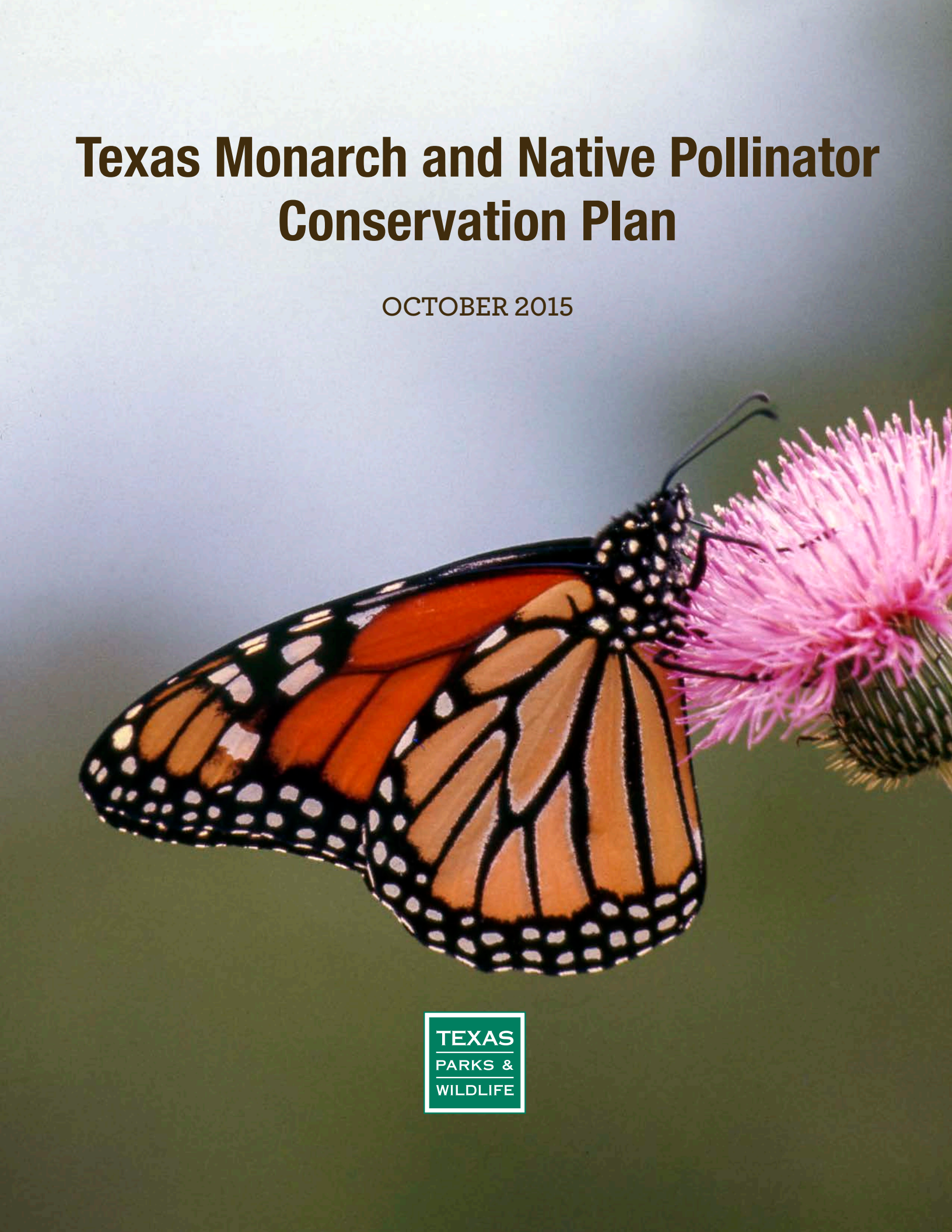
Texas Monarch and Native Pollinator Conservation Plan

OCTOBER 2015



TEXAS PARKS & WILDLIFE

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EXECUTIVE SUMMARY

Significant decline in the population of eastern North American migrating monarchs has led to widespread concern in Canada, the United States, and Mexico. Texas will play a critical role in conservation efforts aimed at monarch conservation given its strategic position along the species migratory pathway. In addition, 30 native pollinator/flower-visiting species (bees, butterflies, and moths) are designated as Species of Greatest Conservation Need (SGCN) in Texas Parks and Wildlife Department's (TPWD) Texas Conservation Action Plan. These SGCN and the monarch are dependent upon similar landscape level habitat features (open natural community types hosting floral resources and host plants).

USFWS, Rick L. Hansen

The Texas Monarch/Native Pollinator Conservation Plan acknowledges Texas' unique contribution to the long-term persistence of the North American monarch migration and TPWD's leading role in the conservation of SGCN in Texas. This plan outlines actions in Texas that will contribute to monarch and overall native pollinator conservation in Texas by highlighting four broad categories of monarch and native pollinator conservation: habitat conservation, education and outreach, research and monitoring, and partnerships. This conservation plan details specific actions associated with each of these categories by TPWD and other stakeholders. TPWD will continue to develop this plan as new stakeholders are identified and become engaged in this collaboration.

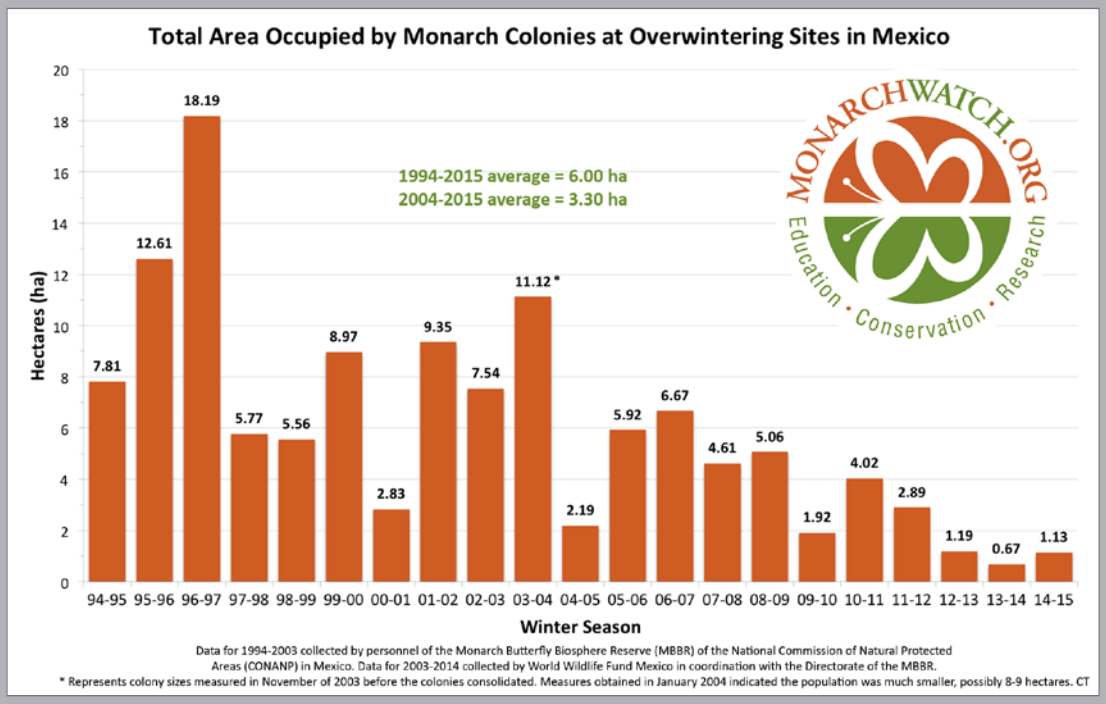
BACKGROUND

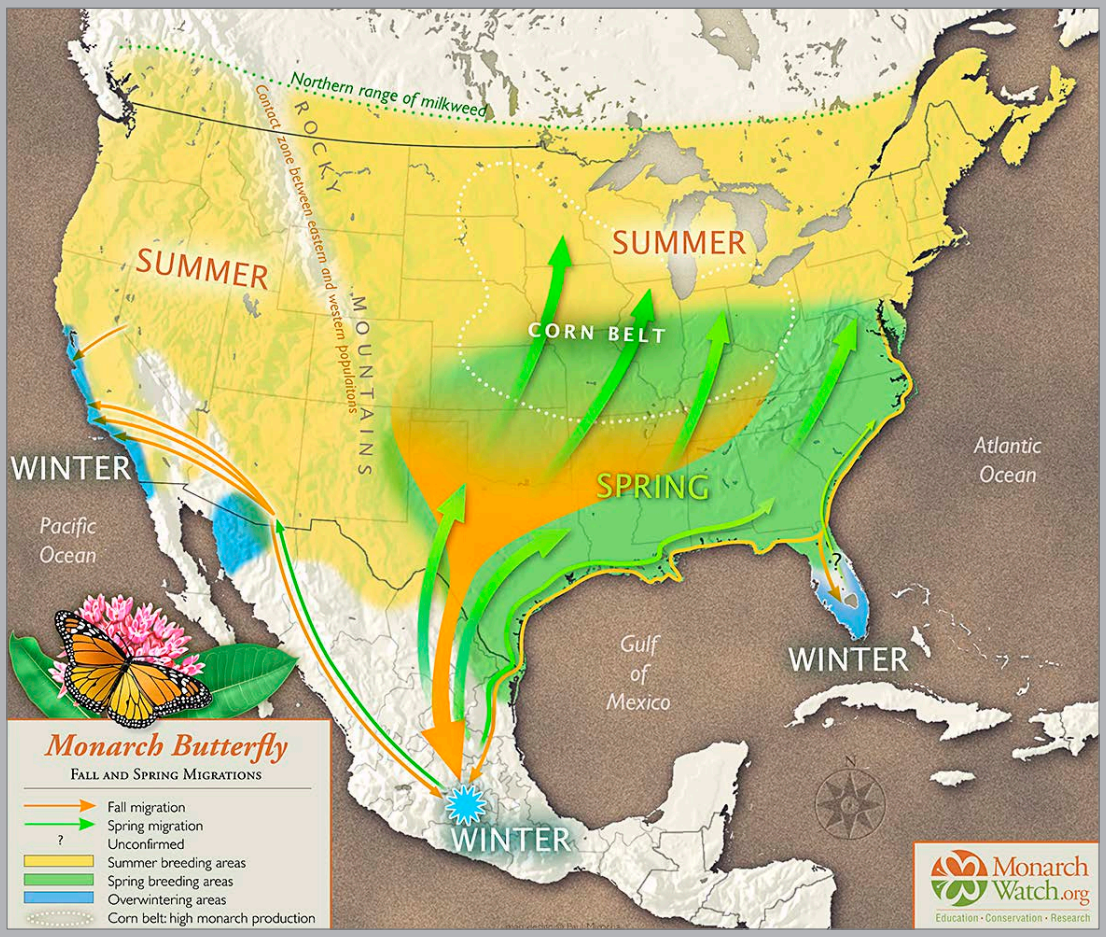
Since monitoring of overwintering monarch (*Danaus plexippus*) populations in the Mexican states of Michoacán and México began in 1993, the World Wildlife Fund has documented a significant decline in overwintering area (a surrogate for population size). Total overwintering area for the eastern North American migratory monarch population reached an all-time low in the winter of 2013 with an estimated population of 35 million as compared with a population of close to 1 billion in 1996.

Decline of this monarch population has been attributed to multiple factors including illegal logging of Oyamel forests in Mexico, extreme weather conditions in overwintering and breeding grounds, and decline in milkweed and nectar-producing plant availability in the species' upper Midwestern breeding grounds. While the latest survey confirms a modest increase in the overwintering grounds for 2015 (Figure 1), the species continues to experience a downward population trend. Concerns about the viability of the eastern North American migratory population by citizens, scientists, and state and national governments has resulted in a series of high-profile conservation actions, including a 2015 petition, and subsequent positive 90-day finding, to list the species as federally threatened under the Endangered Species Act. Furthermore, a high-level, interagency working group has been created to address monarch conservation following an agreement between President Obama and his Canadian and Mexican counterparts during the North American Leaders Summit. Given Texas' strategic position along the monarch migration pathway (Figure 2), Texas Parks and Wildlife Department (TPWD), represented by Executive Director Carter Smith, has a unique role in this interagency working group, which has been tasked with identifying U.S. priorities and actions for monarch conservation.

Increased interest in monarch conservation coincides with a growing interest and concern in the status of a range of managed and native pollinators in North America. Currently, 17 native bee species, seven butterfly species, and six moth species are designated as Species of Greatest Conservation Need (SGCN) by TPWD's Texas Conservation Action Plan (Appendix A).

Most of these species are rarer and less well understood than the monarch and have the potential to benefit from landscape-level actions geared towards that butterfly species. The Texas Monarch and Native Pollinator Conservation Plan acknowledge Texas' unique contribution to the long-term persistence of the eastern North American monarch migration and the state's role in the conservation and management of native pollinators. This plan outlines actions in Texas that will contribute to monarch and overall native pollinator conservation in Texas by highlighting four broad categories of monarch and native pollinator conservation: habitat conservation, education and outreach, research and monitoring, and partnerships. This conservation plan details specific actions associated with each of these categories by TPWD and other stakeholders. TPWD will continue to develop this plan as new stakeholders are identified and become engaged in this collaboration.


Total Area Occupied by Monarch Colonies at Overwintering Sites in Mexico
Hectares (ha)
1994-2015 average = 6.00 ha
2004-2015 average = 3.30 ha
7.81
12.61
18.19
5.77
5.56
8.97
2.83
9.35
7.54
11.12 *
2.19
5.92
6.67
4.61
5.06
1.92
4.02
2.89
1.19
0.67
1.13
94-95 95-96 96-97 97-98 98-99 99-00 00-01 01-02 02-03 03-04 04-05 05-06 06-07 07-08 08-09 09-10 10-11 11-12 12-13 13-14 14-15
Winter Season
MONARCHWATCH.ORG
Education · Conservation · Research
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 2003-2014 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


Northern range of milkweed
Contact zone between eastern and western populations
ROCKY MOUNTAINS
SUMMER
SUMMER
CORN BELT
WINTER
Pacific Ocean
SPRING
Atlantic Ocean
Gulf of Mexico
WINTER
WINTER
Monarch Butterfly
Fall and Spring Migrations
Fall migration
Spring migration
? Unconfirmed
Summer breeding areas
Spring breeding areas
Overwintering areas
Corn belt: high monarch production
Monarch Watch.org
Education · Conservation · Research

I. Habitat Conservation

A. Inventory of Current Habitat Conservation and Management Activities on Public Lands

Inventory of current habitat conservation and management activities being conducted on state lands will identify existing conservation efforts/impacts as well as potential gaps in the state's response to monarch decline and overall native pollinator conservation. An inventory is also useful for effective communication of Texas monarch and native pollinator conservation activities to the general public, partners, and user groups.

> TPWD has developed and will maintain a matrix of Wildlife Division Wildlife Management Areas within Wildlife Regions 2 and 4 (Appendix B) and State Parks and State Natural Areas within State Parks Regions 2 and 3 (Appendix C) with specific beneficial actions (quantifiable when applicable) and estimated monarch/ native pollinator habitat.

B. Conservation and Perpetuation of Floral Resources and Larval Host Plants on Public Lands

Loss of native host plants (*Asclepias* species) for monarch egg-laying and larval development has been identified as a key factor contributing to the decline of the eastern North American migratory population, particularly in the upper Midwestern breeding grounds. Reductions in native floral resources (nectar, pollen), along with nesting sites and host plants, have also been implicated in declines of other native pollinators.

Pollination and the production of viable seed are critical for the perpetuation of plant populations and the integrity of native plant communities. In addition, the fruits, nuts, berries, and other edible structures produced through pollination serve as vital food resources for a diverse array of animals from birds, insects, reptiles, to mammals. Because native pollinators play such a significant role in plant reproduction, as well as production of plant-based foods for other wildlife species, practices that benefit native pollinators should be a component of any wildlife or natural resource management plan.

Conservation and perpetuation of native larval host plants and floral resources are critical to the conservation of monarchs and a range of native pollinator/flower-visiting species (ants, bees, beetles, butterflies, hummingbirds, and moths). There is need for continued coordination between researchers, non-governmental organizations, federal agencies, and state agencies regarding the development of a cost-effective and science-based state strategy aimed at increasing the availability of larval host plants and floral resources on private and public lands throughout the monarch migration corridor in Texas.

Where appropriate and feasible, management practices will be revised to enhance native pollinator resources on state owned lands. Several activities detailed elsewhere in the Texas Monarch and Native Pollinator Conservation Plan also directly promote the augmentation of larval host plants and floral resources on other lands, including development of native pollinator management protocols for private landowners and state development projects.

- TPWD will continue to collaborate with federal, state, and non-governmental partners and relevant working groups to prioritize research needs and participate in the development of native seed resources and guidelines for habitat management/restoration benefitting monarchs and other native pollinator/flower-visiting species.
- Habitat management/restoration projects in TPWD State Parks and Wildlife Management Areas will continue to emphasize holistic, community management rather than single-species management. However, guidelines for managing appropriate habitat for monarch/native pollinator conservation within a larger, community-level framework will be developed and made available to TPWD land managers.
- Practices defined in TPWD's Native Pollinator Protocols for Agricultural Tax Valuation Based on Wildlife Management Use and other pollinator management resources developed by NRCS (Pollinator Resources) and the Xerces Society for Invertebrate Conservation (Pollinator Conservation) should be applied, where applicable, on TPWD lands.
- TPWD will continue to modify or expand management efforts as needed and where feasible to enhance monarch/native pollinator habitat on State Parks, State Natural Areas, and Wildlife Management Areas. Wildlife Division, in cooperation with the Texas Parks and Wildlife Foundation, has submitted a proposal to the National Fish and Wildlife Foundation's Monarch Butterfly Conservation Fund to acquire funds to support habitat restoration (enhance floristic diversity of nectar, pollen, and host plant resources and improve overall habitat quality) on select Wildlife Management Areas and private lands. A proposal submitted by the Texas Parks and Wildlife Foundation in July 2015 was recently selected for funding in September 2015. The total awarded for habitat restoration is $244,080.

C. Native Pollinator Protocols for Agricultural Tax Valuation Based on Wildlife Management Use

As more than 94% of Texas lands are privately owned, effective monarch/native pollinator conservation will require private landowner engagement and involvement. However, large scale conservation is often cost-prohibitive without financial incentive. One such incentive available to landowners who currently manage land qualified under the 1-D-1 Agricultural Tax Valuation is Agricultural Tax Appraisal Based on Wildlife Management Use. Landowners may qualify for this tax valuation by developing a wildlife management plan for their property and implementing a set of specific management actions.

Although management plans have not traditionally targeted monarchs and/or native pollinator communities, interest in managing for these and other nongame wildlife species has been increasing in recent years. While management practices for other species, such as grassland birds, have the potential to indirectly benefit native pollinators, they do not always accommodate the full life-history needs of a diverse assemblage of native pollinator species. For that reason, development and dissemination of protocols geared directly at the management of native pollinators are needed to fully address issues regarding monarch and overall native pollinator conservation on private lands.

- TPWD Wildlife Division staff will develop native pollinator management guidelines to assist private landowners in creating a wildlife management plan for ad valorem tax purposes. After internal staff review, guidelines will be submitted for graphic design, posted online in the ecoregion-specific appendices on TPWD's Private Lands and Habitat Program web pages, and hard copy versions printed and distributed.
- TPWD Nongame Program staff will provide trainings to Technical Guidance Biologists and other appropriate staff to promote awareness and effective implementation of native pollinator management strategies on private lands. By June 2016, six trainings will be provided across the monarch migratory pathway.
- TPWD Nongame Program staff in collaboration with District Biologists and other staff will deliver private landowner workshops to disseminate information regarding native pollinator management practices. Involvement of Natural Resource Conservation Service staff would provide additional benefit of promoting that federal agency's native growing pollinator programs and resources. Workshops will be planned and conducted from 2016 onward.

D. Native Pollinator Protocols for State Development Projects

Infrastructure and development projects that require re-vegetation may result in net loss or increase in monarch/native pollinator habitat. Likewise, the periodic management (herbicide applications, mowing) of such sites can also lead to reduction or enhancement of monarch/native pollinator resources. Actions are intended to standardize and promote adoption of re-vegetation and management activities that restore native plant communities and include native milkweeds and other flowering plants for monarch/native pollinators.

- TPWD Wildlife Habitat Assessment Program staff provides management recommendations through response letters for development projects. For projects that require re-vegetation or landscaping (e.g. pipelines, transmission lines), response letters will include recommendations regarding

inclusion of monarch/native pollinator-friendly plant species. Program staff currently includes standard recommendations regarding monarch migration in response letters on development projects that require re-vegetation of disturbed habitat. These letters recommend re-vegetation efforts include planting or seeding native milkweed and nectar plants. On proposed projects that include landscaping, butterfly gardening is recommended where appropriate and sustainable. Recommendations have been incorporated into the Wildlife Habitat Assessment Program website.

- TPWD Wildlife Habitat Assessment Program staff will continue to work closely with Texas Department of Transportation (TXDoT) Maintenance Division regarding incorporation of native plant species and native pollinator-friendly management practices into their existing wildflower program. Program staff meets with TxDOT staff on a quarterly basis, and these meetings will provide ample opportunities to continue to encourage TxDOT to remove non-native species from seed mixes and include nectar plants and milkweed once a suitable milkweed seed source is available.

II. Education and Outreach

Broad public awareness of monarch/native pollinator conservation and how the general public can play a role is important for showcasing Texas' efforts. Effective communication can result in increased public support and participation in monarch/native pollinator conservation on both public and private lands.

- TPWD staff will continue to provide information on the importance of and opportunities for monarch/pollinator conservation. TPWD will engage customers, stakeholders and the general public through a wide range of tactics including landowner workshops and conferences and communication vehicles such as the TPWD website, social media, email, press releases, television and radio will also be utilized. The Texas Parks and Wildlife magazine and TV show are award winning examples that will play a critical role in elevating the importance of- and opportunities for monarch/pollinator conservation.
- TPWD will explore developing a promotional campaign to support monarch conservation with a focus on spring and fall migration periods. The department will explore opportunities to partner with plant stores/nurseries, nature centers, state parks, wildlife management areas to host seasonal monarch/native pollinator focused events, educational workshops and presentations from TPWD biologists.
- Wherever possible, bilingual training and materials will be included in outreach efforts.
- TPWD staff will continue to use these resources to disseminate information concerning monarch/native pollinator conservation actions at state parks and other TPWD lands. State Parks, Historic Sites, and Wildlife Management Areas have been identified for installation of monarch larval monitoring/demonstration sites, and designated monarch gardens, which provide opportunities for community involvement and education as well as increasing larval feeding opportunities.
- Texas Master Naturalists will be recruited to help with monitoring and upkeep.

- State Parks Interpretive Services will help create interpretive materials, including interpretive signage for installation at demonstration sites, with monarch conservation and native plant messages.
- TPWD will offer training through interpretive supervisor meetings for state park interpreters where monarch conservation outreach is most effective. By September 2015, regional interpretive meetings led by the Regional Interpretive Specialists will disseminate tools to implement monarch conservation awareness at their respective parks. The training will include fall and spring migration, parks in the migration path, citizen science, iNaturalist, partnerships and dates for monarch events, and guided activities for park visitors and school groups. Throughout the year, Regional Interpretive Specialists and park interpreters will continue to share ideas, new trainings, and outreach opportunities with each other via the outlook Global Interpreters distribution list.
- TPWD staff will encourage development of additional monarch/native pollinator gardens at schools, community centers, nature centers, and along Texas Wildlife Trails. Educational materials and training support will be provided for volunteer organizations such as Texas Master Naturalists, Master Gardeners, and others to facilitate planting, maintaining and monitoring activity at these gardens.
- TPWD will explore granting partnerships with Native Plant Society of Texas and others to provide resources for school and community-based pollinator gardens and create a tool for reporting number of pollinator species.
- TPWD staff will develop interactive educational opportunities such as real time reporting of monarch migration, hatching, etc. through social media that can be used by schools and community gardens as well as reports from the general public.
- TPWD will consider introducing a Monarch Conservation License Plate to help fund efforts identified in the TPWD Monarch/Native Pollinator Conservation Plan.

III. Research and Monitoring

A number of questions exist regarding monarch/native pollinator conservation needs in Texas. While

loss of native milkweed in the upper Midwestern U.S breeding grounds of the monarch has been implicated as a driving factor in the species decline, the status of native milkweed resources in Texas is less well known. A better understanding of milkweed distribution is needed to assess species status, guide potential seed-collection efforts, and identify important milkweed aggregations. In addition, basic information on the impact of land management practices, current species distribution, and assessment of threats is needed to fully implement effective conservation. External expertise is required in design and implementation of studies aimed at generating data to meet existing research needs.

- TPWD Nongame Program and Texas Nature Tracker Program have developed a citizen-science based project, Texas Milkweeds and Monarchs, through the online portal iNaturalist. A companion field guide to the 37 native milkweed species known to occur in Texas has also been developed.
- To solicit involvement in citizen-science efforts, TPWD Nongame Program and Texas Nature Tracker Program staff will promote citizen-science through social media as well as delivery of presentations to interested groups. Development and delivery of press releases and promotion through the primary TPWD Facebook page will aid in increasing awareness and involvement. Involvement of State Parks in education of visitors regarding this initiative will also be beneficial. Wildlife Division staff and Communications Division staff will collaborate to craft appropriate media messages and delivery outlets.
- As appropriate funds are available, TPWD will issue Request for Proposals (RFP) for pass-through grant programs. Discrete priorities to address research needs will be established and posted online. TPWD Wildlife Division offers external grants through its Conservation License Plate Grant Program and State Wildlife Grant Program and since 2012, funding priorities have included native pollinator research. An RFP for the State Wildlife Grant Program with native pollinator priorities was posted online in April 2015 for work to be conducted in Fiscal Year 2016.
- TPWD staff will serve in an advisory capacity on a working group formed by the Texas Comptroller of Public Account to identify monarch research priorities for funding through Comptroller funds. The working group has identified research priorities and has selected a state university project to receive funding.

IV. Partnerships and Collaboration

The challenge of effective monarch/native pollinator conservation on a state-wide and national level is substantial. Numerous entities are involved in the issue and collaboration is essential for efficient allocation of resources and effective action among entities. TPWD will continue to solicit the support and collaboration of stakeholders and their efforts will be detailed in addendums located within this plan.

- TPWD will continue to engage in high-level dialogue between non-governmental organizations and state agencies to promote adoption of monarch conservation recommendations and to invite collaboration in the development of monarch conservation protocols. Potential state partners include, but are not limited to the National Wildlife Federation (South Central Region), Texan by Nature, Monarch Joint Venture, Texas A&M AgriLife Extension, Texas Comptroller of Public Accounts, Texas Department of Transportation, Texas Wildlife Association, state river authorities and the Lady Bird Johnson Wildflower Center.
- Staff will update Wildlife Division (Private Lands, Wildlife Diversity) citizen advisory groups regarding TPWD monarch/native pollinator conservation efforts.
- Texas Parks and Wildlife Foundation, the official nonprofit funding partner of TPWD, will raise private funds to support TPWD's conservation efforts outlined in this plan.

ADDENDUMS

Addendum A. Guadalupe-Blanco River Trust

The Guadalupe-Blanco River Trust is a 501(c)(3) nonprofit land trust organization that was developed to conserve land in the Guadalupe River Basin for its natural, recreational, scenic, historic and productive value. It was founded in 2001 by the Guadalupe-Blanco River Authority, a conservation and reclamation district created in 1933 by the Texas Legislature. The Upper Guadalupe River Authority (UGRA) has also partnered with the Trust. The voluntary board of directors consists of citizens who share a love of the Guadalupe River - one of the most pristine rivers in Texas. The Guadalupe-Blanco River Trust (GBRT) was the first accredited land trust in Texas. GBRT has permanently conserved over 10,000 acres in the Guadalupe River Basin.

I. HABITAT CONSERVATION

A. Inventory of Current Habitat Conservation and Management Activities on State Lands

Guadalupe-Blanco River Trust

- Develop and maintain a map of GBRT fee simple lands and conservation easements throughout the Guadalupe River Basin with conservation management activities, i.e. prescribed fire, brush management, invasive species management and native vegetation planting that are beneficial to enhancement of monarch/native pollinator habitat.

B. Conservation and Perpetuation of Flora Resources and Larval Host Plants on State Lands

Guadalupe-Blanco River Trust

- On GBRT's fee simple properties, GBRT will plan and implement holistic land management projects that include appropriate monarch or native pollinator habitat restoration. For GBRT's conservation easements, GBRT will offer technical assistance to landowners who wish to enhance or create monarch or native pollinator habitat.

C. Native Pollinator Protocols: No GBRT input on this section

D. Native Pollinator Protocols for State Development Projects

Guadalupe-Blanco River Trust

- For re-vegetation projects on GBRT fee simple lands in Caldwell and Calhoun Counties, GBRT will incorporate native pollinator plant species, including milkweed and nectar plants, and eliminate non-native species from seed mixes.
- GBRT will install demonstration gardens featuring native milkweed plants at the Plum Creek Wetlands Preserve in Caldwell County.

II. EDUCATION AND OUTREACH

Guadalupe-Blanco River Trust

- Through civic group presentations, workshops and field days, GBRT will help convey the importance of a multi-native species approach to land management and its potential positive impact on monarch and native pollinator populations.
- At native milkweed garden plots, GBRT will install monarch butterfly interpretation signage.

III. RESEARCH AND MONITORING

A. Citizen-Science Initiative to Assess Native Milkweed Species in Texas

Guadalupe-Blanco River Trust

- GBRT will join TPWD in distributing milkweed field guides throughout the Guadalupe River Basin.
- GBRT will promote the Texas Milkweeds and Monarchs project on GBRT's website and social media outlets.

B. External Research on Native Pollinator Conservation

Guadalupe-Blanco River Trust

- GBRT is already participating in research program being implemented by the University of Texas at San Antonio that is funded by the Office of the Texas Comptroller of Public Accounts. GBRT will seek additional opportunities to participate in monarch and native pollinator research.

IV. PARTNERSHIPS AND COLLABORATION

Guadalupe-Blanco River Trust

- GBRT will participate in high-level dialogue with non-governmental organizations and state agencies to promote monarch and native pollinator conservation efforts.
- GBRT will search for grant funding to support all the items we have listed requiring additional funds.

Addendum B. Lady Bird Johnson Wildflower Center

The University of Texas at Austin Lady Bird Johnson Wildflower Center is dedicated to the conservation of plants and landscapes that support native pollinators, including monarch butterflies and other pollinator species of greatest conservation need (SGCN) in Texas. We offer support for each of the four broad categories outlined in the Texas Monarch and Native Pollinator Conservation Plan.

Our mission is to conserve, restore and create healthy landscapes. The Wildflower Center is a 279-acre public native plant botanic garden in southwest Austin, Texas, that welcomes more than 125,000 visitors per year. Founded in 1982 by Lady Bird Johnson and Helen Hayes, the center joined The University of Texas at Austin as a self-supporting unit in 2006. The center is a national leader in plant conservation and landscape restoration that has guided the development of urban and rural landscapes incorporating native prairies, green roofs and other sustainable features. It operates North America's largest online resource about native plants. Among the center's conservation efforts have been the setting aside of millions of seeds from Texas native plants for future generations. The center also led the development of the nation's most comprehensive sustainable landscape rating system, known as SITES.

The Wildflower Center

The Wildflower Center campus displays 650 native Texas plant species in formal gardens, meadows and nature trails. Our garden is a living laboratory and research facility of the University of Texas. The high concentration of pollinator-friendly native plants attracts many species of pollinators which have been studied by lay and professional entomologists and students of all ages. The gardens lend themselves well to pollinator research, especially host plant-pollinator interactions. For example, The Lady Bird Johnson Wildflower Center Fauna Project, initiated by entomologist Valerie Bugh in March, 2010, contains a weekly inventory to date of the insects, spiders, other invertebrates as well as reptiles, birds and mammals found on-site (http://www.austinbug.com/survey/faunaproject.html). This inventory is of tremendous value to pollinator research and is available for use with the Texas Monarch and Native Pollinator Conservation Action Plan.

The Ecosystem Design Group

As an organized research unit of The University of Texas at Austin, we have contributed to the advancement of scientific knowledge of green roofs, sustainable turfgrass, low impact development and stormwater Best Management Practices (BMPs), native ecosystem restoration, invasive species management, roadside revegetation and urban-wildland interface fire ecology. We also bring extensive and diverse experience from our work on high-impact projects for public and private clients, including national and regional parks, corporate headquarters, urban developments, institutional campuses, river and prairie restoration, state highways and botanic gardens. Our experienced team includes staff trained in landscape architecture, ecology, geography, planning and sustainable design. We stand ready to assist TPWD with the implementation of the Texas Monarch and Native Pollinator Conservation Plan.

Plant Conservation Program

Our professional botanists can assist in the identification, collection, monitoring, inventory and phenological research of pollinator-friendly plants. In partnership with the United States Fish and Wildlife Service, we are currently conducting research to increase the availability of native milkweed seed ecotypes (the larval hosts for Monarchs) for habitat restoration. The goal of this project is to enhance the production of milkweed plants in Texas by collecting seeds all milkweed species to propagate plants and provide seed to growers throughout the public and private sectors. In addition, germ plasm from seeds across the geographical range of each species are being collected, conserved, banked and made available for future research and restoration efforts.

Plant Nursery Program

Our Nursery Program can assist in propagating and growing pollinator friendly plants and developing protocols for successful propagation for use by growers in both the public and private sector. In our role as an exclusively native plant botanic garden, we have spent the past three decades growing and developing successful protocols for plant propagation. Our extensive body of knowledge of native plant propagation could be tapped for this initiative. The nursery is currently growing 6,000 milkweed plants for distribution to Austin area public schools as part of the National Wildlife Federation's initiative to increase Monarch butterfly gardens in schools this year. In addition, pollinator friendly native plants are propagated year round to enhance pollinator habitat in our botanic garden and for sale to the public at our bi-annual plant sale.

Education and Outreach

Education and outreach about the sustainable use and conservation of native plants is the mainstay of our mission (https://www.wildflower.org/education.php). Pollinator conservation outreach is embedded in our educational and outreach programs. Our education programs engage all levels and ages. These programs could be modified to assist TPWD in implementing the Texas Monarch and Native Pollinator Conservation Plan. The Wildflower Center website contains the Native Plant Information Network (NPIN) one of the largest plant education information databases (https://www.wildflower.org/explore.php) in existence, with 2.4 million website viewers in 2014. We provide pollinator/plant education through University of Texas Informal Classes, Go Native U, Landscape for Life, and on-site elementary and pre-school educational programs. Our website hosts a pollinator conservation page with state and national information on pollinators, including monarchs (https://www.wildflower.org/conservation_pollinators/). Our botanic garden houses an insectary and pollinator gardens which we use to educate the public. Our family oriented summertime community outreach education program, Nature Nights (https://www.wildflower.org/nature/) features native pollinator conservation

Citizen Science

Engagement of citizen scientists is key to our mission. For the past two decades we have trained scores of citizen scientists to help us conduct research and undertake community based native plant conservation projects throughout the state. We are currently training citizen scientists to collect milkweed seed for our Milkweed Seed Collecting Project. The training module includes on site presentations, a webinar, instruction on best practices for obtaining milkweed seed ecotype collections, and pollinator-based education. We work closely with the Native Plant Society, Texas Master Naturalists, Master Gardeners, and other community based volunteer organizations. We would engage citizen scientists to implement the Texas Moanrch and Native Pollinator Conservation Plan.

Partnerships and Collaboration

The Lady Bird Johnson Wildflower Center is a partner with conservation organizations across the United States that comprise the National Pollinator Garden Network, which supports and promotes the Million Pollinator Garden Challenge. We partner with the Xerces Society and Butterflies and Moths of North America to help gardeners find thousands of plants that sustain bees and butterflies. The Wildflower Center is a proud member of Monarch Joint Venture (MJV), the national partnership of federal and state agencies, non-governmental organizations, and academic programs working together to conserve the monarch butterfly migration.

Addendum C. Lower Colorado River Authority

The Lower Colorado River Authority serves customers and communities throughout Texas by managing the lower Colorado River; generating and transmitting electric power; ensuring a clean, reliable water supply; and offering access to nature at more than 40 parks, recreation areas and river access sites along the Texas Colorado River, from the Hill Country to the Gulf Coast. LCRA and its employees are committed to enhancing the lives of Texans through water stewardship, energy and community services. LCRA was created by the Texas Legislature in 1934. The organization neither levies taxes nor receives tax money.

I. HABITAT CONSERVATION

A. Inventory of Current Habitat Conservation and Management Activities on State Lands

Lower Colorado River Authority

- Develop and maintain a map of LCRA lands throughout the lower Colorado River basin with conservation management activities, i.e. prescribed fire, brush management, invasive species management and native vegetation planting to enhance monarch/native pollinator habitat.

B. Conservation and Perpetuation of Flora Resources and Larval Host Plants on State Lands

Lower Colorado River Authority

- LCRA will plan and implement holistic land management projects that include appropriate monarch or native pollinator habitat restoration.

C. Native Pollinator Protocols: No LCRA input on this section

D. Native Pollinator Protocols for State Development Projects

Lower Colorado River Authority

- For re-vegetation projects on LCRA lands, LCRA will incorporate native pollinator plant species, including milkweed and nectar plants, and eliminate non-native species from seed mixes.
- LCRA will install demonstration gardens featuring native milkweed plants at natural science centers at McKinney Roughs Nature Park and Matagorda Bay Nature Park.

II. EDUCATION AND OUTREACH

Lower Colorado River Authority

- Through civic group presentations, workshops and field days, LCRA will help convey the importance of a multi-native species approach to land management and its potential positive impact on monarch and native pollinator populations.
- LCRA will add a monarch butterfly life cycle and habitat requirements education program to its natural science centers program curriculum.
- Where appropriate, LCRA will include information about the monarch butterfly in education and recreational programs at its natural science centers.
- At native milkweed garden plots, LCRA will install monarch butterfly interpretation signage.

III. RESEARCH AND MONITORING

A. Citizen-Science Initiative to Assess Native Milkweed Species in Texas

Lower Colorado River Authority

- LCRA will join TPWD in distributing milkweed field guides throughout the lower Colorado River basin.
- LCRA will promote the Texas Milkweeds and Monarchs project on LCRA's website and social media outlets.

B. External Research on Native Pollinator Conservation: No LCRA input on this section

IV. PARTNERSHIPS AND COLLABORATION

Lower Colorado River Authority

- LCRA will participate in high-level dialogue with non-governmental organizations and state agencies to promote monarch and native pollinator conservation efforts.

Addendum D. National Wildlife Federation (NWF)

The National Wildlife Federation will be working in urban areas throughout the Monarch Central Flyway to engage and support local governments, NGOs, and citizens in taking effective action toward monarch recovery. We will provide direct, in-person support and technical assistance to 8 – 10 major cities to help them develop and implement actionable monarch-recovery plans. We will also conduct broad-based outreach to hundreds of other cities, towns, schools, garden clubs, businesses, homeowners and other players in the central flyway, providing tools that equip them to engage in monarch recovery. NWF's work will take place in two phases: a 6-month start-up phase (beginning July 1, 2015), supported by a start-up grant from the National Fish and Wildlife Foundation, which will focus on the development of materials and tools and initial outreach to key communities to gauge interest and support, and an 18-month implementation phase (funding pending), that will focus on the development and implementation of monarch-recovery action plans in targeted major cities and the widespread distribution of tools and techniques any community can use to do its part for monarchs. Though NWF's urban work will include education and outreach, we think this work fits best under the category of Partnerships and Collaboration in the Texas Plan. Because of its very critical location along the monarch migration route, Texas will be a major focus of NWF's urban outreach work. The following description represents NWF's anticipated program activities as they apply to Texas.

Direct Support to Major Cities and School Districts

1. Facilitate development of city-wide monarch recovery plans in 4-5 major cities in Texas that are located within the monarch central flyway. NWF will secure commitments from 4-5 major cities in Texas to take action on behalf of monarch recovery. In each city we will recruit and convene a local Monarch Network, representing key city staff and the appropriate local NGO's (native plant societies, master gardeners, botanical gardens, community garden groups, Keep America Beautiful affiliates, etc.), key corporate citizens and others willing to help on the ground, to develop and implement a city-wide monarch recovery plan. Drawing on our long experience with our Community Wildlife Habitat program and our ready access to monarch expertise (through NWF's partnerships with U.S. Fish & Wildlife Service, Monarch Joint Venture, Monarch Watch, and the National Pollinator Garden Network) NWF will offer local network members ideas and models for effective action. Plans will include such actions as changes in management of city parks and other public spaces to expand or preserve monarch habitat, NGO-led campaigns to encourage residents to plant milkweed and nectar plants in home gardens, development of demonstration monarch habitat gardens at arboretums or on high-visibility city properties, and other steps to engage the community in monarch recovery.

2. Develop and deploy a monarch-trained volunteer corps to support implementation of urban monarch-recovery efforts in 4-5 major cities in Texas. To support implementation of city-wide monarch-recovery plans, NWF will create and implement a monarch-specific version of its Habitat Stewards Training, a program that trains and equips volunteers to design, plant, and promote wildlife-friendly habitat gardens. (http://www.nwf.org/How-to-Help/Volunteer/Find-Opportunities.aspx) NWF will conduct a 1.5-day Monarch Habitat Stewards Training in each of the target cities, training 20-to-25 stewards per locale to design and plant monarch/pollinator gardens and to reach out to community groups on the need to increase monarch habitat. In exchange for NWF certification, Habitat Stewards pledge at least 30 volunteer hours per year for activities related to their training. Many contribute more hours. The 100-125 new Texas-based Monarch Habitat Stewards trained under this grant will provide target cities between 3,000 and 3,750 volunteer hours toward the design and planting of monarch habitat (at city facilities, schools, business lands, or in residential neighborhoods) and for community recruitment related to monarch-habitat development.

3. Conduct school-district-wide Monarch Heroes training for teachers, curriculum leads, and administrators in urban school districts in target cities in Texas. To facilitate participation by urban school districts in city-level monarch-recovery efforts, NWF will conduct a full-day orientation and training for up to 45 lead teachers, curriculum specialists and administrators in school districts located in 4 of the Texas target cities. The training will equip educators to incorporate monarch-recovery into the classroom and the community. They will be prepared to develop onsite monarch habitat gardens using monarch-focused curriculum materials that demonstrate how to create and use monarch/pollinator gardens on school grounds. Educators will also have the capacity to support student-led leadership activities that engage neighborhoods in monarch recovery. The training will draw on materials from a Monarch Heroes project NWF is doing with selected schools in Austin, TX during the 2015-16 school year under grants from the US Fish and Wildlife Service and several corporate sponsors.

4. Conduct a Monarch Heroes Landowner Webinar for each of the 4-5 target cities in Texas. To help cities engage residents, businesses, places of worship and other community members in monarch-recovery efforts, NWF will organize and conduct a series of webinars, one customized for each target city, to educate and equip landowners to plant milkweed and nectar plants in home gardens and other private landscapes. Webinars will be customized by using local subject-matter experts to deliver content, by including information on where residents can get appropriate seeds and plants, and by otherwise highlighting local resources. NWF will promote participation in the webinars through the local Monarch Network, through its own network of Certified Backyard and Community Wildlife Habitats in the area, and through the local affiliates of the National Pollinator Garden Network. We expect at least 250 participants in each webinar. NWF will also record the webinars and make them available free online to others in the community.

Broad-based Outreach and Technical Support to Cities, Towns, Schools, Individuals

5. Promote the Mayor's Monarch Pledge throughout Texas. During the 6-month start-up phase, NWF will develop and launch a Mayor's Monarch Pledge, through which participating mayors will commit to supporting monarch recovery through a range of specific actions. These actions could include: launching a public communication effort to encourage citizen monarch gardens; planting a major demonstration

garden at City Hall or another prominent location, creating monarch habitat in public parks and on other local property, modifying management of city parks and other public lands to better support monarchs, modifying local ordinances to remove any obstacles to planting milkweed, supporting a milkweed seed collection and propagation effort, and many other actions that will increase monarch habitat in the city. During the implementation phase, NWF will continue to promote the pledge to mayors in Texas through email, newsletters, blogs, social media, print publications, webinars, and conferences, as well as through state, national, and metro-area associations such as the U. S. Conference of Mayors, the National Recreation and Park Association, National Garden Clubs, AmericanHort, the Texas Municipal League, and others. NWF will also engage the 11,000 Texas property owners who have certified a backyard or other habitat with NWF, as well as the National Pollinator Garden Network members to urge their mayors to take the pledge. We expect to secure at least 100 pledges from Texas mayors.

6. Provide technical support to the Texas cities that take the Mayor's Monarch Pledge. During the 6-month start-up phase, NWF will develop and widely distribute a Monarch Solutions Guide for Cities, providing concepts for monarch-protective ordinances or resolutions, advice on how to find native milkweed and nectar plants, examples of successful urban monarch-recovery initiatives, and suggestions for other actions that cities can take, such as neighborhood challenges and community garden campaigns, to aid monarch recovery. During the implementation phase NWF will offer technical support to cities in the form of webinars that enable participating cities to hear from experts, ask questions, and share experiences, challenges, and best practices for effective habitat creation and restoration. NWF will compile and document best practices on line. NWF will also foster city-to-city sharing through social media by creating an "open" Mayor's Monarch Pledge Facebook group and by promoting use of the #SaveTheMonarch or a similar hashtag on Twitter. Drawing on its long experience working with communities on becoming Community Wildlife Habitats (www.nwf.org/community), NWF's Garden for Wildlife staff will also maintain informal communications—emails, blogs, etc.—with Texas communities participating in monarch recovery.

7. Mobilize NWF's existing network of Backyard Wildlife Habitats and Community Wildlife Habitats to create new monarch habitat in the central flyway. In Texas, NWF has certified 11,000 backyards, places of worship, places of business and other locales as wildlife-friendly habitat Many of these habitat gardens already feature plants with value for monarchs, but NWF estimates that this value can be increased by recruiting these landowners to enhance their gardens with regional milkweed and native nectar plants. These homeowners and others willing to adapt their gardens for monarchs will receive free native milkweed/ nectar plant seed packets from NWF. We conservatively expect several hundred new monarch gardens to be established in Texas through this route. Finally, in the course of NWF's ongoing Garden for Wildlife Program, we expect to certify about 750 new wildlife habits in Texas during the project period. We will ask these landowners to adapt their gardens for monarch habitat and provide those who agree with seed packets.

8. Create monarch gardens at K-12 schools in the flyway. NWF has approximately 500 schools in Texas either NWF certified schoolyard habitats (www.nwf.org/schoolyard) or are NWF Eco Schools (www.EcoSchoolsUSA.org), many of which likewise have gardens or are greening their grounds. Many of these gardens have pollinator value, and some are focused on monarchs, but more can be done. During the implementation phase, NWF will at least 100 of these schools to establish or enhance monarch-friendly gardens with native milkweed and nectar plants by: a) confirming their interest in creating a monarch garden, b) providing seed packets and planting guidance and c) offering guidance and webinars to help them toward success. These gardens will become community showpieces for parents and other school visitors who may want to take similar actions at home.

9. Deploy the grassroots capacity of members of the National Pollinator Garden Network. As part of its partnership with the US Fish & Wildlife Service, NWF has played a major role in co-founding and coordinating the activities of the National Pollinator Garden Network, made up of 30 leading NGOs with the networks and expertise to support monarch and pollinator conservation on the ground. Co-founders with NWF include: American Public Gardens Association, The Pollinator Partnership, National Gardening Association, National Garden Bureau, American Seed Trade Association, AmericanHort, and the Home Garden Seed Association. Other committed Network partners include National Garden Clubs, Inc., Keep America Beautiful, the Lady Bird Johnson Wildflower Center, the National Recreation and Park Association, American Horticultural Society, National Audubon Society, Monarch Joint Venture, Monarch Watch, and the Xerces Society for Invertebrate Conservation, as well as experts from the pollinator initiatives of the National Park Service, US Forest Service, the Smithsonian, and others. Network partners are asked to encourage their constituents in the central flyway to create and support monarch/pollinator habitat gardens as part of the Million Pollinator Garden Challenge. As a result, thousands of Network members, including local garden clubs, landscapers, plant nurseries, seed companies and others, will support long-term monarch conservation in Texas and elsewhere in the central flyway.

Addendum E. Texas Comptroller of Public Accounts

The Texas Comptroller of Public Accounts is the presiding officer of the legislatively created Interagency Task Force on Economic Growth and Endangered Species (Task Force), a group of state agencies with a charge to assist local communities, businesses and landowners in working with endangered species issues. Other member agencies include the Texas Department of Agriculture, Texas Department of Transportation, Texas Parks and Wildlife Department (TPWD) and Texas State Soil and Water Conservation Board. These member agencies share information on Endangered Species Act issues; work with institutions of higher education, agriculture and conservation groups; assess the economic impact of proposed listings; develop strategies for protecting endangered species while encouraging economic growth; and provide recommendations and reports on endangered species concerns across the state.

At the Task Force's February 17, 2015 meeting, the monarch butterfly was identified as a priority species because of its widespread range across the state and potential impact on numerous communities and economic sectors. Through the following efforts, the Comptroller's office plans to coordinate with task force members, agency partners and other interested stakeholders to raise awareness, support conservation efforts and gather additional data regarding the monarch butterfly and its habitat needs in Texas.

Education and Outreach

The Comptroller's office created a Monarch Butterfly Working Group comprised of task force member agency representatives, researchers, community and business leaders and other interested stakeholders to share information on the status of the butterfly and opportunities to participate in pollinator conservation efforts. This working group is one venue to connect individuals and organizations interested in learning more about the butterfly and participation in conservation efforts.

Additionally, as part of the Comptroller funded butterfly research project, the University of Texas at San Antonio (UTSA) is creating outreach and education programs for students in the San Antonio area through the Educating Youth in Ecology program with support from the U.S. Forest Service Southern Research Station. They are developing educational curriculum for grades kindergarten – 5th designed around the monarch butterfly that will be delivered to elementary schools during the 2015-2016 school year and a summer camp in 2016. The university will also create a web page related to the research project to present updates and other information related to the monarch butterfly and milkweed.

Research and Monitoring

Significant research on the monarch butterfly has focused on the Midwest, leaving gaps in scientific literature regarding Texas. Understanding what happens in Texas is crucial in understanding the needs of the species, given the state's key role as the connection between the overwinter grounds in Mexico and summer breeding grounds of the Midwest and southern Canada. Specifically, additional information is needed about milkweed and associated habitats to fully develop management objectives for the butterfly.

To assist in gathering the data to fill these gaps, the Comptroller's office funded a project to be conducted by UTSA researchers. The research project was developed with input from the working group and monarch

and milkweed experts including TPWD and U.S. Fish and Wildlife Service. The following components of this research will evaluate the abundance, species type and distribution of milkweed in Texas as well as examine land management approaches to enhance the abundance of milkweed if necessary.

- Roadside surveys of milkweed and monarch butterfly populations and associated habitat characteristics including but not limited to soil type, related forbs, grasses and nectar sources, disturbance levels and fire ant occupancy will be conducted. Roadside surveys will be conducted during the fall and spring/summer seasons along an east/west (estimated Ozona-Pineland) and north/south (estimated South Texas – Wichita Falls) transect. Data collected as part of the surveys will be compatible with and have the ability to contribute to other monarch butterfly research and data collection efforts across the United States.
- Site Specific Surveys of milkweed, monarch butterfly populations and associated habitat characteristics including but not limited to soil type, related forbs, grasses nectar sources, disturbance levels and fire ant occupancy will be conducted. Site specific surveys will be conducted on larger tracts in a number of ecoregions in soil types. Survey efforts will be conducted in coordination with private landowners, the Texas Parks and Wildlife Department, San Antonio River Authority, Guadalupe Blanco River Trust and other potential project partners.
- Seed Viability and Germination Experiments will be conducted to evaluate seed germination requirements.
- Greenhouse Experiments will research the response of milkweeds to various growth conditions including light levels, nitrogen levels and drought.
- Field Experiments will be used to examine milkweed patch size dynamics, effect of fire ants and monarch butterfly success and to evaluate the effect of varying land management practices on the milkweed and monarch butterflies in Texas. Specific practices shall include mowing, grazing, prescribed fire and control (no treatment).

As a result of this research, the following information will be compiled into a final report, which will be available in summer 2017.

- A synopsis of understanding of monarch and milkweed populations in Texas.
- Data and maps detailing populations of milkweed species as well as associated habitat characteristics including but not limited to soil type, related forbs, grasses and nectar sources, disturbance levels and fire ant occupancy.
- Comprehensive habitat assessments of milkweed species for the different ecoregions of the state, including but not limited to a discussion of the potential effect of patch sizes, disturbance levels, land management and fire ant occupancy.
- Summary and recommendations regarding optimal growth conditions for milkweed based on conducted experiments.
- Recommendations for management of milkweed populations that will benefit monarch butterflies.

Partnerships and Collaboration

The Comptroller's office will continue to host meetings of the Monarch Working Group to coordinate and share information on research regarding the butterfly as well as discuss opportunities for further partnership and collaboration to support butterfly conservation efforts. Future Task Force meetings will include updates on monarch conservation and research efforts.

Addendum F. Texas Department of Transportation (TxDOT)

The Texas Department of Transportation (TxDOT) is pleased to participate in The Texas Monarch and Native Pollinator Conservation Plan. TxDOT recognizes the decline in the population of eastern North American migrating monarchs in addition to the 30 native pollinator/flower-visiting species (bees, butterflies, and moths) designated as Species of Greatest Conservation Need (SGCN) in Texas Parks and Wildlife Department's (TPWD) Texas Conservation Action Plan. TxDOT appreciates its partnership with TPWD, United States Fish and Wildlife Service (USFWS), Native Plant Society of Texas (NPSOT), Caesar Kleberg Wildlife Research Institute (CKWRI), and others, as we move forward in a collaborative effort to conserve monarch and overall native pollinator species in Texas. TxDOT owns and maintains more than 1.1 million acres of roadway right-of-way (ROW) in Texas, of which, some 800,000 acres are vegetated, These ROWs include all ecological regions of Texas and represent a cross-section of the state's varying landscapes. They range from humid prairies and forests in the southeast and east to desert shrub, grassland and forests in the mountainous region of west Texas. These landscapes support more than 900 species of wildlife and about 5,500 species of vascular plants. Because roadsides within these landscapes provide habitat for a wide variety of plants and wildlife, they are an integral part of healthy ecosystems. The following sections describe TxDOT's participation in the Texas Monarch and Native Pollinator Conservation Plan.

I. HABITAT CONSERVATION

TxDOT Wildflower Program

TxDOT maintains over 800,000 acres of roadside vegetation within its 1,100,000 acres of ROW. The TxDOT Wildflower Program is designed to reduce the cost of maintenance and labor, to create aesthetically-pleasing vegetation on highway ROW, and to establish ROW that blends into local surroundings. The TxDOT Wildflower Program began in the 1930s with a simple but important message: "Don't mow until the wildflowers have gone to seed." Because TxDOT vegetation managers recognized that native flower species were less costly to maintain than other options, these plants and their associated pollinator habitat have thrived on Texas highway roadsides for decades. More than 2,000 different species of wildflowers grow along Texas highways, attracting tourists nationwide to the state each spring and bringing millions of tourist dollars to the State and local economies. Without proper maintenance and care, many of these wildflowers and related tourist activities would decline. Through its Wildflower Program, TxDOT works to preserve and protect these wildflowers so that biodiversity, pollinator health, and tourism are secured year after year.

Challenges

TxDOT faces challenges and complaints from farmers who believe roadside wildflowers threaten crops and ranchers who believe milkweed—the only food source for monarch caterpillars—threatens livestock. Some members of the public expect the department to maintain the ROW to resemble a manicured golf course or front lawn, while others believe it should appear as one of our last great prairies. TxDOT continues to respondto concerns from the agricultural community to educate them about the agricultural

benefits of wildflowers and the pollinators they support. Success in these educational efforts varies across the State. In addition to conflicting public expectations, TxDOT is required to comply with the National Pollutant Discharge Elimination System (NPDES) and follow storm water runoff guidelines on all construction projects. If storm water guidelines are not followed on disturbed areas, the engineers overseeing the project could be held civilly and criminally liable for erosion and water quality violations. The engineer is held responsible until the disturbed site has reached 70% perennial vegetative cover. With these regulations, one can see why the department seeks to obtain a perennial cover that will grow quickly. Many native and non-native species currently on the market can accomplish this but seed choice is not the only factor to consider in revegetation. A problem arises when not all of the species planted are desirable to the adjacent landowners or even for roadway maintenance purposes. For example, the Department may utilize a pure, tall bunch grass seed mix. Some adjacent landowners may find it desirable, while others may consider the mix a fire hazard. Even if the tall bunch grass becomes established, routine mowing will eliminate it, so the grass will only thrive in non-mowed areas.

Methods for Success

One of the keys to success of TxDOT's Wildflower Program is properly timed mowing twice a year—once after the spring bloom season and once after the fall bloom season. TxDOT also mows at a sufficient height to help retain soil moisture. Mowing techniques, and the establishment of non-mow areas, promote both spring and fall blooms by helping seed germination to ensure the success of the next bloom season. The spring wildflower display is comprised mostly of annuals, and fall wildflowers are predominately perennial species.

To protect and preserve these natural wildflower lifecycle processes, TxDOT practices integrated vegetation management that is overseen by the Maintenance Field Support Section. The Section oversees a statewide program for herbicide operations, mowing, re-vegetation, soil erosion control, endangered species and wildlife habitat protection, pruning, and noxious weed control. To avoid herbicide effects to native vegetation, TxDOT does not use the broadcast method of herbicide application but instead uses techniques such as spot treatments to target problematic species. As part of its vegetation management program, TxDOT purchases and sows approximately 30,000 pounds of wildflower seeds annually, and seeds approximately 15,000 acres of ROW with native grasses and wildflowers.

Each of TxDOT's 25 districts has a vegetation manager who oversees the proper application of TxDOT vegetation management techniques, which differ by road type and function. Vegetation managers encourage diversity of wildflower species, particularly with the use of native plants. The diverse plant species on TxDOT roadsides create corridors beneficial to many species of pollinators and other animals. Vegetation corridors can help connect fragmented wildlife habitat in urban and agricultural areas.

The diverse vegetation on TxDOT roadsides supports several species of pollinators, including honeybees that are important to agricultural sustainability. Through education, adjacent landowners have also learned that there are economic benefits to allowing vegetation diversity on their lands. For example, some ranchers with high quality avian habitat have found that they are making money by allowing access to their lands to birders and other outdoor enthusiasts.

One of the native plants that benefits the most from TxDOT vegetation management practices are milkweeds. This is important for monarch butterflies, a species that has seen a dramatic decline since 1990, largely due to a decline in milkweed. Monarch butterflies migrate north from their over-wintering areas in Central Mexico and California at the first sign of milkweed and lay their eggs on these plants, which are the sole food source for monarch caterpillars. Although there are multiple migration corridors for the monarch, perhaps the most critical migratory path follows the area in and around the Interstate 35

corridor, which runs north-south from Laredo, Texas at the Mexican border to Duluth, Minnesota.

Outcomes

Because of TxDOT's overall vegetation management and maintenance practices, Texas' wildflowers have become a major tourist attraction across the state. Many ranchers offer wildflower and wildlife viewing opportunities and communities have organized festivals, arts and crafts shows, sports events, and performing arts showcases that coincide with the spring wildflower season. TxDOT also promotes wildflower tourism; Texas Highways, published monthly by TxDOT, includes annual articles about wildflower "sightings," local events, and biological information about various wildflower species. From an ecological perspective, grasses and wildflowers planted and/or protected through the Wildflower Program have conserved water, controlled soil erosion, and provided habitats for wildlife, including pollinators, across Texas.

Conclusions

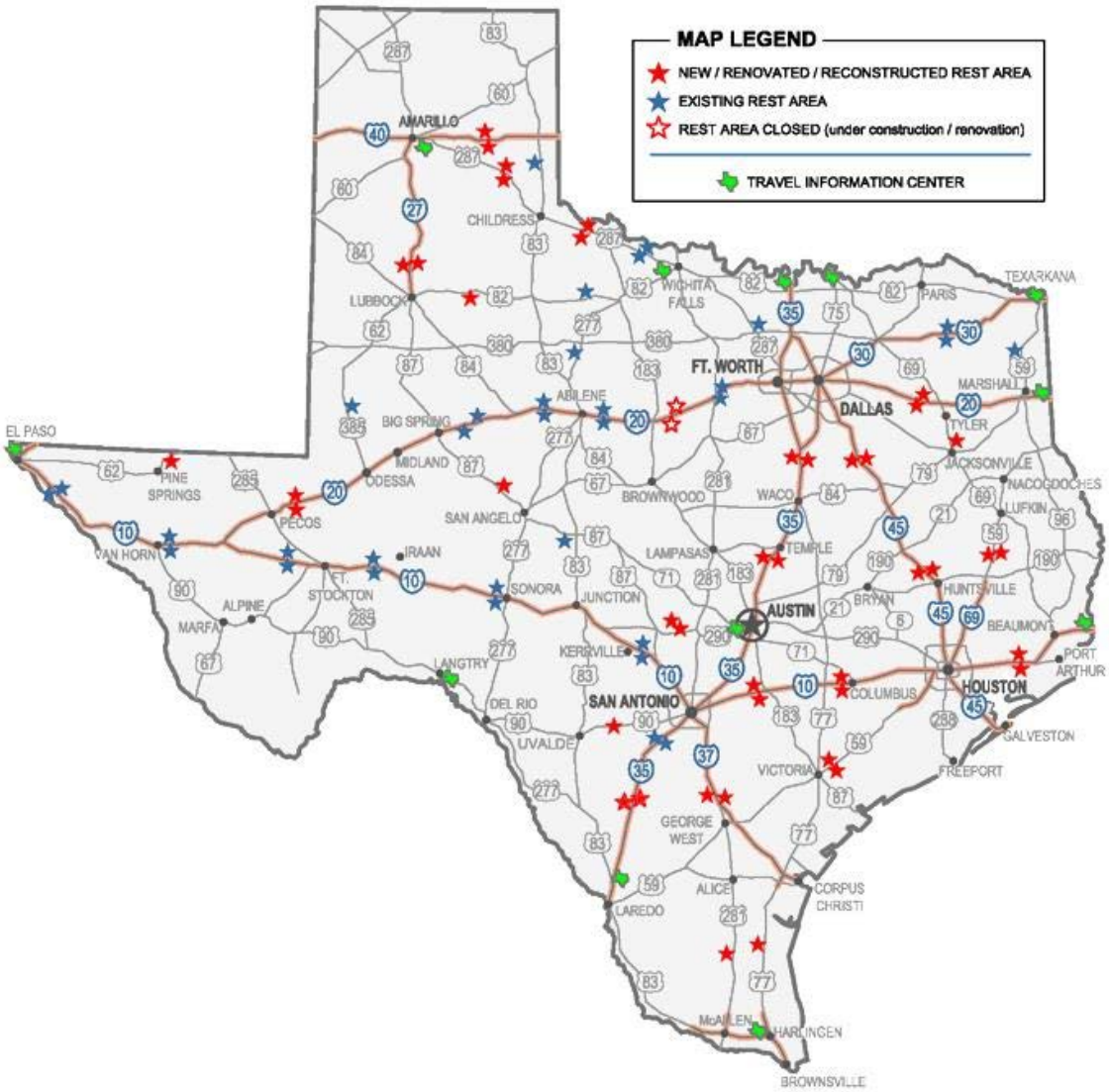
By establishing a strong and sustainable vegetation management program that specifically addresses wildflower preservation and protection, TxDOT has maintained biodiversity across the State while reducing ROW mowing and maintenance costs. TxDOT's long-continuing tradition and effort in this important program sets the stage for aesthetically-pleasing highway landscapes that attract tourists (who contribute to the economy) while promoting overall ecosystem health that benefits pollinators. Additional information regarding TxDOT's commitment to wildflower and pollinator conservation, and vegetation management can be found in the Roadside Vegetation Manual located by accessing the following hyperlink: http://onlinemanuals.txdot.gov/txdotmanuals/veg/index.htm.

II. EDUCATION AND OUTREACH

Monarch Gardens at TxDOT Safety Rest Areas

TxDOT maintains attractive, safe, and clean rest area facilities which are strategically placed along 21 major highways throughout the state. These facilities include 80 Safety Rest Areas plus 12 Travel Information Centers as depicted in the map below. Each Safety Rest Area is designed to incorporate natural and historical features unique to its location, as well as native landscaping elements.

In August 2015, TxDOT facilitated a cooperative agreement between the USFWS and NPSOT to allow for those entities to plan, establish, and maintain monarch gardens on TxDOT Safety Rest Areas. Monarch gardens, also called demonstration gardens, are areas that provide resources necessary for monarch butterflies to produce successive generations and sustain their migration. These gardens will provide important habitat components for the monarch migration including native nectar- and host-plants. Each established monarch garden will include interpretive signage, which will educate the public on monarch biology and habitat as well as opportunities for engagement in monarch conservation. This project will benefit the public by highlighting the habitat needs of the monarch butterfly and other pollinators. Four TxDOT Safety Rest Areas have been identified as appropriate for immediate monarch garden installation; the paired (northbound and southbound) Hill County Safety Rest Areas on IH 35 near Hillsboro, and the paired (northbound and southbound) Bell County Safety Rest Areas on IH 35 near Salado. Installations of the gardens are currently in progress as of September 2015. In addition to Hillsboro and Salado, TxDOT will continue to collaborate with USFWS and NPSOT to support the installation of additional monarch gardens at Safety Rest Areas along the I-35 corridor and other rest areas, as deemed appropriate, throughout the state.



III. RESEARCH AND MONITORING

Milkweeds are present on TxDOT ROW throughout the state but milkweed seeds are not currently available in quantities appropriate for incorporation into TxDOT seeding specifications. TxDOT will continue to participate with its partners on research into improved methods of seed collection and plant propagation. TxDOT's current vegetation management practices benefit the propagation of wildflowers and existing populations of milkweed within the ROW, therefore ensuring long term native species sustainability.

Milkweed Propagation Project

In July and August 2015, TxDOT partnered with the Mid-Coast Chapter Texas Master Naturalists, South Texas NPSOT to collect green antelope horn milkweed (Asclepias viridis) seed, to be used for research, from its ROW on US 77 in Victoria County. The South Texas NPSOT identified approximately 1,094 plants appropriate for seed collection and research.

South Texas Natives and Texas Native Seeds Projects

From 2001-present, TxDOT has been a major partner in the South Texas Natives (STN) and Texas Native Seeds (TNS) Projects. These collaborative efforts are led by the Caesar Kleberg Wildlife Research Institute

at Texas A&M University-Kingsville, and involve researchers at Tarleton State University, Texas AgriLife Research, Sul Ross State University, and the USDA NRCS Plant Materials Centers in Kingsville and Knox City. The focus of these projects is the development of regionally appropriate native plant seed sources for use by TxDOT and other entities. Native milkweeds are just some of the many species of grasses and forbs that have been collected and targeted for seed source development in these programs. Seed collections of native milkweeds have been obtained during collection efforts of TNS since 2010.

To date, the STN and TNS projects have resulted in 30 new native seed mix varieties and significant advancements in seeding methodology by TxDOT and other entities. Many of these seed sources have been of forbs, which are used by monarchs and other pollinators as food sources. Some of the forbs that have been formally released and that are available to consumers as a result of the projects include orange zexmenia (Wedelia hispida), clammyweed (Polanisia dodecandra), awnless bush sunflower (Simsia calva), and prairie acacia (Acacia angustissima). A variety of other forbs are under consideration for release in each of the project regions.

In each year since 2013, because of the work of STN and TNS, native seeds release by these programs have been available in quantities that would allow for up to 30,000 acres of seeding annually by TxDOT and other consumers. As a result of this work, in 2010, TxDOT seeding specifications for the Pharr and Corpus Christi Districts were amended to incorporate the use of native seeds developed by the programs. In 2014, seeding specifications for 15 of the 25 TxDOT Districts in Texas were modified to utilize native seeds developed in the STN and TNS programs. These changes will help greatly reduce the use of introduced grasses in roadside seedings throughout Texas. Each of these specification changes also added regionally appropriate legumes and forbs to seed mixes specified by TxDOT in order to improve biodiversity and habitat for pollinators on TxDOT ROW.

At present, as part of their work to obtain native seed collections from throughout the state, TNS personnel are obtaining native milkweed seed collections from South, Central, and West Texas. Evaluation studies of 5 of the most common Texas milkweed species from these regions have been initiated. With TxDOT and other's support, and by working with commercial seedsmen, TNS will eventually release regionally appropriate seed selections of several milkweeds for large scale seed production and to meet large scale restoration needs by TxDOT, other agencies, private landowners, and industry throughout Texas.

IV. PARTNERS AND COLLABORATION

TxDOT has established monarch conservation partnerships with USFWS and NPSOT on the monarch garden installation project. TxDOT maintains its partnership with CKWRI on the TNS and STN projects, which directly benefits the conservation of all pollinator species. In addition, TxDOT is currently collaborating with the Mid-Coast Chapter Texas Master Naturalists, South Texas Chapter NPSOT, Texas Monarch Watch, and the USDA's Kika de la Garza Plant Materials Center on green antelope horn milkweed research within the US 77 ROW in Victoria County. As the Texas Monarch and Native Pollinator Conservation Plan continues to develop,

TxDOT looks forward to establishing working relationship and collaborative partnerships with other entities sharing the same vision.

Addendum G. U.S. Department of Agriculture Natural Resources Conservation Service (NRCS)

Goals

Establish, and or enhance desired and beneficial habitat for winter and spring migrations of the Monarch Butterfly in Texas.

National

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

Restore or enhance 7 million acres of land for pollinators over the next five years through federal actions and public/private partnerships.

State: Texas

Restore and or enhance 180,000 acres of diverse pollinator habitat to provide high quality nectar during critical migration time periods (March 1 to Mid-April and Mid-September to November).

To meet the short term goals, Texas NRCS will promote conserving and enhancing diverse native plant communities, focusing on forbs, late blooming nectar plants, patch burning, and conservation management practices.

Outreach Activities

a. Landowner workshops about the monarchs and available conservation opportunities, i.e.:
   - Texas Parks and Wildlife Landowner Incentive Program
   - Wildlife Management Plans
   - NRCS Financial Assistance and Conservation Technical Assistance Programs
   - NRCS Plant Materials Center demonstration projects and workshops
   - Butterfly Garden Grants (through numerous nonprofits)
   - Texas PowWow Conferences
   - Promote Backyard Conservation through local NRCS field offices and Soil and Water Conservation Districts

b. Nonprofits and educational institutions – provide funding through agreements to nonprofit organizations that already have a butterfly garden grant program in place. i.e.:
   - The Native Plant Society of Texas has 32 chapters throughout the state including urban areas. Grants range from $40-$400; and, they provided 56 grants for a total of $11,000 in April of 2015.
   - Houston Urban Wildlife Refuge Partnership
   - Friends of Brazoria Wildlife Refuges
   - Texas Master Naturalist
   - Green Space Alliance of South Texas

c. Social Media – publicize apps like iNaturalist and others to encourage support of monarch butterfly conservation efforts. Develop a Monarch butterfly section on Texas NRCS website and connect monarch websites to it for easy access. For example:
   - Monarch Watch
   - Monarch Larva Monitoring Project
   - Journey North

d. Educational Pamphlet Development – conservation practices/photos, informational links.

e. Collectively work with conservation partners to promote and develop habitat through conservation planning, implementation, and education/outreach activities.

Conservation Planning

a) Develop a list of conservation practices with positive effects for Monarch Butterfly habitat (when and where they can be applied):
   a. Core Practices:
      i. Rangeland: (at least two practices to include UWHM)
         - Prescribed Grazing
         - Prescribed Burning
         - Range Planting
         - Upland Wildlife Habitat Management
      ii. Cropland/Pastureland
         - Conservation Cover
         - Conservation Crop Rotation
         - Contour Buffer Strips
         - Field Borders
         - Upland Wildlife Habitat Management
         - * all other practices will be can be used as facilitating practices provide training to field staffs about Conservation Planning and Pollinator Habitat to benefit the Monarch Butterfly

b) Review ecological site descriptions compared to National Resources Inventory (NRI) data.

c) Utilize joint habitat assessment tool when finalized for Texas.

USDA-NRCS Financial Assistance Programs for Land Owners and Managers

Wetlands Reserve Program (WRP)/Wetlands Reserve Easement (WRE):
- Create and enhance wetland wildlife habitat on 10 WRP easements in 2015-2016
- Target contiguous WRP easements in the Corsicana Resource Team
- 500 acres of estimated impact in 2015-2016
- Planned practices and estimated cost will be completed by the WRP team and ECS technical staff by July 10, 2015
- New plans will include practices to meet the resource concerns and objectives of Monarchs and pollinator habitat.

Grassland Reserve Program (GRP)/Agricultural Conservation Easement Program (ACEP):
- Identify and consider opportunities to plan and implement habitat practices
- New plans will include practices to meet the resource concerns and objectives of Monarchs and pollinator habitat.

Environmental Quality Incentives Program (EQIP)/Conservation Stewardship Program (CSP):
- In the planning phases, focus on habitat improvement conservation practices to restore, improve and or enhance pollinator habitat addressing Monarch Butterfly needs
- Review payment schedule to ensure monarch/pollinator friendly practices are addressed.

Addendum H. U.S. Fish and Wildlife Service - Southwest Region

The U.S. Fish and Wildlife Service (Service) Southwest Region is deeply invested in the conservation of pollinators and has welcomed the opportunity to step up for monarch conservation. The Service recognizes that the State of Texas is situated in the core of the migratory flyway for the Eastern monarch population and has the highest diversity of milkweed species in the United States with 37 known species. As such, Texas will play a vital role in monarch conservation due to its importance for both spring breeding while returning to the United States and fall nectar sources that fuel the butterfly's magnificent migration to Mexico.

In an unprecedented acknowledgement of the importance of pollinators, the Presidential Memorandum of June 2014 set the national direction for pollinator issues and called for a strategy to address four themes. These themes are:

1) **Research:** conducting research to understand, prevent, and recover from pollinator losses;

2) **Education:** expanding public education programs and outreach;

3) **Habitat:** increasing and improving pollinator habitat; and

4) **Partnerships:** developing public-private partnerships to accomplish these activities.

The subsequent May 2015 National Strategy to Promote the Health of Honey Bees and Other Pollinators expanded upon these priorities and invited Federal departments and agencies to take actions to restore pollinator populations across the nation. In response, the Director of the Service challenged our Regions to incorporate monarch and pollinator conservation into ongoing activities and highlight new opportunities, particularly in geographic areas within the migratory flyway. The Service's Southwest Region drafted a Regional Monarch Conservation Plan in November 2014, outlining our commitment to promoting monarch conservation and dedicating resources to fulfill the nation's ambitious goals.

In the spirit of advancing these efforts, the Texas Parks and Wildlife Department has taken a lead role in boosting the success in accomplishing these directives, while adding important components unique to Texas, such as tax incentives for private landowners and a focus on spring breeding and fall nectaring plants and habitats. With the development of the Texas Monarch and Native Pollinator Conservation Plan, the Texas Parks and Wildlife Department lights a clear path for Texans to contribute to monarch butterfly and pollinator conservation, while also expanding research and monitoring, education and outreach, habitat conservation, and partnerships. These efforts are in alignment with the best available science at state, regional, national, and international levels, and present a model for monarch, pollinator, and native grassland ecosystem conservation and coordination.

To support broad pollinator initiatives, over the past year, the Service's Southwest Region allocated $550,000 to monarch conservation in all four states (Texas, Oklahoma, New Mexico, and Arizona), with the majority going toward projects in Texas. With this funding, the Southwest Region was able to complete 25 habitat enhancement and restoration projects on approximately 66,170 acres this past year alone. Additionally, the Service obligated funds in the coming year for at least 16 additional projects to be completed by 2017. Through our Partners for Fish and Wildlife program, we crafted agreements in Texas to create urban gardens and outdoor classrooms, as well as produce native seed through partners—such as the Lady Bird Johnson Wildflower Center and the NRCS Plant Material Centers—to be used to enrich floral diversity in Texas grasslands. On August 20, 2015, Service Director Dan Ashe announced his commitment to spending "$4 million, starting in October, to support partnership-driven, landscape-scale monarch conservation projects." The Service is committed to continuing our efforts to support monarch butterflies and other pollinators in the State of Texas and throughout the Southwest Region.

The Service commends the Texas Parks and Wildlife Department on their strategic efforts to conserve monarchs and other pollinators, as outlined in the Texas Monarch and Native Pollinator Conservation Plan. Together, Texas Parks and Wildlife Department, the U.S. Fish and Wildlife Service, other State and Federal agencies, organizations, universities, and partners can raise awareness about the needs of monarchs and pollinators and offer guidance on how every citizen can participate. The beauty and notoriety of the monarch butterfly help carry forth the message, as the monarch is a flagship species for the native prairie ecosystems that historically occurred throughout Texas. What we do to help monarchs throughout Texas will also benefit all grassland species, including rare species. Conducting relevant research, teaching all citizens about monarchs, creating backyard habitats, improving condition for native prairies, and expanding native grasslands through restoration and enhancement actions—including prescribed burning, managed grazing, and native seed spreading—will directly benefit monarchs and other native species. We are devoted to developing and sustaining partnerships, like those in Texas, to reach the national goal of increasing the population to 225 million monarchs by 2020, while inspiring an urban and landscape restoration legacy into the future.

Addendum I . University of Texas at San Antonio

With the support and funding from the Texas State Comptroller's Office the University of Texas at San Antonio is conducting research focused on the monarch butterfly and preferred milkweed species in Texas. Following the monarch butterflies identification as a priority species within the state, this research project was developed by UTSA along with input from state agency experts, researchers, community and business leaders, and other interested stakeholders.

Research and Monitoring

With relatively limited data on Texas milkweed (Asclepiadaceae) population trends, resource requirements for germination and growth, and monarch preferred species within the state, it is important that these gaps in knowledge are addressed given the present state of the declining monarch population. In an effort to deal with these issues concerning changes in monarch populations and the crucial relationship that exists with native Texas milkweed, a combination of roadside and site specific surveys, greenhouse experiments, and field experiments are being conducted.

- **Surveys:** To evaluate changes in milkweed populations, species distribution, and the potential for species preference by monarchs among ecoregions, cross-Texas transects running east-west and north-south are being conducted each fall and spring following the migration, as well as surveys on larger land tracts.
- **Seed Viability and Germination:** Seeds collected from multiple milkweed species during the initial surveys or commercial seeds are being evaluated for viability and for germination responses to cold stratification, sulfuric acid, and gibberellic acid treatments.
- **Greenhouse Experiments:** Utilizing the facilities at the University of Texas as San Antonio experiments investigating the response of milkweed species to variations in light intensity, nitrogen levels, and drought tolerance.
- **Field Experiments:** Selected sites determined following initial surveys will be used to investigate the relationship between monarch butterfly success and milkweed patch size dynamics, and the effect the land management practices of grazing, mowing, and prescribed burning have on influencing milkweed or monarch variables.

Education and Outreach

The University of Texas at San Antonio is also developing outreach and educational programs designed for K-5 students. These programs will be administered by University faculty and staff and will target underrepresented students in the community and foster greater understanding of the natural world and environmental concepts. The curriculum will be centered on the monarch butterfly and delivered to area elementary schools along with a summer camp culminating the program.

Partnerships and Collaboration

The scope of this project and the importance of the topic at hand outlines the necessity for the program at UTSA to partner with federal, state, and non-governmental agencies to contribute toward the goal of monarch conservation in the U.S. Currently the U.S. Forest Service, U.S. Fish and Wildlife, Texas Parks and Wildlife Department, San Antonio River Authority, Guadalupe-Blanco River Authority, and the Guadalupe-Blanco River Trust have all helped in providing the support necessary for this vital project to be successful.

APPENDIX

Appendix A. Native Pollinator/Flower-visitor Species of Greatest Conservation Need in Texas

Scientific Name	Common Name
Andrena scotoptera	A mining bee
Apodemia chisosensis	Chisos metalmark
Bombus pensylvanicus	American bumblebee
Bombus sonorus	Sonoran bumblebee
Bombus variabilis	Variable cuckoo bumblebee
Celotes limpia	Scarce streaky-skipper
Cisthene conjuncta	A lichen moth
Coelioxys piercei	A cuckoo leaf-cutter bee
Colletes bumeliae	A cellophane bee
Colletes saritensis	A cellophane bee
Decinea percosius	Percosius skipper
Eucera birkmanniella	A longhorned bee
Euphyes bayensis	Bay skipper
Eupseudomorpha brillians	Brilliant forester moth
Holcopasites jerryrozeni	A cuckoo bee
Macrotera parkeri	A mining bee
Macrotera robertsi	A mining bee
Megachile parksi	a leaf-cutting bee
Oxyelophila callista	A snout moth
Perdita atriventris	A mining bee
Perdita dolanensis	A mining bee
Perdita fraticincta	A mining bee
Perdita tricincta	A mining bee
Petrophila daemonalis	A snout moth
Piruna haferniki	Chisos skipperling
Protandrena maurula	A mining bee
Pygarctia lorula	A tiger moth
Satyrium polingi	Poling's hairstreak
Sphinx eremitoides	Sage sphinx
Stallingsia maculosus	Manfreda giant-skipper

Appendix B. TPWD Wildlife Division: Wildlife Management Areas (WMA) and Activities in Regions 2 and 4

WMA	Total Area (Acres)	Estimated Monarch/ Native Pollinator Habitat (Acres)	Habitat Management Activities
Arroyo Colorado	215	100	Fallow disking
Atkinson Island	152	50	
Candy Abshier	209	175	Brush removal
Chaparral	15200	15185	Prescribed burning, fallow disking
Guadalupe Delta	7240	2500	Prescribed burning, livestock grazing, fallow disking, brush removal
J. D. Murphree	24516	150	Prescribed burning, brush removal
James E. Daughtrey	5610	5600	Prescribed burning, fallow disking, brush removal
Justin Hurst	17826	4000	Prescribed burning, livestock grazing, fallow disking, brush removal
Kerr	6460	3200	Prescribed burning, livestock grazing, brush removal
Las Palomas (multiple units)	2349	355	Fallow disking
Lower Neches	1437	100	Prescribed burning, brush removal
M. O. Neasloney	100	40	Prescribed burning, brush removal
Mad Island	7281	3500	Prescribed burning, livestock grazing, fallow disking, brush removal
Mason Mountain	5301	2500	Prescribed burning, fallow disking, brush removal
Matagorda Island	43893	21500	Prescribed burning
McGillivray and Leona McKie Muse	1972	446	Prescribed burning, livestock grazing, fallow disking, brush removal, range reseeding
Nannie M. Stringfellow	3553	2500	Fallow disking, brush removal
Redhead Pond	37	10	
Tony Houseman	3896	50	Pipeline vegetation management
Wintermann	246	200	Prescribed burning, brush removal
Powderhorn Ranch	17351	6800	Prescribed burning, livestock grazing, fallow disking, brush removal

Appendix C. TPWD State Parks Division: State Parks (SP) and State Natural Areas (SNA) Activities in Regions 2 and 3

SP/SNA	Total Area (Acres)	Estimated Monarch/ Native Pollinator Habitat (Acres)	Habitat Management Activities
Albert & Bessie Kronkosky	3814	950	Prescribed fire, brush removal, invasive species removal
Bastrop	6606	5300	Prescribed fire, brush removal, invasive species removal, native vegetation planting
Bentsen-Rio Grande Valley	798	566	Native thornscrub revegetation, forest flooding, invasive species removal, native pollinator garden maintenance
Blanco	105	30	Restoration of flood damaged riparian gallery forest
Buescher	1060	150	Prescribed fire, invasive species removal
Choke Canyon	2435	2041	Prescribed fire
Colorado Bend	5335	1800	Prescribed fire, brush removal, invasive species removal
Enchanted Rock	1639	900	Prescribed fire
Estero Llano Grande	241	69	Native thornscrub revegetation, invasive species removal, native pollinator garden maintenance
Falcon Lake	576	441	Native pollinator garden maintenance
Garner	2539	500	Prescribed fire, brush removal, invasive species removal
Goliad	188	114	Invasive species management, restoration/ management bottomland woodlands and prairie
Goose Island	321	157	Invasive species removal
Government Canyon	15100	3700	Prescribed fire, brush removal, invasive species removal, native vegetation planting
Guadalupe River	1939	1150	Prescribed fire, brush removal, invasive species removal
Hill Country	5366	1500	Prescribed fire, brush removal
Honey Creek	2294	1800	Prescribed fire, brush removal, invasive species removal
Inks Lake	1194	350	Prescribed fire, invasive species removal

SP/SNA	Total Area (Acres)	Estimated Monarch/ Native Pollinator Habitat (Acres)	Habitat Management Activities
Lake Casa Blanca	328	127	Invasive species management, native species revegetation
Lake Corpus Christi	388	227	Invasive species management, native species revegetation
Lockhart	273	174	Native species revegetation
Longhorn Caverns	637	100	
Lost Maples	2900	550	Prescribed fire, invasive species removal
Lyndon B. Johnson	760	350	Historic ranch/farm demonstration, invasive species management, habitat restoration
McKinney Falls	715	100	Invasive species control
Mustang Island	4080	2575	Prescribed fire, invasive species management, native species revegetation
Old Tunnel	17	10	Invasive species control
Palmetto	296	231	Invasive species management, native species revegetation
Pedernales Falls	5212	1550	Prescribed fire, brush removal
Resaca de la Palma	1200	671	Native thornscrub revegetation, invasive species removal, native pollinator garden maintenance
South Llano River	2743	550	Prescribed fire, invasive species removal

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