, the total amount of habitat provided is conservatively estimated to be 1.4 acres. Although this is a small amount of habitat, there are likely many more acres of suitable habitat that have not been registered with Monarch Watch. These resource patches are useful to migrating monarchs, and the creation of more of these waystations should be encouraged<sup>6</sup>.
- **Municipal Public Lands.** OMPC is still working on understanding the baseline and habitat availability within municipal parks and easements within the state. Due to the varied nature of land management for these urban habitat areas, local leadership and cooperation on habitat management will be essential. The Mayor's Monarch Pledge and other citizen-driven actions are already happening in the state to enhance habitat. See [section 4.5](#) for details. **ANY DETAILS on urban public land ACREAGE, Planted Pollinator Gardens, etc, welcome here!**

## 4. Oklahoma Monarch Habitat Conservation Goals

Based on information gathered from local experts at the Oklahoma Monarch Summit and subsequent steering committee meetings, the OMPC has established the following draft conservation goals for the state, organized by sector. It is worth noting that invasive species management is a cross-cutting theme - it is addressed from an educational perspective in the outreach section of the goals, and from a best management practice perspective in the goals across sectors.

Note that this plan presents high level goals, objectives, and strategies. To meet these goals, objectives, and strategies, a detailed set of over one hundred specific actions/tasks has been created as well. These actions are kept in a 'live' Action Tracker spreadsheet, where information on priority, timeline, and status are also recorded. [The Action Tracker is available online](#) for public view, is maintained by the OMPC steering committee, and is meant to serve as an interactive and evolving project management tool to complement and implement the goals laid out in this plan.

---

<sup>5</sup> See the [Field Museum](#) guide and website for more details on this ongoing pilot research. The site includes midwest urban garden planting guides as well.

<sup>6</sup> See <http://www.nwf.org/Garden-For-Wildlife/About/National-Initiatives/Urban-Monarch-Conservation-Plans.aspx> for Oklahoma City Metro Monarch Network's urban plan and other state urban monarch conservation resources. See

## 4.1 Statewide Stem and Acreage Goals

We recognize the importance of an “all hands on deck” approach to monarch conservation (Oberhauser et al. 2016, Thogmartin et al. 2017<sup>7</sup>), and will focus our efforts across sectors. Determining a specific conservation target for Oklahoma is currently pending, as an estimated statewide inventory of currently available habitat for monarch butterflies has not yet been determined. State technical staff within the governance structure of the Midwest Association of Fish and Wildlife Agencies’ “Mid-America Conservation Strategy for the Monarch Butterfly” are currently collaborating with the U.S. Fish and Wildlife Service on a habitat allocation tool for assigning both rangewide and state-specific habitat targets. **Once such targets have been assigned by MAFWA, the Oklahoma statewide plan will incorporate these here.**

## 4.2 Conservation Lands

This section focuses on lands that have been established and are under permanent or very long term protection as conservation lands, whether through public or private ownership, conservation easement agreements, or otherwise. (This does not include CRP lands, whose protection status is too short term for long-range planning.)

**PRIMARY GOAL: To maintain and increase a diverse array of nectar source plants and milkweeds on potential conservation lands, both public (state and federal government) and private (non-governmental land trusts and organizations) through management and restoration.**

**OBJECTIVE A:** Engage both public and private entities that own and manage protected grasslands and rangelands to both maintain and increase (when and where feasible) available habitat for monarch butterflies.

**STRATEGY 1. Identify Target Agencies** - Identify agencies and organizations that own or manage conservation lands that currently, or have the potential to contain habitat for monarch butterflies.

**STRATEGY 2. Habitat Inventory on Conservation Lands** - Assess the current availability of monarch butterfly habitat on both public and private conservation lands.

**STRATEGY 3. Support Managers of Public and Private Conservation Lands** - Compile and distribute resources to support the management of conservation lands for monarchs and other pollinators by developing a one-stop-shop web page (Okies for Monarchs, [www.okiesformonarchs.org](http://www.okiesformonarchs.org)).

**STRATEGY 4. Habitat Restoration for Monarchs on Conservation Lands**- Restore monarch butterfly habitat on both public and private conservation lands.

---

<sup>7</sup> This study also offered an update to the 1.5 billion stem goal for the USA shared at the November 2016 Oklahoma Monarch Summit, and the more commonly cited number is now 1.8 billion stems for the USA. This 1.8 billion stem goal is based on needing 28.5 stems/monarch, which comes from the 2015 research of Nail et al.



**OBJECTIVE B:** Develop Best (Land) Management Practices for monarch/pollinator habitat

**STRATEGY 1.** Develop and promote Best Management Practices (BMPs) to various partners and audiences to encourage their implementation to restore, enhance and maintain m/p habitat.

### 4.3 Private Agricultural Lands and Rangelands

**PRIMARY GOAL:** To conserve, restore and enhance rangelands, introduced-variety pastures, hay meadows, croplands (row crop farms, orchards, etc.) to support monarch butterflies and other pollinator species.

**OBJECTIVE A:** Maximize to the extent possible the utilization of agricultural lands and rangelands by monarchs and other pollinator species by encouraging the maintenance of existing monarch habitat and the creation of additional monarch habitat.

**STRATEGY 1.** Identify agricultural systems and best management practices that are compatible with monarch conservation.

**STRATEGY 2:** Create a web page for rural landowners to access all resources specific to them and register their participation in Okies for Monarchs at simple web address such as: [okiesformonarchs.org/agriculture](http://okiesformonarchs.org/agriculture).

**STRATEGY 3:** Educate rural landowners and agricultural groups about monarch biology and conservation.

**STRATEGY 4. Identify and Contact Landowners** - Identify agricultural lands and rangelands with existing habitat to be enhanced through best management practices, and lands with good potential for successful monarch restoration activities.

### 4.4 Rights-of-Way

**PRIMARY GOAL:** Conserve, enhance, and restore habitat on public and private rights-of-way (ROW) to support monarch butterflies and other pollinator species.

**OBJECTIVE A:** Maintain and increase (when and where feasible) available habitat for monarch butterflies and other pollinator species on both public and private ROW.

**STRATEGY 1:** Promote monarch/pollinator habitat conservation on public and private ROW.

**OBJECTIVE B:** Engage public and private ROW managers in discussions about ways that they can meet monarch habitat objectives using methods that are compatible with ROW management.

**STRATEGY 1. Identify ROW management practices that are compatible with monarch conservation.**

**OBJECTIVE C:** Educate public and private utility managers to enhance awareness of monarch conservation issues and opportunities.

**STRATEGY 1. Identify or develop methods to train ROW managers on the proper maintenance, and if necessary the establishment and maintenance, of quality monarch and pollinator habitat.**

**OBJECTIVE D:** Conduct research and monitoring of conservation efforts to preserve or enhance existing milkweed and nectar source plants within roadside and utility ROWs.

**STRATEGY 1. Create an easy and efficient method for partners to collect and self-report accomplishments in a timely manner.**

#### **4.5 Urban and Municipal Lands**

**PRIMARY GOAL:** Conserve, enhance, and restore habitat on public and private lands in urban and suburban areas to support populations of monarch butterflies and other pollinator species.

**OBJECTIVE A:** Engage municipalities in conserving and managing existing monarch and pollinator habitat and creating additional habitat via the Okies for Monarchs campaign.

**STRATEGY 1. Identify Target Geographies -** Identify existing habitat for conservation and high priority geographies for enhancement and restoration. Involve as many municipalities as possible. Realistically target 25 municipalities in the first three years with intent to inspire other communities via promotions and media coverage.

**STRATEGY 2: Convene and engage representatives from municipalities** via a one-stop-shop web page for municipalities to access all resources specific to them and register their participation in Okies for Monarchs at simple web address (such as: [okiesformonarchs.org/cities](http://okiesformonarchs.org/cities)).

**STRATEGY 3: Educate citizens, landowners and administration of municipalities and parks & recreation departments.**

**STRATEGY 4: Encourage 25 target municipalities to take action.**

**STRATEGY 5: Generate recognition for participating municipalities.**

**OBJECTIVE B:** Engage corporations in conserving and managing existing monarch and pollinator habitat and creating additional habitat via the Okies for Monarchs campaign.

**STRATEGY 1:** Generate recognition for participating corporations.

## 4.6 Seed and Plant Production

**PRIMARY GOAL:** Increase the production of native milkweed and nectar plant seeds and plants to meet the numbers needed to create or restore sufficient habitat for monarchs and other pollinator species in all land-use sectors.

**OBJECTIVE A:** Create lists of the plant species needed in each region of the state.

**STRATEGY 1:** Convene experts, materials, reviewers needed to create lists.

**OBJECTIVE B:** Engage and educate seed and plant producers about the monarch conservation effort in the state and region.

**STRATEGY 1:** Develop outreach plan for engaging this group.

**STRATEGY 2:** Form Seed and Plant Production Working Group and/or listserv.

**OBJECTIVE C:** Facilitate demand for locally sourced native milkweed and nectar plants.

## 5. Monitoring, Management, and Research

### 5.1. Quantifiable Monitoring and Performance Objectives

The first goal is to develop a baseline of existing monarch habitat. At this time, the OMPC has not achieved consensus on what habitat monitoring protocols to use, and members acknowledge that ensuring all organizations use the same protocols may not be practical based on the needs of specific organizations. However, some consensus exists. There is agreement that Oklahoma data need to be relatable to regional and national datasets. Existing regional or nationwide protocols include the national Integrated Monitoring Strategy for the monarch butterfly (Monarch Conservation Science Partnership, Monarch Joint Venture), the Monarch Habitat Quantification Tool (Environmental Defense Fund), and the USDA NRCS Monarch Butterfly Wildlife Habitat Evaluation Guide and Decision Support Tool: Southern Great Plains Edition. There is consensus that habitat monitoring should include the following response variables:

- milkweed species richness
- milkweed density by species
- blooming nectar plant abundance by species when possible.

These habitat variables should be measured across land uses and associated management practices, to identify the effects of land use and management on habitat, as well as before and after restoration activities.

A second goal is to monitor the spatial and temporal timing of monarch activity in Oklahoma. Monitoring for eggs and larvae (or adults) will be more labor intensive than for habitat in general given the narrower time frame of activity (so narrower window to collect data). Because survival rates are of interest, visiting sites once every two weeks would provide an estimate of egg to 5th instar survival (eggs on the first visit should be 5th instars two weeks later), which would provide valuable data for estimating the number of milkweed plants needed to produce a monarch in the south (see Nail et al. 2015). Absence data will be important for identifying the spatial and temporal distribution of the 1st, 2nd, and 5th generations in Oklahoma. Given the negative impacts of diseases and parasites on monarchs, monitoring the prevalence of those threats at the same time that monarch abundance is monitored will provide valuable information for the conservation of monarchs.

The third major goal is to ensure data are contributed to (and compatible with) USFWS's Monarch Conservation Database (MCD). Information collected through the MCD will further inform development of the ongoing Species Status Assessment (SSA) for the monarch. The MCD is currently being developed by the Monarch Conservation Science Partnership (MCSP).

## 5.2 Data and Plan Management

In order for the Oklahoma Monarch and Pollinator Collaborative (OMPC) to be successful in its mission, vision and scope, a flexible and continuous partnership among the various participants must have structure within which to function. The successful implementation of this plan will require ongoing work in data and information management, as well as governance and oversight of implementation activities to ensure accountability as well as ongoing adaptability. A sound information management strategy is a key part of the plan management process as it will allow the OMPC to collect and disseminate data to track progress on conservation goals to be shared locally and incorporated at larger scales (e.g./ regional/national plans and the PECE evaluation process). In addition, one of OMPC's key goals is for collected data to be fully-integrable into the U.S. Fish and Wildlife Service's Monarch Conservation Database (MCD). As with the specific conservation goals, core plan management activities are being tracked in a 'live', public [Action Tracker](#) spreadsheet with up-to-date timeline information. The high level goals, objectives, and strategies for information management and governance are outlined below.

**PRIMARY GOAL: Implement information and decision management strategies to ensure long-term successful, inclusive, and adaptive management measures are in place to achieve plan goals.**

**OBJECTIVE A:** Articulate the specific types of data that will be needed to measure our movements towards accomplishing the goals of the strategy.

**STRATEGY 1: Form Information Management Working Group comprised of:** a database/IT professional, and OMPC representatives from state government, federal government, non-governmental conservation groups, and non-governmental agriculture groups.

**OBJECTIVE B:** Define and create a working governance structure for the OMPC.

**STRATEGY 1: Create an OMPC memorandum of understanding or charter of agreement** among participants to define objectives, structure of organizational components, shared principles of collaboration, ground rules, media protocols, and potential funding sources.

**OBJECTIVE C:** Create roles and structure to manage OMPC plan implementation.

**STRATEGY 1:** Maintain a set framework for ongoing communication and meeting schedules.

**STRATEGY 2:** Establish mechanisms of accountability for achievement of plan goals.

### 5.3 Key Research Needs

The following research needs have been identified to date. This list focuses on facilitating research that addresses data gaps relevant to Oklahoma, though some of the research may be conducted regionally or nationally and still be of benefit to Oklahoma activities. Themes include:

- 1) Contribution of the 5th generation to the overall monarch population.
  - a. Rationale: Little is known about the contribution of the 5th generation to the overall monarch population. Recent stable isotope work suggests the contribution may vary among years, although questions remain and it isn't clear what factors contribute to this variation (e.g., Flockhart et al. 2017). Additional research is needed to assess the importance of this generation and if conservation efforts should include increasing milkweed availability in the fall.
- 2) The degree to which monarchs lay eggs on milkweeds other than green antelopehorn (*A. viridis*).
  - a. Rationale: Green antelopehorn is the most abundant milkweed in Oklahoma, and is the most-used host plant for monarch caterpillars here. However, there are regions within the state where this milkweed is rare or non-existent compared to other milkweed species. It would be valuable to know what other milkweed species monarchs use in the state, and the extent and timing of that use, as well as if survival and development rates differ among milkweed species.
- 3) Natural factors that limit milkweed distribution.
  - a. Rationale: Improving our understanding of natural factors that limit milkweed distribution is one of the conservation actions listed in the Monarch Joint Venture's 2017 Monarch Conservation Implementation Plan. Research on this topic is needed in the Southern Plains, if not Oklahoma.
    - i. Several groups are developing ecological niche models on milkweed distributions. The focus tends to be Texas, although Oklahoma is included to some extent.
- 4) Obtain more observations of the distribution and abundance of milkweed species in Oklahoma.
  - a. Rationale: More milkweed observations (spatial coordinates for where species are observed) would support the effort to develop ecological niche models for milkweeds. Density data would support the quantification of monarch habitat in Oklahoma in terms of milkweed availability.
- 5) Conduct research needed to estimate the number of milkweed stems needed to produce a monarch in the southern Great Plains.
  - a. Rationale: Nail et al. (2015) estimated that approximately 28.5 stems of milkweed in the Upper Midwest are needed to produce a single monarch that is expected to migrate to Mexico. A similar approach could be used for making estimates for 5th generation monarchs, and it will be more complicated to make estimates for 1st generation monarchs that are several generations removed from the fall migration to Mexico. An alternative approach for estimating the number of milkweed stems needed for 1st generation monarchs would be to estimate the number of milkweed stems needed to

- support expected egg laying (and associated mortality of immature stages) by the monarchs that produce the 1st generation (i.e., monarchs that overwinter in Mexico and make the return migration to the southern Great Plains in the spring), which could be based on conservation goals for the size of the monarch population on the overwintering grounds (i.e., 6ha; see Thogmartin et al. 2017 for recent estimates of the number of monarchs per ha).
- 6) How “milkweed and nectar plant diversity, abundance and distribution affect monarch reproduction, survival and movement” - Monarch Joint Venture.
    - a. Rationale: Another of the conservation actions listed in the Monarch Joint Venture’s 2017 Monarch Conservation Implementation Plan, research on this topic is needed in Oklahoma or the surrounding region.
  - 7) How to manage existing milkweed populations in each of the major land uses (rangeland, hay meadows, cropland, roadsides, etc.)
    - a. Rationale: We have research to support BMPs for green antelopehorn in some but not all land uses. And we lack data on how to best manage most other milkweed species in Oklahoma.
  - 8) Identify important monarch nectar sources in Oklahoma.
    - a. Rationale: Additional research is needed to identify important nectar sources for monarchs in each region of the state, particularly during spring and fall migration, but also during the late summer breeding season (August and September). Research is also needed to determine if important nectar sources vary among years.
  - 9) Learn how to manage nectar source availability in each of the major land uses (rangeland, hay meadows, cropland, roadsides, etc.)
    - a. Rationale: Research in Missouri and Iowa has shown dramatic effects of prescribed fire and grazing on flowering stem production of a few monarch nectar sources. However, it is difficult to recommend BMPs in Oklahoma when so little research has been conducted on our nectar sources.
  - 10) Effects of invasive species on monarch habitat and associated best management practices
    - a. Rationale: Invasive species could negatively impact monarch habitat. Information is needed on how species that are invasive in Oklahoma respond to best management practices for monarchs to develop long-term strategies for maintaining monarch habitat.
  - 11) Best techniques for planting milkweeds and nectar sources in each of the major land uses (rangeland, hay meadows, cropland, roadsides, etc.).
    - a. Rationale: Although management of existing milkweed and nectar resources is considered the higher priority in Oklahoma, there will be many opportunities to create/restore monarch habitat through plantings. Some BMPs have been developed for plantings, but additional research would help to develop more BMPs for monarch plantings beyond the scale of the backyard garden
  - 12) Pesticides that have potential to harm monarchs should be identified.
    - a. Rationale: Research elsewhere has shown direct harmful effects of some insecticides on monarchs, and herbicides have been implicated in monarch declines indirectly, via their negative effects on milkweeds and/or nectar sources. Much needs to be done to identify pesticides used in Oklahoma and to determine from the landscape context if they have potential to harm monarchs.
  - 12) Contribute data to existing projects as appropriate to ensure adequate representation of Oklahoma relevant data.
    - a. Rationale: Relevant data will likely be collected as the research needs listed above are addressed, and contributing to these projects will broaden the value of those data. Relevant projects include:
      - i. Journey North (<http://www.learner.org/jnorth/monarch/>): report “first” sightings for

- monarchs in the spring and fall, and milkweed, monarch egg, and larvae sightings in the spring; also report monarchs (any life stage) seen at any time
- ii. Monarch Larva Monitoring Project (<http://www.mlmp.org/>): monitor milkweed plants for monarch eggs and larvae; includes reporting site characteristics and estimating milkweed density, as well as submitting parasitoids
- iii. Project Monarch Health (<http://www.monarchparasites.org/>): sample for OE
- iv. Monarch Watch (<http://monarchwatch.org/index.html>): tag monarchs during fall migration
- v. Xerces Society Monarch Nectar Plant Observations (<https://docs.google.com/a/spspioneers.com/forms/d/e/1FAIpQLSfC85E-btqsGSrt16TSAogICzLV2PvOlrID-un-m0jWJpJQkA/viewform>): submit observations of monarch use of nectar plants

## 5.4 Timeline for Implementation

The following is a broad timeline for the work ahead:

- Implementation work to begin Q4 2017 and run through a Spring 2018 public launch:
  - Establish implementation Working Groups
  - Hire Coordinator
  - Launch website
  - Begin quarterly calls for work group leads and Steering Committee to share updates and direct progress
- By time of formal Okies for Monarch campaign launch (April 2018), a coordinator and/or coordination plan for the year will be in place, work groups established, and a broad outreach push for the April launch will have been planned to set the implementation activities in motion for the years to come.
- Once each year, funding allowing, the full OMPC will meet in person to review and celebrate progress, troubleshoot challenges, conduct in person work on plan goals, and modify the plan as needed.
- The plan is expected to take 5-10 years to fully complete, with significant action focused in the first three years to catalyze the creation of as much habitat as possible by 2020.

For timeline details for all actions in this plan, [visit our 'live' interactive Action Tracker spreadsheet.](#)

## 6. Communications and Outreach Strategy

See [Partners & Audiences: Appendix C](#), pg 36

Throughout this strategy, content will focus on educating the public about the state of monarchs, collaborative habitat restoration efforts, and actions groups and individuals can take to support vibrant



monarch habitat (protection, restoration, invasive management, etc.). Again, detailed task and timeline updates are available in the [Action Tracker spreadsheet](#).

**Goal 1 - Establish a clearinghouse for information about monarch butterflies and pollinator conservation in Oklahoma.**

**Objective A:** Launch the Okies for Monarchs Campaign. The campaign includes all the public outreach components associated with meeting the goals of the OMPC, including the website, social media, press releases, etc.

**Strategy 1. Design, develop and rollout an official Okies for Monarchs website.**

**Strategy 2. Incorporate social media into the Okies for Monarchs Campaign to promote the website, encourage participation in strategies, and raise awareness of importance of pollinators.**

**Strategy 3. Develop a communications campaign with specific messaging goals for each of the target audiences.**

**Goal 2 - Initiate action for monarchs across the state of Oklahoma.**

**Objective A:** Educate and empower citizens in how they can participate in monarch conservation.

**Strategy 1. Develop online pledge for citizens to take on website stating they will help the monarchs.**

**Strategy 2. Develop online garden registration tool for website.**

**Strategy 3. Provide resources on website for how to build a garden.**

**Strategy 4: Provide information on website<sup>8</sup> for where citizens can visit a garden.**

**Strategy 5: Develop specific tools and tips that allow individuals to take actions.**

**Strategy 6: Promote participation in national efforts and citizen science opportunities to improve understanding of monarch population.**

---

<sup>8</sup> Note re: WAYSTATIONS: that planning for this website is in process, and the plan includes (after much deliberation), a recommendation to create a distinct Oklahoma data collection portal, but one where data can be exported to be shared with national efforts such as the Monarch Watch Way Stations and upcoming Monarch Conservation Database (MCD) habitat tracking tools being developed by the US Fish and Wildlife Service.



**Objective B:** Engage OMPC partners' audiences, members, fans, followers, friends, partners, etc.

**Strategy 1: Provide pre-made content to OMPC partners.**

**Strategy 2: Provide relevant content to the varied partner audiences.**

**Objective C:** Engage and involve youth-focused groups/organizations.

**Strategy 1. Encourage schools to participate in pollinator initiatives by establishing school habitats and incorporating monarch curriculum into the classroom.**

**Strategy 2. Target youth-focused groups such as 4-H, FFA, Boys & Girls Clubs, scouts, church groups to engage them with current initiatives/programs that engage youth in habitat projects.**

## **7. Funding & Partnerships**

Reliable sources of funding will be necessary and critical to attain goals and conservation targets identified in the statewide Monarch Conservation Plan. The Oklahoma Monarch and Pollinator Collaborative (OMPC) recognizes that in order to be most effective, the OMPC itself must continue to convene on a regular basis after the plan is finalized. OMPC has identified the following categories as being essential components that will require stable funding for success:

- 1) OMPC and Statewide Plan Coordination
- 2) Habitat Restoration
- 3) Monitoring
- 4) Outreach
- 5) Research
- 6) Tracking and Data Management

### **OMPC and Statewide Plan Coordination**

A central coordinator position will be essential in this effort. While this remains in the planning phase, the OMPC will continue to move forward in the development and establishment of either a part-time or full-time coordinator position to assist in coordinating both the OMPC and statewide plan for Oklahoma. Organizations that may have the capacity to house this position include Pheasants Forever/Quail Forever or the Oklahoma City Zoo and Botanical Garden.

### **Habitat Restoration**

Across all sectors, restoration and maintenance of suitable monarch butterfly habitat will be required on a statewide level. Private landowners and agricultural producers have the option of enrolling in various federal and state cost-share programs that can offset the cost of maintaining and/or improving

habitat for monarch butterflies and other pollinators. In addition, sources exist for milkweed plugs to be planted for relatively large-scale habitat improvement projects on both public and private lands. Examples of such practices that may be eligible for cost-share funding include eastern red cedar removal, invasive species removal, native grass and forb seed plantings, and prescribed burn planning.

#### Monitoring

Once protocols are released by the National Monarch Conservation Science Partnership (MCSP), funding will be needed for staff to monitor designated sites within the state. This will include the quantification of milkweed stems or plants, nectar sources, eggs, caterpillars, and/or adult butterflies.

#### Outreach

Funding will be needed to develop and distribute informational materials and host outreach events to educate the public about monarchs and essential habitat. This may include hosting landowner/agricultural producer field days, distributing hard copy fact sheets, and/or live presentations.

#### Research

As outlined in Section 5.3, numerous questions and information gaps have been identified as key research needs in understanding the conservation needs of the monarch butterfly in Oklahoma.

#### Tracking and Data Management

One important goal of the OMPC is to ensure that the tracking of statewide conservation targets will integrate (to every extent practical) into the U.S. Fish and Wildlife Service's national Monarch Conservation Database (MCD). However, OMPC will maintain a user-friendly digital infrastructure or database to store information for the statewide plan. Set to launch in June of 2018, the MCD will allow users to enter various conservation actions and will also have a user-friendly interface called the "Monarch Conservation Mapper".

## **7.1 Funding mechanism(s)**

OMPC members who are able to track potential sources through grant and RCPP requests will distribute opportunities to the Steering Committee for action (this may be written as a provision of the Steering Committee charter to be developed as per section 5.4, Goal 1).

The following funding sources represent a partial list of existing and prospective funders:

#### OMPC and Statewide Plan Coordination Funding Sources:

- National Fish and Wildlife Foundation (NFWF) Monarch Butterfly Conservation Fund
- Additional seed funding has been provided by The Nature Conservancy, the Conservation Coalition of Oklahoma. Additional commitments have been made by the Oklahoma City Zoo and some individual donors.

#### Habitat Restoration Funding Sources:

- USDA-Natural Resources Conservation Service
  - Environmental Quality Incentives Program (EQIP)

- Regional Conservation Partnership Program (RCPP)
- Farm Service Agency (FSA)
  - Conservation Reserve Program (CRP)
- U.S. Fish and Wildlife Service - Partners for Fish and Wildlife Program
- National Fish and Wildlife Foundation (NFWF) - Monarch Butterfly Conservation Fund
- Oklahoma Department of Wildlife Conservation
  - Wildlife Habitat Improvement Program (WHIP)
  - Wildlife Diversity Program grants (less than \$1,000)
  - State Wildlife Grants
- Tribal Wildlife Grants
- Monarch Watch
- ConocoPhillips SPIRIT of Conservation and Innovation Program

#### Monitoring Funding Sources:

- National Fish and Wildlife Foundation (NFWF) - Monarch Butterfly Conservation Fund

#### Outreach

- National Fish and Wildlife Foundation (NFWF) - Monarch Butterfly Conservation Fund

#### Research

- Oklahoma Department of Wildlife Conservation (ODWC)
  - 1. State Wildlife Grants
- Foundation for Food and Agriculture Research (FFAR) Pollinator Health Fund
- United States Department of Agriculture (USDA), National Institute of Food and Agriculture (NIFA), Agriculture and Food Research Initiative (AFRI) Foundational Program

#### Tracking and Data Management:

- National Fish and Wildlife Foundation (NFWF) - Monarch Butterfly Conservation Fund

## 7.2 Prospective partnerships to amplify success

Monarch butterflies have the potential to greatly benefit from ongoing conservation actions set forth for other species and associated ecosystem management or restoration efforts. Examples include mitigation bank properties for federally-endangered species, wetland restoration or improvement, eastern red cedar removal, and private properties managed for game species. Therefore, it is critical that such benefits be encapsulated and accounted for across the state to understand the potential for maintaining or improving habitat for monarch butterflies in Oklahoma. We also expect that activities to support monarchs will benefit many other species as well.

This plan includes a list of current and prospective partners ([Appendix C](#)). This list is a starting point for what we hope will be a growing and evolving array of mutually beneficial partnerships to serve monarch conservation and other important efforts across the region. Partners can be engaged to help with multi-species joint habitat enhancement goals, business and conservation alliances, staff and volunteer support for the work of implementing this plan, joint fundraising, and others.

Creativity, [collaborative mindsets](#), and trust-building will be key to the successful movement toward the OMPC vision of Oklahomans working together to ensure our landscapes and gardens support thriving pollinator populations and monarch migrations for generations to come.

## **Literature Cited**

Altizer, S. M., K. S. Oberhauser, and L. P. Brower. 2000. Associations between host migration and the prevalence of a protozoan parasite in natural populations of adult monarch butterflies. *Ecological Entomology* 25: 125-139.

Altizer, S. M. 2001. Migratory behaviour and host- parasite co-evolution in natural populations of monarch butterflies infected with a protozoan parasite. *Evolutionary Ecology Research* 3: 567-581.

Altizer S.M. and K.S. Oberhauser, 1999. Effects of the Protozoan Parasite *Ophryocystis elektroscirrha* on the Fitness of monarch Butterflies (*Danaus plexippus*). *Journal of Invertebrate Pathology* 74: 76-88.

Batalden, R.V., K. Oberhauser, and A.T. Peterson. 2007. Ecological Niches in Sequential Generations of Eastern North American Monarch Butterflies (Lepidoptera: Danaidae): The Ecology of Migration and Likely Climate Change Implications. *Environmental Entomology* 36:1365- 1373.

Baum, K. A., and E. K. Mueller. 2015. Grassland and roadside management practices affect milkweed abundance and opportunities for monarch recruitment. *In* Oberhauser, K., S. Altizer, and K. Nail, Eds. *Monarchs in a changing world: Biology and conservation of an iconic insect*. Cornell University Press.

Baum K.A., and W.V. Sharber. 2012. Fire creates host plant patches for monarch butterflies. *Biol. Lett.* 8: 968- 971.

Borders, B. and E. Lee-Mader. 2014. *Milkweeds: A Conservation Practitioner's Guide*. The Xerces Society for Invertebrate Conservation, Portland, OR., 146 pp.

Brower, L. P., O. R. Taylor, E. H. Williams, D. A. Slayback, R.R. Zubieta, and M. I. Ramírez. 2012a. Decline of monarch butterflies overwintering in Mexico: Is the migratory phenomenon at risk? *Insect Conservation and Diversity* 5:95- 100.

Bureau of Land Management, U.S. Department of the Interior. 1994. *Oklahoma Resource Management Plan*.

Calvert, W. H. 1996. Fire ant predation on monarch larvae (Nymphalidae: Danainae) in a Central Texas prairie. *Journal of the Lepidopterists' Society* 50:149- 151.

- Calvert, W.H. 2004. The effect of fire ants on monarchs breeding in Texas. Pages 47-54 In Oberhauser K.S., Solensky M.J., eds. The Monarch Butterfly: Biology and Conservation. Ithaca: Cornell University Press.
- Calvert, W. H., W. Zuchowski and L. P. Brower. 1983. The effect of rain, snow and freezing temperatures on overwintering monarch butterflies in Mexico. *Biotropica* 15:42-47.
- Center for Biological Diversity, Center for Food Safety, Xerces Society and L. Brower. 2014 Petition to protect the monarch butterfly (*Danaus plexippus plexippus*) under the Endangered Species Act. Submitted to the U.S. Department of the Interior, August 26, 2014.
- Forister, M. L., B. Cousens, J. G. Harrison, K. Anderson, J. H. Thorne, D. Waetjen, C. C. Nice, M. De Parsia, M. L. Hladik, R. Meese, H. van Vliet, and A. M. Shapiro. 2016. Increasing neonicotinoid use and the declining butterfly fauna of lowland California. *Biology Letters* 12:20160475.
- Garbuzov, M., K. Alton, F. L. W. Ratnieks. 2017. Most ornamental plants on sale in garden centres are unattractive to flower-visiting insects. *PeerJ* 5:e3066.
- Gilburn, A. S., N. Bunnefeld, J. McVean Wilson, M. S. Botham, T. M. Brereton, R. Fox, and D. Goulson. 2015. Are neonicotinoid insecticides driving declines of widespread butterflies? *PeerJ* 3:e1402.
- Howard, E., H. Aschen, and A. K. Davis. 2010. Citizen science observations of monarch butterfly overwintering in the southern United States. *Psyche* 2010:1-6.
- Inamine, H., S. P. Ellner, J. P. Springer, and A. A. Agrawal. 2016. Linking the continental migratory cycle of the monarch butterfly to understand its population decline. *Oikos* 125: 1081-1091.
- Jepsen, S., D. F. Schweitzer, B. Young, N. Sears, M. Ormes, and S. H. Black. 2015. Conservation Status and Ecology of Monarchs in the United States. 36 pp. NatureServe, Arlington, Virginia, and the Xerces Society for Invertebrate Conservation, Portland, Oregon.
- McCoshum, S. M., S. L. Andreoli, C. M. Stenoien, K. S. Oberhauser, K. A. Baum. 2016. Species distribution models for natural enemies of monarch butterfly (*Danaus plexippus*) larvae and pupae: distribution patterns and implications for conservation. *Journal of Insect Conservation* 20: 223-237.
- Nail, K. R., C. Stenoien, and K. S. Oberhauser. 2015. Immature monarch survival: effects of site characteristics, density, and time. *Annals of the Entomological Society of America* 108: 680-690.
- Oberhauser, K. S., Prysby, M. D., Mattila, H. R., Stanley-Horn, D. E., Sears, M. K., Dively, G., Olson, E., Pleasants, J. M., Lam, W. F., and Hellmich R. L. 2001. Temporal and spatial overlap between monarch larvae and corn pollen. *Proceedings of the National Academy of Sciences of the United States of America* 98: 11913-11918.

Oberhauser, K., I. Gebhard, C. Cameron, and S. Oberhauser. 2007. Parasitism of monarch butterflies (*Danaus plexippus*) by *Lespesia archippivora* (Diptera: Tachinidae). *American Midland Naturalist* 157: 312-328.

Oberhauser K. S., M. Anderson, S. Anderson, W. Caldwell, A. De Anda, M. Hunter, M. C. Kaiser, and M. J. Solensky. 2015. Lacewings, wasps, and flies—Oh My. Pages 71-82 *In* Oberhauser, K., S. Altizer, and K. Nail, Eds. *Monarchs in a changing world: Biology and Conservation of an Iconic Insect*. Cornell University Press.

Oberhauser, K., D. Elmquist, J. M. Perilla-López, I. Gebhard, L. Lukens, and J. Stireman. 2017. Tachinid fly (Diptera: Tachinidae) parasitoids of *Danaus plexippus* (Lepidoptera: Nymphalidae). *Annals of the Entomological Society of America*. doi: 10.1093/aesa/sax048

Oberhauser, K., Wiederholt, R., Diffendorfer, J. E., Semmens, D., Ries, L., Thogmartin, W. E., Lopez-hoffman, L. And Semmens, B. 2017. A trans-national monarch butterfly population model and implications for regional conservation priorities. *Ecological Entomology* 42: 51- 60.

Oklahoma Invasive Plant Council. 2017. <https://okipc.wordpress.com/the-dirty-dozen/>. Website accessed 2017-06-29.

Pecenka, J. R., and J. G. Lundgren. 2015. Non-target effects of clothianidin on monarch butterflies. *The Science of Nature* 102(3- 4):19.

Pleasants, J. M. 2017. milkweed restoration in the Midwest for monarch butterfly recovery: Estimates of milkweeds lost, milkweeds remaining and milkweeds that must be added to increase the monarch population. *Insect Conservation and Diversity* 10: 42-53.

Pleasants, J. M. and Oberhauser, K. S. 2012. Milkweed Loss in Agricultural fields Because of Herbicide Use: Effect on the Monarch Butterfly Population. *Insect Conservation and Diversity*. doi:10.1111/j.1752-4598.2012.00196.x

Scott, James A. 1986. *The Butterflies of North America*. Stanford University Press, Stanford, CA.

Thogmartin, W. E., J. E. Diffendorfer, L. Lopez-Hoffman, K. Oberhauser, J. Pleasants, B. X. Semmens, D. Semmens, O. R. Taylor, and R. Wiederholt. 2017. Density estimates of monarch butterflies overwintering in central Mexico. *PeerJ* DOI: 10.7717/peerj.3221.

Thogmartin, W. E., L. Lopez-Hoffman, J. Rohweder, J. Diffendorfer, R. Drum, D. Semmens, S. Black, I. Caldwell, D. Cotter, P. Drobney, L. L. Jackson, M. Gale, D. Helmers, S. Hilburger, E. Howard, K. Oberhauser, J. Pleasants, B. Semmens, O. Taylor, P. Ward, J. F. Weltzin, and R. Wiederholt. 2017. Restoring monarch butterfly habitat in the Midwestern US: 'all hands on deck'. *Environmental Research Letters* 12: 074005.

Tyrl, R.J., S.C. Barber, W.J. Elisens, J.R. Estes, P. Folley, C. L. Murray, B.A. Smith, C.E.S. Taylor, R.A. Thompson, J.B. Walker, and L.E. Watson. 2015. *Flora of Oklahoma Keys and Descriptions*. Flora Oklahoma Inc., Oklahoma City, Oklahoma.

Vidal, O., J. López-García, and E. Rendón-Salinas. 2014. Trends in deforestation and forest degradation after a decade of monitoring in the Monarch Butterfly Biosphere Reserve in Mexico. *Conservation Biology* 28(1):177- 186.

USGS 2017. USGS Pesticide National Synthesis Project. Website:  
[https://water.usgs.gov/nawqa/pnsp/usage/maps/show\\_map.php?year=2014&map=IMIDACLOPRID&hilo=L&disp=Imidacloprid](https://water.usgs.gov/nawqa/pnsp/usage/maps/show_map.php?year=2014&map=IMIDACLOPRID&hilo=L&disp=Imidacloprid) (accessed on 2017-06-29).

Vidal, O., and E. Rendon-Salinas. 2014. Dynamics and trends of overwintering colonies of the monarch butterfly in Mexico. *Biological Conservation* 180:165- 175.

Zhan, S., W. Zhang, K. Niitepöld, J. Hsu, J. Fernández Haeger, M. P. Zalucki, S. Altizer, J. C. de Roode, S. M. Reppert, and M. R. Kronforst. 2014. The genetics of monarch butterfly migration and warning colouration. *Nature* 514(7522):317- 321.

## Appendix A: Nectar and Host Plant Lists

### OMPC Native Nectar and Host Plant List for Monarchs in Oklahoma

The following plant list was developed by OMPC biologists for statewide use. Note that a few species (such as *Asclepias syriaca*) are not included due to narrow range within the state.

Monarch Nectar and Host Plant List: Oklahoma														
				Bloom (x) Monarch Presence (orange)										Commercially Available
Species Name	Common Name	Monarch Value	Growth Habit	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Seeds	Live Plants
<i>Asclepias asperula</i> *	spider milkweed	Very High	forb/herb		x	x	x		x	x				
<i>Asclepias incarnata</i> *	swamp milkweed	Very High	forb/herb						x	x	x		x	x
<i>Asclepias speciosa</i> *	showy milkweed	Very High	forb/herb			x	x	x	x					
<i>Asclepias tuberosa</i> *	butterfly weed	Very High	forb/herb			x	x	x	x	x			x	x
<i>Asclepias verticillata</i> *	whorled milkweed	Very High	forb/herb			x	x	x	x	x			x	x
<i>Asclepias viridis</i> *	green antelopehorn	Very High	forb/herb		x	x	x		x	x				
<i>Bidens aristosa</i>	bearded beggarticks	Very High	forb/herb					x	x	x	x		x	x
<i>Cephalanthus occidentalis</i>	buttonbush	Very High	shrub				x	x						x
<i>Cirsium altissimum</i>	tall thistle	high	forb/herb					x	x	x	x		x	
<i>Conoclinium coelestinum</i>	blue mistflower	Very High	forb/herb					x	x	x	x			
<i>Echinacea angustifolia</i>	black samson	Very High	forb/herb			x	x							
<i>Echinacea pallida</i>	pale purple coneflower	Very High	forb/herb			x	x	x					x	x
<i>Eupatorium serotinum</i>	lateflowering thoroughwort	Very High	forb/herb					x	x	x	x			
<i>Glandularia bipinnatifida</i>	prairie verbena	High	forb/herb		x	x	x							
<i>Grindelia papposa</i>	Spanish gold	Very High	forb/herb					x	x	x	x			
<i>Helianthus annuus</i>	common	Very High	forb/herb					x	x	x	x		x	



	sunflower													
<i>Helianthus grosseserratus</i>	sawtooth sunflower	High	forb/herb						x	x	x		x	x
<i>Helianthus maximiliani</i>	Maximilian sunflower	Very High	forb/herb						x	x	x		x	x
<i>Liatris aspera</i>	tall blazing star	Very High	forb/herb					x	x	x			x	x
<i>Liatris punctata</i>	dotted blazing star	High	forb/herb					x	x	x	x		x	x
<i>Liatris pycnostachya</i>	prairie blazing star	High	forb/herb				x	x	x	x	x		x	x
<i>Monarda fistulosa</i>	wild bergamot	High	forb/herb, subshrub			x	x	x	x	x			x	x
<i>Oligoneuron rigidum</i>	stiff goldenrod	High	forb/herb						x	x	x		x	x
<i>Polygonum pennsylvanicum</i>	Pennsylvania smartweed	High	forb/herb					x	x	x	x			
<i>Salvia azurea</i>	blue sage	High	forb/herb				x	x	x	x	x			
<i>Silphium laciniatum</i>	compass plant	High	forb/herb				x	x	x	x				
<i>Solidago missouriensis</i>	Missouri goldenrod	high	forb/herb						x	x				
<i>Solidago nemoralis</i>	gray goldenrod	Very High	forb/herb							x	x			
<i>Solidago petiolaris</i>	downy ragged goldenrod	High	forb/herb						x	x	x			
<i>Symphyotrichum drummondii</i>	Drummond's aster	High	forb/herb											
<i>Symphyotrichum ericoides</i>	heath aster	High	forb/herb							x	x		x	x
<i>Symphyotrichum praealtum</i>	willowleaf aster	High	forb/herb						x	x	x			x
<i>Symphyotrichum patens</i>	late purple aster	High	forb/herb							x	x			
<i>Verbena halei</i>	Texas vervain	High	forb/herb		x	x	x	x						
<i>Verbena stricta</i>	hoary verbena	High	forb/herb				x	x						
<i>Verbesina encelioides</i>	golden crownbeard	Very High	forb/herb				x	x	x	x	x			
<i>Verbesina virginica</i>	frostweed	High	forb/herb						x	x	x			
<i>Vernonia baldwinii</i>	Baldwin's ironweed	High	forb/herb					x	x	x	x	x		

\*Host plants

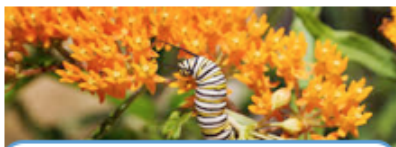
### **Oklahoma City Metro Monarch Network: Nectar & Host Plant List**

The following plant list was developed for urban areas by the Oklahoma City Metro Monarch Network. It includes a few non-native varieties, and the OMPC recommends focusing on native varieties as a best practice throughout the state, even in urban areas.



GREEN MILKWEED

*Asclepias viridis*, likes full sun. Moist soils. Blooms from April-Sept. Grows up to 2 ft. tall. Perennial. Host and nectar plant.



BUTTERFLY WEED

*Asclepias tuberosa*, likes full sun. Moist and dry soils. Grows up to 2 ft. tall. Blooms from May- Sept. Perennial. Nectar and host plant.



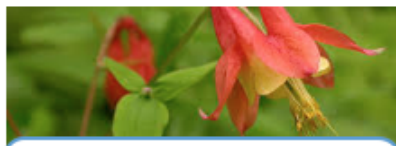
SHOWY MILKWEED

*Asclepias speciosa*, likes full sun. Grows up to 3 ft. tall. Moist soils. Blooms from May-Sept. Perennial. Nectar and host plant.



INDIAN BLANKET

*Gaillardia pulchella*, likes partial shade to full sun. Blooms from May-August. Grows between 1-2 ft. tall. Perennial. Nectar plant.



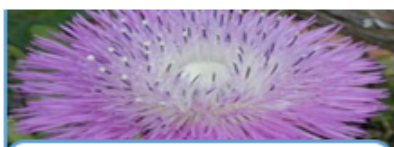
AMERICAN COLUMBINE

*Aquilegia Canadensis*, likes partial to full sun. Moist soils. Grows up to 3 feet tall. Blooms from April- late May. Perennial. Nectar plant.



WESTERN SUNFLOWER

*Helianthus occidentalis*, likes full sun. Grows up to 3 ft. tall. Tolerates moist and dry soils. Blooms from June-August. Perennial. Nectar plant.



AMERICAN BASKET-FLOWER

*Centaurea americana*, likes partial shade and dry soils. Blooms from May-June. Grows between 3-6 ft tall. Annual. Nectar plant.



LANCELEAF COREOPSIS

*Coreopsis lanceolate*, likes partial shade. Dry soils. Grows up to 3ft. tall. Blooms from May-June. Perennial. Nectar plant.



LEADPLANT

*Amorpha canescens*, likes full sun and loamy soils. Blooms from June-August. Grows between 1-3 ft. tall. Perennial. Nectar plant.



BLUE SAGE

*Salvia azurea*, likes partial shade and dry soils. Grows between 3-6 ft. tall. Blooms from September-Oct. Perennial. Nectar plant.



CONEFLOWER

*Echinacea augustiflora*, likes partial shade and dry soils. Blooms from May-June. Grows between 1-2 ft. tall. Perennial. Nectar plant.



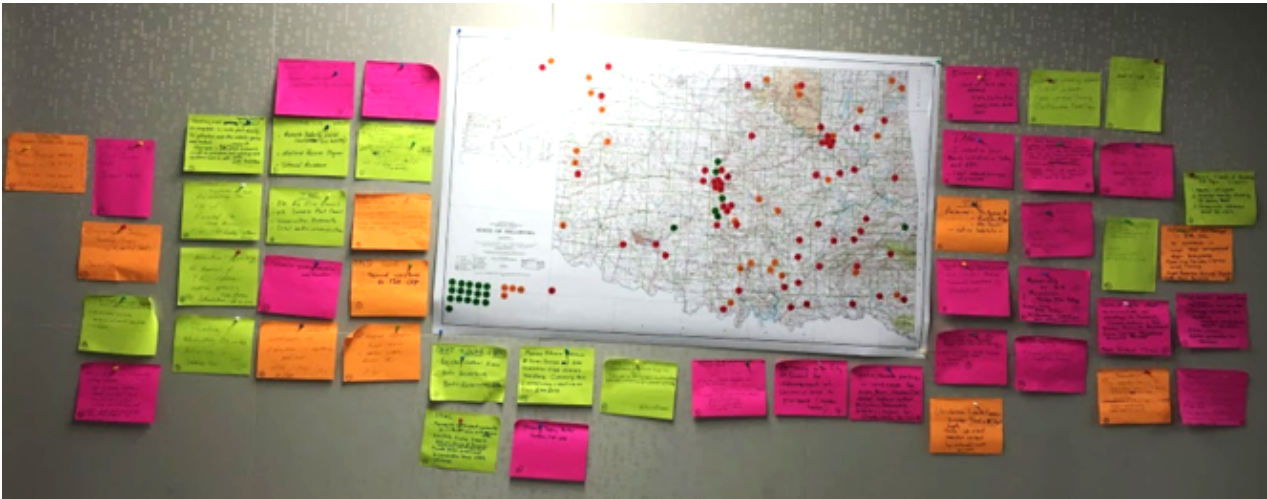
GOLDENROD

*Solidago Canadensis*, likes full to partial sun. Most soil types. Blooms from August-Oct. Grows between 3-6 ft. tall. Perennial. Nectar plant.

## **Appendix B: A Sampling of Current Activities in the State**

Most of the information below was compiled at the November 2016 Oklahoma Monarch Summit, and offers a starting reference for work being done and partners to engage as of that time. It will expand in the years to come, and updating this information repository will be part of the work of the OMPC.

### **Mapping the Territory Highlights**



#### **Highlights:**

1. Oklahoma Native Plant Society
  - a. State-wide- Color Oklahoma- license plates, collects proceeds that are donated to projects for native plantings- tribes, schools, turnpike, oknativeplants.org
2. US Fish and Wildlife Service's Partners Program
  - a. State-wide- improve rangeland habitat, including work with red cedar removal across the state, cooperative agreement with monarch Initiative, works with local producers, provide more funding for I-35 Corridor Counties
3. Seven Tribes
  - a. Regional- reestablish native habitat w/ 7 tribes in Oklahoma, planted 15,000 milkweed plugs, 50 acres of restored habitat, 20,000 more milkweed plants coming next spring and 4,000 native nectar plants
4. Natural Resources Conservation Service
  - a. State-wide- Publications- monarch Habitat Initiative, identify landowners and restore degraded rangeland, 2 million dollars for Oklahoma; provide technical assistance for landowners and Farm Service Agency- CRP land and bonus points for pollinator habitat
5. The Nature Conservancy
  - a. State-wide- initiatives- OK Prescribed Fire Council to coordinate efforts statewide to better manage efforts and manage invasive plants; social media on various issues; conservation easements for lands statewide
  - b. Regional- Preserves- native habitats that have been restored or maintained (milkweed present at most), 13 preserves around state

- c. Local activities- education materials for teachers and students and the public, written and social media, how to plant milkweed and what sorts of milkweed- Tulsa and OKC
- 6. McClain County Conservation District, works with US Fish and Wildlife Service
  - a. Local activities- educate people about monarchs, outreach, works with NRCS locally, works with farmers and cattle producers
- 7. Oklahoma Department of Transportation
  - a. State-wide- field divisions were directed to mow less, partnered with OSU to protect pollinators. Work with OSU to research mowing timing with milkweed. Oklahoma Gardening and Sunup shows for public education
  - b. Local activities- monarch way station at visitor center
- 8. Samuel Roberts Noble Foundation in Ardmore, OK
  - a. State-wide- Promote diversity on rangelands, conduct workshops on rangeland issues, include discussion on pollinators
  - b. Local activities- way station in Ardmore, work with producers who want to produce honey; consultation with private landowners
- 9. National Wildlife Federation
  - a. Local activities- Mayor's Monarch Pledge (7 cities that have signed on in Oklahoma); certified wildlife habitat program, Eco-schools program, community habitat program; OKC monarch metro network; [okiesformonarchs.org](http://okiesformonarchs.org) (INCOMPLETE - website is in development and is a collaborative project with this OK Monarch Collaborative) website to share information; toolkit for teachers for monarch research
- 10. Pheasants Forever and Quail Forever
  - a. State-wide- Removal of Eastern Red Cedar and other invasive plants, advocating prescribed fire, pollinator activities, regional landowner workshops to educate landowners
  - b. Regional- habitat restoration and rehabilitation
- 11. Oklahoma State University
  - a. State-wide/Regional- monarch.okstate.edu website, prairie project website, state wildlife grant, Oklahoma plant field guide, part of efforts mentioned by other groups
  - b. Local activities- Prairie demo garden at OSU Botanic Garden (Stillwater), OSU research range
- 12. OKC Sierra Club
  - a. Regional- educational tabling across state
  - b. Local activities- in urban areas, fall butterfly garden tour (collaborative), gorilla garden group (OKC metro)- school and pollinator gardens, Norman- creek restoration project and school garden (collaborative)
- 13. Oklahoma Natural Heritage Organization, University of Oklahoma
  - a. State-wide- maintain spatial data on plant communities, keeping biodiversity information in the state, and landcover mapping for species modeling, land registry- natural communities and populations of species in heritage inventory, stay ahead of threatened species
  - b. Local activities- Sam Noble Museum monarch way station
- 14. Kerr Center for Sustainable Agriculture
  - a. State-wide- collect seeds and working ranch, promote understanding of working with native pollinators and balancing landowner interests, publications online- seed collection and germination
- 15. City of Piedmont
  - a. Local activities- certified wildlife community- over 100 homes and schools that have habitat, garden clubs, afterschool programs
- 16. Tulsa Urban Wilderness Coalition



- a. Local activities- monarchs on the mountain- citizen science presentations and tagging, includes 11 agencies, done on Turkey Mountain in Tulsa, a holistic system, next event is on September 23rd; Broken Arrow monarch movement applied for NFWF grant? Other examples of collaboration- Tulsa monarch Initiative, Tulsa has a seed library, can check out seed, Tulsa Audubon Society and backyard habitat program
- 17. Sandra Schwinn, raising monarchs for 35 years, retired educator
  - a. Local activities- monarch way station (one of first 50) in Oklahoma, presentations to local organizations in Tulsa area, help establish local way stations, make connections, education on how to raise milkweed and monarchs, two social media groups on Facebook: Oklahoma Friends of Monarchs (statewide) to educate in all aspects of monarchs, increase reporting to Journey North, disseminate information across the state- events and; Butterflies of Oklahoma Kansas and Texas
- 18. Western Farmers Electric Coop
  - a. Local activities- Switch station by Norman, substations (wants to make it statewide)- using them for way stations, develop a solar mix of plants that will be suitable
- 19. Farm Bureau
  - a. State-wide- concerned about understanding practices, need education- science and methods, need workable solutions with them
- 20. OKC Zoo
  - a. Local activities- monarch Festival- raise public awareness about monarchs- 196 people who pledged to plant gardens, monarch way station and tag monarchs there, educate zoo visitors, local artist promoted way station, OKC metro monarch network partner
- 21. Tishomingo National Wildlife Refuge
  - a. Local activities- education, set up pollinator garden, prairie restoration and demonstration, collect seeds with other projects, butterfly counts and tagging monarchs
- 22. Choctaw Nation
  - a. Local activities- partnering w/ city of Durant to create monarch habitat, the mayors pledge, tribal facilities designated as butterfly friendly
- 23. Oklahoma Department of Wildlife Conservation
  - a. State-wide- manage for plant communities, prescribed burning and grazing, potential funding source for monarch monitoring, promote public involvement
- 24. Jimmy Emmons (private farmer/landowner)
  - a. Local activities- Uses native cover crops to bring in natural predators and mimic native prairie systems and does education/outreach on these practices.
- 25. Larry Wright (private farmer/landowner)
  - a. Local activities- Runs his land at a pollinator (bees, bats, butterflies, and birds) level.
- 26. State Parks
  - a. State-wide- Mowing less and creating natural areas with signage explaining the ecological and economic benefits of reduced mowing.
- 27. Collaboration of Tulsa Zoo, Monarch Initiative of Tulsa, The Tulsa Garden Center, Sustainable Tulsa, The Nature Conservancy, Oxley Nature Center, Riverfield Country Day School, and the Botanic Garden in helping establishing Monarch Waystations and other local monarch conservation awareness activities within the Tulsa Metro Area.  
<http://sustainabletulsainc.org/monarchs/>

### Detailed local monarch success story examples:



## Events

- Monarch Initiative Of Tulsa helped in creating the first annual monarchs on the Mountain Festival which was recently held at Turkey Mountain in October 2016 and hosted ~12000 visitors to enjoy monarch educational activities, plant sales & seed ball crafting, tagging demos, and butterfly release. The event was hosted by the Tulsa River Parks Authority in partnership with the Tulsa Urban Wilderness Coalition, the Tulsa Audubon Society and The M.E.T. and supporters; Sustainable Tulsa, Blue Thumb, The Tulsa Zoo, City of Tulsa, monarch Initiative of Tulsa, West-side Y and the USFWS.

## New Projects

- As part of the City of Tulsa's "More than a Sidewalk" program, The Tulsa Zoo and the monarch Initiative of Tulsa have partnered with the city in creating a monarch Waystation walkway through University Village retirement community.
- The monarch Initiative also helped establish a monarch Waystation at Oral Roberts University, this was the first of its kind and the University is now involved with having students work within the Tulsa community helping others in planting monarch Waystations.
- monarch/pollinator gardens have been established in a number of state parks. For example, Lake Thunderbird, Lake Eufaula, Osage Hills, Greenleaf, Lake Wister and Sequoyah are among the state parks that are participating.
- ODOT has modified its mowing this year partly due to pollinator issues. Through mid October mowing is about 75K acres less than the average of the 5 previous years through the same date.
- The Bishop's Creek Restoration Project collaboration Norman includes the Sierra Club Red Earth Group, Blue Thumb, WRI, Earth Rebirth, Lincoln Elementary, etc., has been a successful community-level project.
- The City of Broken Arrow has taken the Mayor's monarch Pledge forming the Broken Arrow monarch Movement and began implementing phase I with 8 locations this fall.
- USFWS just completed a Cooperative Agreement with the Oklahoma Conservation Commission (OCC) to work specifically on pollinator habitat. The objective of this agreement is to improve habitat for a number of grassland dependent species including the monarch butterfly. The habitat improvement efforts funded by this Agreement are specifically designed to improve habitat on private lands for the monarch butterfly along the I-35 monarch migratory corridor in Oklahoma. OCC will focus this funding in four counties during the first year. The majority of the work will be brush management, native grass/forb plantings and prescribed fire.

## Ongoing successes

- Agriculture producer partners have planted cover crops and buffer strips on their land to provide habitat and food for monarch/pollinators.
- Support for research and conservation projects - ongoing in LA, TX & OK.
- Many Master Gardener volunteers are promoting these efforts and gardening to encourage butterfly habitat.
- Pheasants Forever's pollinator habitat initiative includes having our chapters do youth pollinator habitat events in their community, advocating why we need them and how it benefits everyone, not just wildlife.

- The Oklahoma City Parks Department has a Butterfly Garden and Will Rogers Gardens. We had thousands of monarch's visiting us this year. We also have a conservation garden at Bluff Creek Park with that includes milkweed plants that were installed this past summer.

## **Appendix C: Partners and Audiences**

The below information was compiled by the Outreach Committee and offers a starting reference for partners and audiences to engage.

### **OMPC Partners**

- 4-H/Master Gardeners
- 7 Tribe Initiative (Tribal Environmental Action for Monarchs)
- Ag Innovations
- Blue Doors at Tenkiller
- Choctaw Nation
- Cimarron Sierra Club
- Euchee Butterfly Farm
- Intertribal Land Trust
- Kerr Center for Sustainable Agriculture
- Kirkpatrick Foundation
- Landowners
- McClain County Conservation District
- Monarch Watch
- National Wildlife Federation
- Natural Resources Conservation Service
- Oaks and Prairies Joint Venture
- OK Assoc. of Conservation Districts
- OK Cattlemen's Assoc.
- OK Dept. of Tourism and Recreation
- OK Dept. of Transportation
- OK Dept. of Wildlife Conservation
- OK Farm Bureau
- OK Invasive Plant Council
- OK Native Plant Society
- OK Natural Heritage Inventory
- OK Quail Forever/Pheasants Forever
- OK State University
- OKC Parks & Recreation
- OKC Urban AG Coalition
- OKC Zoo
- Oxley Nature Center
- Peach Creek Ranch
- Prairie Wind Nursery
- Sam Noble Foundation
- Shawnee Tribe
- Sierra Club
- The Nature Conservancy
- Tishomingo National Wildlife Refuge
- Tulsa Urban Wilderness Coalition
- Tulsa Zoo
- U.S. Fish & Wildlife Service
- U.S. Golf Association
- Western Farmers Electric Coop
- Wild Things Nursery
- Xerces Society for Invertebrate Conservation

### **Target Audiences**

Below is a list of potential target audiences. This is a list in progress and will need to be further developed by defining primary, secondary and possibly tertiary audiences.

- Landowners
- Farmers
- Ranchers
- Municipalities
- Teachers
- Youth
- Businesses/Corporations
- Artists
- Tribes
- Citizens/Residents