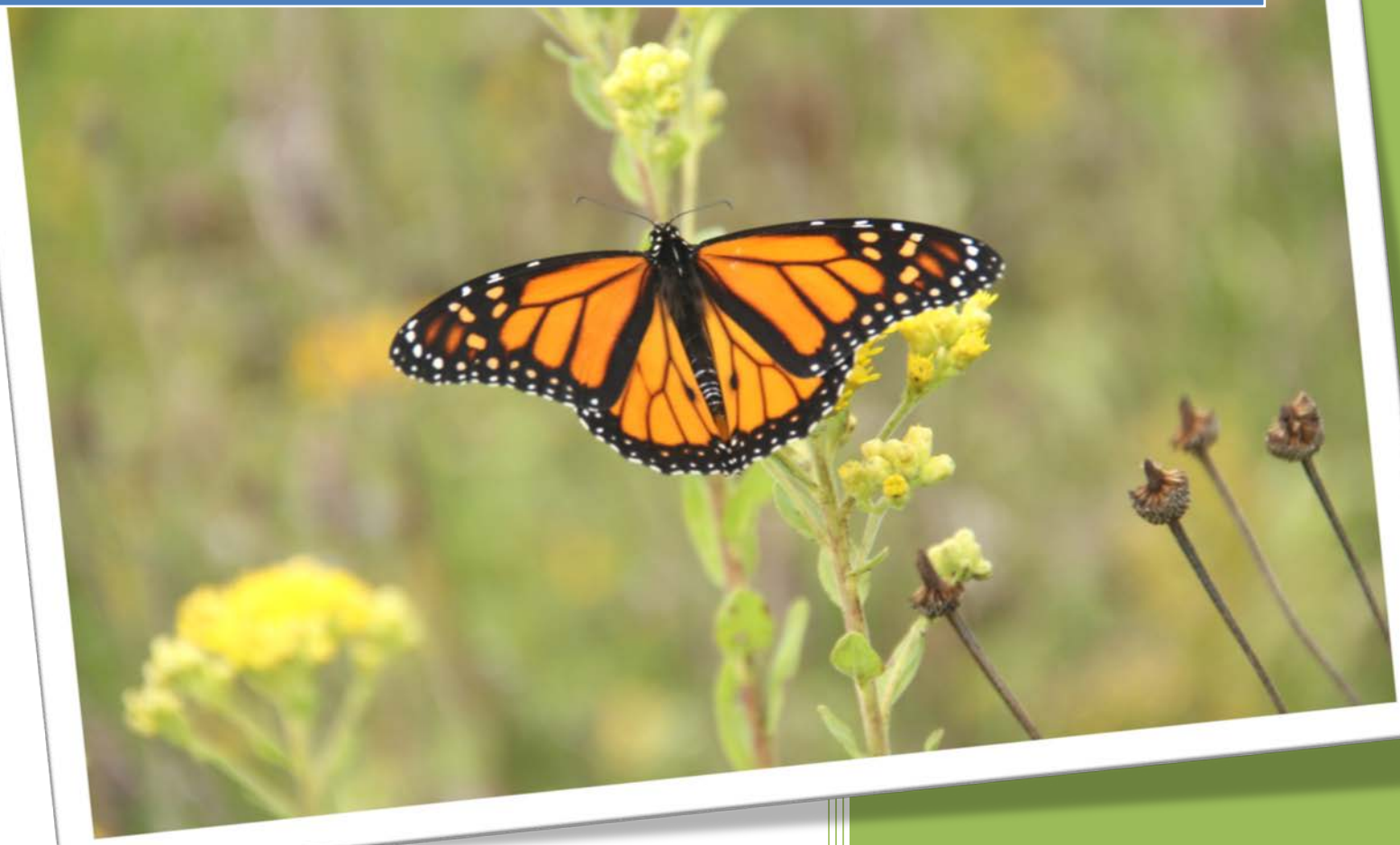
# 2017

# Monarch Conservation Implementation Plan



Prepared by Monarch Joint Venture Coordinator Wendy Caldwell with input from MJV Partners and Steering Committee

Monarch Joint Venture

11/14/2016

# Monarch Conservation Implementation Plan

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## Executive Summary

The Monarch Conservation Implementation Plan was derived from the North American Monarch Conservation Plan (CEC, 2008), and is updated annually by the Monarch Joint Venture (MJV), a national conservation partnership currently consisting of over 50 organizations working together to conserve the monarch migration.

North American Monarch Conservation Plan objectives include:

1. Threats Prevention, Control and Mitigation
2. Innovative Enabling Approaches
3. Research, Monitoring, Evaluation and Reporting
4. Education, Outreach, and Capacity Building

The Implementation Plan supports the above objectives by identifying and prioritizing monarch conservation actions in the United States and promoting cooperation between diverse organizations working together to achieve the goals outlined in the plan. The goals, strategies, objectives, and actions were contributed, prioritized, and reviewed by representatives from MJV partner organizations and the final plan was synthesized by the MJV Coordinator. If you have any questions regarding the plan, please contact the MJV.

The MJV is excited to be a part of a rapidly growing conservation movement. A 2014 Presidential Memorandum includes provisions specifically for monarch butterflies and in 2015 the U.S. government published a *Federal Strategy to Promote the Health of Honey Bees and Other Pollinators* that affirmed the commitment of federal agencies to monarch conservation. In addition, the pending petition to the U.S. Fish and Wildlife Service to consider listing monarchs as a threatened species under the Endangered Species Act is helping to drive monarch conservation efforts. Researchers, non-governmental organizations, academic institutions, and agencies have collaborated under the Monarch Conservation Science Partnership to identify targets for monarch conservation. This group has set an ambitious goal to increase the area covered by wintering monarchs in Mexico to 6 hectares by 2020, a population size that is at a substantially lower risk of declining to a point at which recovery would be unlikely.

As a primary means of reaching this goal, the central flyway of the U.S. has been identified as a high priority for habitat restoration efforts, including the addition of at least 1 to 1.5 billion milkweed stems and abundant nectar resources to support monarch reproduction and migration. Western habitat also serves as an important conservation focus because for many of the monarch butterflies in the west, the entire annual cycle of breeding, migrating, and overwintering occurs within the U.S. Research, monitoring, education, and outreach are also important aspects of the widespread national effort to achieve habitat goals for monarchs. Monarchs are a flagship species for pollinator and grassland conservation. Efforts to create, restore, or enhance monarch habitat will benefit a suite of other organisms; their charisma provides an opportunity to engage a broad and diverse set of stakeholders in conservation on a large scale.

Any individual or entity is encouraged to use this plan to identify and integrate priority monarch conservation actions into their existing or planned efforts. It will take widespread collaboration between all sectors to reach these ambitious goals and preserve the monarch migration for generations to come. As a national coordinating body, the MJV will help identify opportunities for collaboration between different entities, and support and guide conservation actions carried out by our partners. This annually updated plan serves as a guiding document to support ongoing or new conservation actions, recognizing that it will take an “all hands on deck” approach to reach our nation’s monarch population and habitat targets. The plan may also serve to inform other funding sources in an effort to better coordinate monarch conservation efforts throughout the U.S.

## Monarch Conservation Implementation Plan Priorities

The priority areas identified in this plan include:

1. Monarch habitat conservation on public and private lands, including enhancement and improved management of milkweed and nectar resources throughout monarch breeding and migration habitat, and of overwintering groves located along the California coastline.
2. Education and outreach to increase interest, awareness and engagement in monarch conservation efforts.
3. Research and monitoring of monarch populations and habitats to inform ongoing conservation work.

### *Monarch Habitat Conservation, Maintenance and Enhancement*

There is strong evidence that the primary threat to monarchs in the eastern U.S. is widespread loss of breeding habitat (Pleasants and Oberhauser 2012, Pleasants 2015), which includes milkweed (plants of the genus *Asclepias*, for the most part), the only viable food source for monarch larvae. Diverse nectar resources are also vital habitat components. While breeding and migratory habitat restoration and enhancement is important throughout the entire monarch range, two regions of the monarch's eastern range have been prioritized for increased action: the North Central region (i.e. "Corn Belt") and the South Central region. The Corn Belt (primarily IA, MN, WI, IL, IN, MI, OH, NE, KS, and MO) is important for restoration efforts that enhance summer breeding habitat. This region has historically produced a high percentage of the population that migrates to the overwintering grounds in Mexico each fall (Wassenaar and Hobson 1998, Oberhauser et al. 2001). The South Central region (primarily TX and OK) plays a significant role in supporting both the spring and fall migrations (Miller et al. 2012, Flockhart et al. 2013).

In the western U.S., much is still unknown regarding the location of monarch breeding areas and migratory pathways, and conservation strategies in the west focus on identifying this habitat, and protecting the wintering sites. There is some interchange between eastern and western populations, but the proportion of the western monarchs that overwinter in Mexico and their contribution to the eastern population is currently unknown.

### *Education to Enhance Awareness of Monarch Conservation Issues and Opportunities*

The monarch migration is one of the most magnificent and intriguing of all natural phenomena, and thus monarchs are an excellent flagship for pollinator conservation. Monarchs can inspire people to get involved in conservation by creating and restoring habitat beneficial to a wide variety of organisms.

Education and outreach are key to successful conservation, and should be targeted to maximize impact on monarch populations. To engage all sectors, clear messages for collective action to restore habitat for monarchs and other pollinators should be communicated as effectively as possible.

### *Research and Monitoring to Inform Monarch Conservation Efforts*

Research and monitoring efforts help us to understand many aspects of monarch conservation, including population trends and habitat quality and availability. Historically, citizen scientists have contributed greatly to our understanding of monarch biology and ecology, and continue to be a driving force in monarch conservation today. These volunteers, young and old, not only help researchers and conservationists understand monarch populations and habitat distribution, they inspire others to do the same and become invested in the conservation of monarchs beyond their monitoring activities (Lewandowski and Oberhauser, 2016). The Monarch Conservation Science Partnership (MCSP) is a consortium of scientists and conservation professionals from government, academia and NGOs. The group, formed in 2014, is working to understand threats to monarch populations at the landscape level, model population trends, and develop conservation tools. Through both citizen science research and professional research projects, new information can help inform ongoing conservation efforts and areas of greatest conservation need.

# 2016 Monarch Conservation Implementation Plan

**Priority Ranking Considerations:** The actions outlined in this plan are **all** important for monarch conservation. We recognize that individual or organizational priorities may vary, but we have assigned priority rankings established by MJV sub-committees made up of partner representatives, and agreed upon by the full partnership. For sections pertaining to the **western monarch population**, actions were prioritized based on their importance for western monarch conservation only; eastern or nationally relevant actions were ranked separately. Ranking levels are explained below:

- **High:** Actions with great potential to be implemented, to be highly successful, and to have a strong impact on monarch population numbers.
- **Med:** Actions ranked as medium priority may be ongoing efforts that have established a strong foundation but are in need of continual maintenance or improvement, or that are expected to have lower impacts on population numbers than those ranked a high priority.
- **Low:** If actions are well underway with appropriate resources and there is no or minimal need for long term maintenance, the action was given a low priority. In addition, low priority was given to actions for which the importance is unknown or that have relatively low effect on population numbers.

**Intended Audience:** This plan is intended to be used by any individual or entity implementing or funding monarch conservation activities (including, but not exclusive to, MJV partners) as a guiding document for the most important U.S. monarch conservation actions.

**Considerations for listed resources or projects:** This plan is a living document that will be updated as additional resources, research, or other relevant details are presented. The resources column is not intended to be comprehensive at this time. If you would like to submit details to be considered for adding to the plan, please email Wendy Caldwell, monarchs@monarchjointventure.org.

**Considerations for geographic scope of the Plan:** Recognizing that the three North American countries are responsible for different elements of monarch conservation, this plan focuses on actions that are to be conducted in the U.S., or for which the U.S. plays some role.

**Other considerations:** The letters preceding the objectives (H, E, R, and P) refer to the sections which they fall into. These include Habitat, Education, Research, and Program Development. ***Habitat*** for monarchs, whenever mentioned in the plan, refers to areas that include *both* milkweed and nectar sources for monarchs and other pollinators.

## GOAL 1: Monarch Habitat Conservation, Maintenance and Enhancement

### Strategy 1: Develop *Asclepias* and nectar resources for habitat enhancement on public and private lands, including verification of seed source.

| *Objectives* | *Actions* | *Priority* | *Resources* |
|---|---|---|---|
| **H-1:** Maintain milkweed distribution database | a) Evaluate and refine milkweed species distribution databases to guide selection of appropriate species for habitat enhancement work and seek integration of other appropriate databases. | Med | • BONAP: *Asclepias* page<br>• USDA PLANTS Database<br>• Xerces: Western Milkweed Survey<br>• SEINet (Arizona Chapter): Data Portal<br>• MNTaxa: The State of MN Vascular Plant Checklist<br>• iNaturalist groups:<br>  o Texas Milkweed and Monarchs: Observations<br>  o Milkweeds of the National Park Service<br>  o Milkweed is Asclepias |
| **H-2:** Maintain milkweed plant materials inventory | a) Update and improve milkweed supplier lists to include reliable sources of native, regionally-appropriate milkweed plants and seeds. | High | • Monarch Watch: Milkweed Market Plant Vendor List<br>• SWMS: List of Southwest Nurseries<br>• Xerces: Milkweed Seed Finder<br>• TPC: Plant Iowa Native website |
| | b) Assess of commercial availability of native, regionally-sourced milkweed seeds and plants. | Med | • MWfM: Monarch Recovery from a Milkweed's Point of View<br>• TPC: Assessing the Milkweed Seed Marketplace in IA |
| **H-3:** Promote commercial milkweed/forb seed and plant industry, including wholesale capacity and source assessments | a) Increase market demand (see Goal 2), and resources to encourage native plant producers to prioritize and propagate regionally appropriate milkweed and forb seeds and plugs, thus increasing commercial availability. Focus in ecoregions with limited plant availability. | High | • Luna and Dumroese (2013)<br>• MJV Webinar: Growing Milkweed for Monarch Conservation<br>• TPC:<br>  o Native Seed Production Manual<br>  o Natural Selections Program<br>  o Assessing the Milkweed Seed Marketplace in IA<br>• PCA: National Seed Strategy for Rehabilitation and Restoration<br>• Xerces:<br>  o Project Milkweed<br>  o Milkweeds: A Conservation Practitioner's Guide<br>**Notes:** Investigate tools like forward contracts. |
| | b) Promote long-term market demand for non-treated (i.e. without systemic insecticides) milkweeds and forbs. | High | |
| | c) Promote seed increase plots in the commercial native plant industry for recommended species to create long-term sources of native species in priority regions. | High | |

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| **H-4:** Promote native milkweed seed collection or purchase for distribution and restoration, including source assessments | a) Coordinate collection of native seed which is identified as locally sourced, and collaborate with native plant producers or distributers to grow and sell milkweeds appropriate for their ecoregion. | High | • BLM: Seeds of Success<br>• DBG: Great Milkweed Grow Out<br>• Monarch Watch: Milkweed Market<br>• PCA: 2015-2020 National Seed Strategy<br>• TPC:<br>  o Native Seed Production Manual<br>  o Natural Selections Program<br>• Xerces: Project Milkweed |
| | b) Expand milkweed plug production efforts, including solicitation, receipt, cleansing of seeds, growing and distribution of milkweed plugs. | High | |
| | c) Support procurement of milkweed and nectar plant seeds for use in restoration projects. | High | |
| **H-5:** Promote regional, high quality, diverse seed mixes for monarch and pollinator restoration projects | a) Develop and integrate regionally appropriate, diverse native seed mixes into ongoing restoration or enhancement projects. Evaluate mixes for establishment success, vegetation stability, stand longevity, monarch use throughout the growing season, commercial availability, and attractiveness to consumers and refine recommendations as research progresses (see R-12-2). | High | • Heather Holm: Pollinators of Native Plants<br>• LBJWC: Native Plant Information Network<br>• Native Plant Societies<br>• NRCS: Monarch Habitat Development Project<br>• P2:<br>  o Ecoregional Planting Guides<br>  o Monarch Fueling Planting Guides (eastern U.S.)<br>• TPC:<br>  o Designing Native Seed Mixes<br>  o Seed Mix Calculator<br>  o Seed mix design and establishment mowing.<br>• USDA Science and Technology Webinar: *Matching Appropriate Seed to Conservation Practices*<br>• Xerces:<br>  o Pollinator Conservation Resource Center<br>  o Monarch Nectar Plant Lists |
| | b) Work with NRCS and other agencies and NGOs to expand state seeding specifications to include broader list of available forbs for use in conservation program seedings. Write and distribute model bid specifications for large buyers of native plant seed that will encourage the use of regionally-sourced native plant materials, and encourage buyers and seed mix designers to include appropriate *Asclepias* spp. in their mixes. | High | |

| Strategy 2: Create, restore, enhance, and maintain habitat on public and private lands. | | | |
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| **H-6:** Provide monarch habitat development guidelines to assist land managers | a) Provide guidance for prioritizing and obtaining regionally appropriate seeds and plugs for restoration or enhancement projects. | Med | • NRCS: Monarch WHEGs (Midwest and S. Great Plains<br>• MJV:<br>o Breeding Habitat Assessment Tool,<br>o Webinar: Habitat Restoration Fundamentals<br>o Webinar: Enhancing existing landscapes for monarchs and native pollinators<br>• NWF (and other partners): How to plan a statewide monarch conservation summit<br>• P2: Monarch Habitat Development Manuals<br>• Prairie Resto: Guidelines for Establishing a Prairie<br>• TPC: Prairie Reconstruction Tech Guides Series #6-10<br>• Xerces:<br>o Pollinators in Natural Areas<br>o Pollinator Habitat Installation Guides<br>o Pollinator Resource Center<br>o Develop and disseminate guidance on BMPs for public lands in West<br>**Notes:** Always consider broad conservation goals when restoring or enhancing habitat. For example, boosting a remnant prairie by adding milkweed is not encouraged. |
| | b) Broadly disseminate and promote regional guidelines on monarch habitat (breeding and migratory) development for different habitat types through online resources and a targeted training program (see E-8) for different land management audiences. | Med | |
| **H-7:** Promote monarch conservation by public agencies | a) Facilitate information exchange and cooperation between land management agencies (federal, state, and local municipalities) to encourage and recognize monarch and other pollinator habitat best management practices, monitoring opportunities, resource opportunities, and educational programming. | High | • AFWA, MAFWA, USFWS, NWF, PF, MJV, various states: State monarch conservation planning efforts, summit planning guide<br>• Regional coordination through AFWA.<br>• MCSP<br>• 2014 Presidential Memorandum<br>• 2016 Executive Order: Directing Steps to Reverse Pollinator Decline and Restore Pollinator Health in MN<br>• High-Level Working Group for Monarch Conservation<br>• USFWS: Monarch Butterfly Conservation Initiative<br>• USFS: Monarch Butterfly Program<br>• NPS: Pollinator Website<br>• NRCS: Monarch Habitat Development Project<br>• PCA: 2015-2020 National Seed Strategy |
| | b) Encourage partnerships and cooperation between public and private programs to maximize reach and efficiency of habitat restoration projects. | High | |
| | c) Create and implement policy change and encourage use of citizen advisory committees. | High | |

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| **H-8:** Promote monarch-conservation on public and private rights-of-way | a) Encourage county, state, and federal roadside management and public and private utility programs (and surrounding private landowners) to include monarch and pollinator friendly management in ROW areas. | High | • Baum and Sharber (2012)<br>• ERC: Rights-of-Way as Habitat Working Group<br>• FHA: Resources for Pollinator-Friendly Practices<br>• Fischer et al. (2015)<br>• IVM Partners<br>• "Monarch Highway" Partnership: I-35 State DOTs and other agencies.<br>• Ch. 17 Monarchs in a Changing World: Biology and Conservation of an Iconic Butterfly (2015).<br>• MJV Webinar: Enhancing existing landscapes for monarchs and native pollinators<br>• P2: Monarch Habitat Development Manuals and Roadside Technical Manuals<br>• TPC: Integrated Roadside Vegetation Management<br>• TPC: Hydroseeding Survey of IRVM Counties in Iowa<br>• Xerces: Pollinators and Roadsides web page<br>• Xerces: FHA Literature Review |
| | b) Provide recommendations and best management practices to all levels of decision makers to encourage habitat establishment and maintenance in ROWs, taking into consideration limitations ROW managers face. | High | |
| | c) Encourage the inclusion of pollinator gardens or natural areas with interpretive displays at rest areas and other high visibility areas. | Med | |
| **H-9:** Increase planting and maintenance of small habitats for monarchs | a) Provide guidelines for small scale garden or habitat development throughout the breeding and migratory range in various landscape types. Encourage resource support for, registration of and interpretive displays at these areas to promote ongoing site maintenance and increased public engagement in monarch conservation. | Med | • NPSoT: Garden Grants<br>• MAG: Pollinator Habitat Grants<br>• Monarch Lab: Schoolyard Garden Grants<br>• MJV: Gardening for Monarchs<br>• MJV: Schoolyard Butterfly Gardens<br>• Monarch Watch: Waystation Brochure<br>• NABA: Butterfly Garden and Habitat Program<br>• NPGN: Million Pollinator Garden Challenge<br>• NWF: Garden for Wildlife<br>• NWF: Mayors' Monarch Pledge<br>• NWF: Monarch Conservation in America's Cities Guide<br>• USFWS, Field Museum: Urban Monarch Landscape Conservation Design<br>• USFWS: Schoolyard Habitat Programs<br>• WO: Wild for Monarchs Brochure<br>• Wildlife Habitat Council<br>• Xerces: Bring Back the Pollinators |
| | b) Facilitate and promote community or regional habitat networks through outreach to municipalities, urban land managers or landscapers, and relevant businesses, corporate campuses or associations. | Med | |

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| **H-10 :** Increase monarch habitat in agricultural areas | a) Develop and promote recommendations for placement within the agricultural landscape that should be targeted for restoration, taking into consideration potential for exposure to pesticides. (See also R-13-d) | High | • EDF: Monarch Habitat Exchange<br>• Keystone Monarch Collaborative<br>• MJV:<br>o Monarch Habitat on Farms<br>o Breeding Habitat Assessment Tool<br>o Webinar: Habitat Restoration Fundamentals<br>o Webinar: Enhancing existing landscapes for monarchs and native pollinators<br>• NRCS:<br>o Monarch Habitat Development Project<br>o Using Farm Bill Programs for Pollinator Conservation<br>o Monarch WHEGs<br>• PF: Honey Bee and Monarch Butterfly Partnership<br>• P2:<br>o Monarch Habitat Development Manuals<br>o Bee Friendly Farming<br>• Prairie Resto: Guidelines for Establishing a Prairie<br>• Restoration Agriculture, by Mark Shepard<br>• TPC:<br>o Prairie on Farms<br>o Prairie Reconstruction Tech Guides Series #6-10<br>• Xerces:<br>o Pollinators in Natural Areas<br>o Pollinator Habitat Installation Guides<br>o Pollinator Resource Center<br>o Guidance to Protect Habitat from Pesticide Contamination |
| | b) Identify existing and potential agricultural production systems compatible with monarch habitat, and devise strategies to maintain and expand these systems (e.g., cost sharing, market incentives, and certification programs) to create markets for ecosystem services. | High | |
| | c) Create and utilize demonstration sites in agricultural areas to encourage on or near farm/ranch habitat installation or enhancement. (see also E-8). | High | |
| | d) Disseminate habitat development and maintenance guidelines for working and non-working agricultural lands. | High | |
| | e) Connect landowners with opportunities or incentives through Farm Bill or other conservation programs, or other NGOs who do on-farm research and education to create, enhance, or manage lands to support monarchs. Investigate current policies and make recommendations to enhance opportunities for habitat creation. | High | |
| | f) Investigate and promote agricultural production that provides nectar sources (e.g., red clover cover crop, grazing management, prairie hay, delayed haying). | Med | |
| | g) Provide guidance for prioritizing and obtaining regionally appropriate seeds and plugs. | Med | |

| Strategy 3: Address overwintering habitat issues in California. | | | |
|---|---|---|---|
| **H-11:** Assess and manage conditions at western overwintering sites | a) Conduct coast-wide assessment of habitat conditions and willing partners for conservation at overwintering sites in California. | High | • Xerces Society:<br>o Western Monarch Count Resource Center<br>o State of the Monarch Butterfly Overwintering Sites in California<br>o With USFWS: Western Monarch Habitat Suitability Assessment Project<br>o Development of CA overwintering site management plans<br>**Examples:** CDFW, SWCDs or land trusts could hold conservation easements; CA Coastal Commission could designate overwintering groves as Environmentally Sensitive Habitat Areas. |
| | b) Develop, promote and implement technical guidelines and conservation plans for adaptive, site-specific management and conservation of overwintering sites in California (see also R-1-b). | High | |
| | c) Promote special designations in land use plans or develop conservation easements (on private lands) to protect overwintering sites in California. | High | |

## GOAL 2: Education to Enhance Awareness of Monarch Conservation Issues & Opportunities

### Strategy 1: Raise awareness to increase conservation actions and support for monarchs.

| *Objectives* | *Actions* | *Priority* | *Resources* |
|---|---|---|---|
| **E-1:** Utilize and promote Monarch Joint Venture as an information clearinghouse for monarch conservation in the U.S. | a) Contribute new and share existing web resources to increase awareness and share information about monarch conservation. | High | • MJV:<br>o www.monarchjointventure.org, www.plantmilkweed.org<br>o Downloads and Links<br>o Monarch Conservation Webinar Series<br>o FAQs<br>o Partner monarch conservation efforts/projects<br>o Communications Plan<br>o News and Events |
| | b) Contribute recent and relevant research, monitoring, habitat, and education efforts, along with best practices guidelines to be communicated more broadly. | High | |
| | c) Share relevant monarch conservation webinars and contribute suggestions for additional material. | Med | |
| | d) Utilize existing translated materials and contribute Spanish or French translations of materials for distribution, dependent on demand for those materials. | Low | |
| **E-2:** Expand outreach at conferences, meetings | a) Attend and participate in or speak at stakeholder meetings and conferences to engage broad audiences in monarch conservation. Develop and disseminate consistent messaging to engage audiences reached at these events. | Med | • MJV Communications Plan |
| **E-3:** Expand communication to different audiences | a) Facilitate development and sharing of collaborative, science-based messaging for use with different audiences. | High | • CEC: Monarch Butterfly Communication and Education<br>• MJV Communications Plan<br>• MJV and NCTC Webinar Series<br>• NWF: Butterfly Heroes<br>• USFWS: Human Dimensions Project |
| | b) Identify priority audiences for increasing monarch conservation actions and leverage partners to effectively communicate conservation needs to those audiences. | Low | |
| **E-4:** Mitigate negative perceptions and barriers preventing | a) Encourage inclusion of diverse native plants in restoration efforts, decreased pesticide use, and adoption of pollinator friendly management practices. | High | • MJV:<br>o Downloads and Links<br>o Monarch and Milkweed Misconceptions |
| | b) Identify and promote successful example projects or initiatives, sharing relevant background research, resources, and messaging that can be adapted for different situations. | High | |

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| planting of native habitat | c) Inform audiences about the importance of planting locally-sourced seeds and plugs. | High | |
| | d) Communicate need for production and purchase of milkweed and nectar sources that are free of systemic insecticides to consumers and producers, and encourage appropriate marketing of non-treated plants. | High | |
| | e) Develop materials to address concerns about weediness and milkweed toxicity. | Med | |
| **E-5:** Promote toolkits and customizable templates for consistent communication | a) Gather information to identify successful (or not successful) campaigns, resources, messaging, or strategies for implementing conservation activities with different audiences. | High | • MJV website and outreach (as a platform for dissemination of these materials) |
| | b) Develop and promote "how-to" templates or toolkits for conservation, education, or research actions, integrating partner insights into easily customizable frameworks to share broadly. | | |
| **E-6:** Improve outreach to media and the press | a) Provide and share press releases, interviews, or targeted articles for various media outlets to promote collaborative efforts and encourage greater participation in monarch conservation from different sectors. | Med | • MJV partners |

<table>
<tr><th colspan="4">Strategy 2: Increase learning about monarchs and their habitat in formal and informal settings.</th></tr>
<tr><td rowspan="5"><u>E-8:</u> Promote monarch education for both formal and informal audiences</td><td>a) Integrate monarch citizen science opportunities into education efforts.</td><td>High</td><td rowspan="5"><ul><li>Ba’s Relief, LLC</li><li>JN:<ul><li>Symbolic Migration</li><li>Informational lessons</li></ul></li><li>MJV Downloads and Links<ul><li>Meet the Monarchs Webinar</li></ul></li><li>Monarch Lab:<ul><li>Monarchs and More Curriculum</li><li>Schoolyard Ecology Explorations Curriculum</li><li>Driven to Discover Monarch Curriculum</li><li>North American Monarch Institute</li></ul></li><li>MLMP: Online Training Series</li><li>Monarch Live! A Distance Learning Adventure</li><li>Monarch Teacher Network: Teacher workshops</li><li>NWF: School Case Studies and Funding Resources and Lego’s Monarch Mission curriculum</li><li>TWA Youth On-Demand Webinar The Magic of Monarchs</li></ul></td></tr>
<tr><td>b) Seek opportunities to deliver monarch conservation information and opportunities to professional networks through meetings or conferences.</td><td>High</td></tr>
<tr><td>c) Identify, evaluate, and recommend existing, relevant curricula or educational activities for different age groups, applying current standards when relevant.</td><td>Med</td></tr>
<tr><td>d) Provide and support monarch conservation educational events or celebrations for the general public (e.g. youth groups, garden clubs, monarch festivals, etc.)</td><td>Med</td></tr>
<tr><td>e) Expand teacher and environmental education workshops (train-the-trainer) in priority areas to strengthen monarch learning networks.</td><td>Med</td></tr>
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| Strategy 3: Foster networking between stakeholders involved in monarch conservation. | | | |
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| **E-9:** Facilitate and support monarch specialist groups | a) Provide communication, networking, and relationship building opportunities for monarch specialist groups to share experiences, lessons learned and resources. | High | • MLMP: Training Framework<br>• Monarch Watch: Conservation Specialist Group |
| | b) Create science-based toolkits designed for trained specialists to teach key principles of habitat establishment and management, habitat and population monitoring, and other education or outreach opportunities. | High | |
| | c) Provide support materials to monarch specialist groups to aid in education/outreach efforts. | Med | |
| **E-10:** Facilitate information sharing and tracking | a) Effectively catalogue and communicate monarch conservation efforts, resources, and potential partners or opportunities. Connect individuals and organizations with relevant projects or opportunities in their area. | Med | • MJV website: www.monarchjointventure.org<br>• CEC:<br>o North American Monarch Conservation Plan<br>o Engaging Farmers and Other Landowners to Support Monarch Butterfly and Pollinator Conservation<br>• EWCL: Monarch Highway "Power Map" Project<br>• Listservs<br>o DPLEX<br>o Western Monarchs<br>o Pollinator<br>o MJV Partners<br>• Trilateral Working Group for Communications<br>• USFWS: Conservation Efforts Database for Monarch Conservation Project (in development) |
| | b) Facilitate or encourage continuing communication and cooperation between U.S., Canada, and Mexico. | Med | |

## GOAL 3: Research and Monitoring to Inform Monarch Conservation Efforts

***Actions that have trinational considerations are indicated with **.***

### Strategy 1: Assess monarch habitat and population status trends.

| *Objectives* | *Actions* | *Priority* | *Status* | *Resources* |
|---|---|---|---|---|
| **R-1:** Improve U.S. overwintering site assessment and habitat and population monitoring | a) Support continued monitoring of the western monarch population and habitat at current and historic overwintering sites in California; use findings to identify priority sites for restoration or enhancement. | High | | • Xerces:<br>o Western Monarch Count Resource Center<br>o Overwintering Site Habitat Assessment Form<br>• **Examples:** promote use of habitat assessment tools during Thanksgiving counts. |
| | b) Define metrics to assess the effectiveness of site management and restoration of overwintering sites. | Med | | |
| | c) Identify microclimate requirements of overwintering monarchs in California. | Med | | |
| | d) Determine whether existing protocols (e.g. the Western Monarch Thanksgiving Count) adequately estimate monarch population size and develop and implement new protocols if necessary. | Low | | |
| **R-2:** Improve understanding of western population drivers | a) Build western population demographic model, considering potential connections or contributions to or from eastern population. | High | | • Cheryl Schultz (WSU), Xerces, and USFWS |
| | b) Develop Population Viability Analysis for western monarchs to construct biological target(s). | | | |
| **R-3:** Document known monarch breeding area and migratory corridors/path ways in the western U.S. | a) Improve and distribute existing online western milkweed survey to a broad base of recipients and update map of milkweed/breeding locations with new information. | Med | | • Xerces and USFWS Western Monarch and Milkweed Habitat Suitability Assessment Project and Western Milkweed Survey and Occurrence Database<br>• Western Habitat Suitability Model (produced from Habitat Assessment Project listed above).<br>• NPS: Southwest Exotic Plant Management Team developing monarch/milkweed mapping project in southwestern U.S. |
| | b) Build western habitat suitability model(s). | Med | | |
| | c) Support tagging efforts to improve knowledge of monarch movement throughout the region, especially in Rocky and inter-mountain west and rocky mountain west. | Med | | • Monarch alert (CA)<br>• SWMS (AZ, NV, NM, CA deserts, UT, CO)<br>• Pacific Northwest tagging program (OR, WA, ID) |

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| **R-4:** Improve understanding of monarch population demography | a) Assess parameters for obtaining increased precision of stage-based demographic model, including migration success, fecundity of overwintered females, and immature survival. | High | | • MCSP:<br>o A trans-national monarch butterfly population model and implications for regional conservation priorities (accepted publication).<br>o **In progress:** MCSP Threats model and tools<br>o Integrated Monitoring Framework |
| **R-4:** Develop and use breeding habitat assessment tools | a) Coordinate, standardize, and validate monarch habitat assessment or evaluation tools. | High | | • Monarch Lab: Breeding Habitat Assessment Tool<br>• Xerces: Pollinator Habitat Assessment Form and Guide<br>• EDF Habitat Quantification Tool for Habitat Exchange<br>• MCSP Integrated Monitoring Framework<br>• NRCS: WHEGs |
| | b) Develop online habitat evaluation and scoring system with data storage and retrieval capacities (see also R-6). | Med | | |
| | c) Identify existing habitat assessment tools and make connections to integrate conservation actions that benefit multiple species. | Low | | |
| **R-5:** Develop and implement a national monitoring program | **a) Encourage open access to data that are already being gathered by monitoring entities. | High | | • MonarchNet |
| | ** b) Continue to develop and implement monarch monitoring data aggregation, standardization and coordinated analysis and data exchange (incorporating programs that monitor monarch breeding, migrating and overwintering numbers and survival). | | | |
| **R-6:** Maintain records of habitat created and monarch conservation efforts | a) Estimate acres of existing monarch habitat in different landscapes. | High | | • USFWS: Conservation Efforts Database for Monarch Conservation (in development)<br>• Monarch Lab:<br>o Midwest roadside milkweed assessment<br>o With Prairie Resto, NRCS: Evaluating monarch habitat, restoration, and management in the Midwest<br>o With the Field Museum: Urban habitat monitoring |
| | b) Create a database to track new habitat creation and devise a strategy to ensure that new habitat is reported. | High | | |
| | c) Evaluate previously reported or restored habitat to determine longevity or loss of that habitat. Identify methods used in establishing successful, long term habitats. | High | | |
| | d) Develop strategy for tracking and evaluating monarch conservation activities and effectiveness. | Med | | |

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| **R-7:** Determine areas of highest monarch overwintering contributions | a) Analyze tagging data to provide yearly estimates of monarch migratory success from different regions. | High | | • University of Guelph conducting isotope study.<br>• Morris et al. (2015)<br>• Monarch Alert<br>• Monarch Watch<br>• Southwest Monarch Study |
| | b) Repeat isotope or similar study to determine variation in relative importance of different breeding regions. | Med | | |
| | c) Study interchange of eastern and western monarchs, and proportion of western monarchs that overwinter in Mexico using stable isotopes and cardenolide fingerprinting. | Med | | |

| Strategy 2: Expand monarch monitoring efforts, data exchange, and data analysis to inform conservation efforts | | | | |
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| **R-8:** Address data gaps in research and monitoring efforts | a) Recruit and train monitors (see E-8) to fill temporal and spatial data gaps in existing monarch and butterfly monitoring programs to inform reliable regional estimates of monarch habitat, populations and trends. | High | | • MJV: Citizen science training programs (agenda, slides, evaluation tools)<br>• MJV Handout: Monarch Citizen Science<br>• MJV web page: Citizen Science Opportunities<br>• MCSP Integrated Monitoring Framework<br>• Xerces, USFWS, IDFG, WDFW Western Monarch Milkweed Mapper (expected Dec 2017) |
| | b) Use and share appropriate and consistent evaluation tools (e.g., pre- and post-training surveys) to improve training programs and protocols. | Med | | |
| **R-9:** Expand, coordinate and share tagging data (all tagging programs) | a) Enter, clean, and analyze tagging data. | High | | • Monarch Alert: Tagging Program<br>• Pacific Northwest: Tagging Program<br>• Monarch Watch: Tagging Program<br>• SWMS: Tagging Program<br>• MonarchNet |
| | b) Develop ways to visualize tagging data, and share aggregated data to allow visualization and use. | High | | |
| | c) Develop and encourage use of standard protocol for geo-referencing tagging data (tagging site and recovery location). | Med | | |
| **R-10:** Develop monitoring apps to improve volunteer reporting | a) Continue to develop user-friendly mobile device apps for monarch monitoring programs, encourage collaborative reporting when possible, and integrate with national monitoring framework. | High | | • Naturedigger: Monarch SOS for iOS<br>• JN mobile app |
| **R-11:** Maintain western overwintering site database | a) Restructure existing database to better capture incoming Thanksgiving Count population and habitat assessment data, and continue to refine spatial data based on annual habitat assessments. | Med | | • Xerces: Western Monarch Count Resource Center<br>• Monarch Alert |
| | b) Address data sensitivity issues to develop version of western overwintering site database that can be shared publicly. | Med | | |
| | c) Maintain Western Monarch Count website and develop capacity for citizen scientists to upload overwintering site monitoring data directly online. | Med | | |

| Strategy 3: Research to improve creation of monarch breeding and migrating habitats on different scales. | | | | |
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| **R- 12:** Determine role of small-scale habitats in monarch conservation (see also R-13) | 1) Use social research to understand current and achievable adoption rates of habitat conservation action, monitoring data to understand the outcome of citizen participation, and the Monarch Conservation Science Partnership "storylines" model to understand biological impacts of reasonable adoption rates. | High | | • USFWS, Field Museum: Urban Monarch Landscape Conservation Design<br>• MCSP Storylines paper (in review)<br>• Decision support tool MCSP (in development)<br>• USFWS human dimensions project |
| **R-13:** Increase understanding of relative habitat quality at the patch and landscape scales | a) On the landscape scale, establish regionally appropriate targets for the spatial distribution and scale of monarch habitat. | High | | • Cheryl Schultz (WSU) and Tyler Grant/Steve Bradbury (ISU) are looking at monarch movement. Build on Zalucki papers.<br>• DBG is studying use of monarch habitat by other beneficial species in the Southwest. |
| | b) Determine how milkweed and nectar plant diversity, abundance and distribution affect monarch reproduction, survival, and movement. | High | | |
| | c) At the patch level, study site preparation, seed mix design, planting practices and stand management. Identify practices tailored to regions and habitat types that achieve a) successful establishment, stability, and long term persistence of patches, and b) optimum milkweed density and nectar source diversity. | High | | |
| | d) For habitat established in intensively farmed landscapes within or near fields treated with pesticides, assess pesticide exposure and monarch survival and recruitment. | High | | |
| | e) At landscape and patch levels, document and study use of monarch habitat by other beneficial species. | Med | | |

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| **R-14:** Increase understanding of milkweed propagation and cost-effective habitat establishment | a) Determine best management practices for newly-seeded habitat to maximize the rate of milkweed establishment and vigor. | Med | | • Monarch Watch, MJV: Growing Milkweed for Monarch Conservation<br>• Monarch Watch: Milkweed Market<br>• Xerces: Milkweeds: A Conservation Practitioner's Guide |
| | b) Determine the effects of using plugs vs. seeds, especially for higher cost seeds. | Med | | |
| | c) Determine how to manage plants to maximize contributions to local seed bank ("mother plants"). | Med | | |
| | d) Determine when, how, and resources needed to best improve existing habitat vs. restore habitat from scratch using a decision analysis tree. | High | | |
| | e) Identify natural factors that limit milkweed distribution (elevation, soil, light, latitude, temperature, precipitation) to inform region- and site-specific seed mixes. For sites that lack milkweed entirely, determine what barriers exist to natural colonization (e.g., lack of local seed source, competition, inadequate soil moisture, or disturbance). Tailor interventions to fit the situation. | Med | | |
| **R-15:** Leverage benefits of monarch habitat | a) Identify shared geospatial priorities and leverage actions in areas that benefit multiple species. | High | | |
| **R-16:** Improve understanding of social factors influencing monarch conservation | a) Conduct stakeholder analyses, assessing the effectiveness of efforts to engage them. | Med | | • USFWS: Human Dimensions Project |
| | b) Identify social science research relevant to monarch conservation. | Low | | |

| Strategy 4: Study the effects of diseases, non-native species, and changing environment on monarchs and their habitat | | | | |
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| **R-17:** Explore effects of non-native milkweed on monarchs | a) Continue to assess the prevalence of O.e. (*Ophryocystis elektroscirrha)* in monarchs in managed gardens throughout the year, and use data to provide recommendations to minimize spread of disease. | High | | • Monarch Alert<br>• Monarch Health: Latest Research<br>• MJV: Potential Risks of Growing Exotic Milkweed for Monarchs<br>• USFWS project in southern California to explore non-migratory behavior, contact Samantha Marcum. |
| | b) Determine status of non-migratory populations in the U.S. and whether non-migratory behavior is becoming more common for monarchs in the southern U.S. and coastal CA. Continue to assess the diapause status of migrating monarchs and develop standard, repeatable protocols based on existing research. | High | | |
| | c) Continue to measure the prevalence, species, and management of milkweed in gardens in the southern US, including near California overwintering sites. | Med | | |
| | d) Develop management recommendations to limit year-round breeding of monarchs in CA and the southern US, encouraging gardeners not to grow *Asclepias curassavica*, and promoting diverse nectar plants as an alternative. | Med | | |
| **R-18:** Assess effects of plant pests and diseases, and invasive species on monarchs and their habitats. | c) Assess effects of fire ants and fire ant control on eastern monarchs. | High | | • MJV Handout: Invasive Species Alert<br>• **Examples:** Assess effects of eucalyptus tortoise beetles and eucalyptus longhorned borers (*Phoracantha* sp.) on the health of trees at California monarch overwintering sites. Assess milkweed yellows phytoplasma, pitch canker on Monterey pine, leaf beetle on Eucalyptus. |
| | b) Assess impacts, occurrence, spread and use of different habitats of non-native herbivores (e.g. *Aphis nerii*) that negatively impact milkweeds. | Med | | |
| | d) Determine impacts of and possible solutions to insect pests and tree diseases on overwintering habitat quality. | Med | | |
| | a) Assess *Vincetoxicum* spp (e.g. *Cynanchum louisea, Cynanchum rossicum*) abundance, attempted use by monarchs and possible control methods in areas where it is currently located. | Med | | |
| | f) Determine impacts of and possible solutions to insect pests and tree diseases on overwintering habitat quality. | Med | | |
| | g) Assess impacts of invasive plant species on monarch habitat. | Med | | |
| | e) Assess the extent and impacts of milkweed diseases and provide recommendations for management. | Low | | |

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| **R-19:** Assess impact of weather and climate conditions on monarchs and their habitat | a) Conduct climate vulnerability assessment to determine the consequences of climate, changing climate, and extreme climate events on monarchs and their habitat. | High | | • Zipkin et al. in progress |
| | b) Determine influence of topography, weather, microclimate, soil moisture, and other abiotic factors on monarch populations and movements. | Med | | |
| **R-20:** Assess effects of chemical additions to habitat | a) Study effects of road salt, insecticides, fungicides, herbicides, and fertilizers on monarchs and milkweed (including associations with mycorrhizal fungi) and develop recommendations for mitigating risks. | High | | • ISU project studying neonicotinoid use and monarchs, contact Steve Bradbury.<br>• Purdue University project to assess toxicity levels of common agricultural pesticides and other agricultural chemicals on monarch larvae, contact Ian Kaplan<br>• Emilie Snell-Rood research on road salts and heavy metals. |
| | b) Determine exposure level risks for different chemicals, habitat types or practices. | | | |
| **R-21:** Assess effects of other (non-O.e.) pathogens and natural enemies on monarchs | a) Study monarch interactions with predators and parasitoids to determine the effects of other natural enemies on population dynamics. | Med | | • Monarch Lab: Publications<br>• MLMP: Activity 3 |
| | b) Study the prevalence, transmission, and identity of monarch pathogens and their interactions with O.e., other natural enemies, host plant species and host plant nutritional quality. | Low | | |

| GOAL 4: Monarch Joint Venture Program Development | | |
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| *Objectives* | *Actions* | *Priority* |
| **P-1:** Increase fundraising and leveraging partnerships | a) Expand fundraising strategy to increase sponsorship and private donations to the MJV. | High |
| | b) Identify and pursue funding opportunities for priority conservation projects by pairing opportunities with relevant partners and collaborating to develop grant proposals. | |
| | c) Encourage partners to identify opportunities for additional program funding. | |
| | d) Partners to identify opportunities to build priority monarch conservation, education, or research into their existing programs as in-kind contributions. | |
| **P-2:** Expand partnership | a) Maintain steering committee that represents different sectors of the partnership. | Med |
| | b) Refine partner application and approval process (e.g. define partner selection criteria). | |
| | c) Reach out to organizations that fit partnership criteria and invite selected organizations to apply for MJV partnership. | |
| **P-3:** Improve communications | a) Maintain and refine MJV communications plan. | High |
| | b) Form communications sub-committees as needed to expand and coordinate partnership within and beyond the partnership. | |
| | c) Encourage use of MJV Partner Listserv to share relevant monarch conservation activities and opportunities between partners. | |
| | d) Continue to establish MJV as an information clearinghouse for monarch conservation. | |
| **P-4:** Quantify and track accomplishments | a) Collect quarterly progress updates for MJV funded partner projects. | Med |
| | b) Develop tool to track MJV and partner accomplishments, including in-kind contributions/projects. | |
| | c) Provide accomplishments reports to funding agencies and partners. | |
| | d) Develop and share annual report with funding agencies and the public via the MJV website. | |
| **P-5:** Continue support for MJV core staff team | a) Develop maintenance strategy for MJV core team (coordinator, science coordinator, communications coordinator) and explore potential for increasing staffing. | High |
| | b) Annually update staff work plans with input from MJV steering committee. | |
| | c) Support training and development for MJV staff. | |

## Resource Abbreviations

| Abbreviation | Organization | Abbreviation | Organization |
|---|---|---|---|
| **AFWA** | Association of Fish and Wildlife Agencies | **NABA** | North American Butterfly Association |
| **BLM** | Bureau of Land Management | **NCTC** | National Conservation Training Center |
| **BONAP** | Biota of North America Plant Atlas | **NPGN** | National Pollinator Garden Network |
| **CDFW** | California Department of Fish and Wildlife | **NPS** | National Park Service |
| **CEC** | Commission for Environmental Cooperation | **NPSoT** | Native Plant Society of Texas |
| **DBG** | Desert Botanical Garden | **NRCS** | Natural Resources Conservation Service |
| **DOT** | Department of Transportation | **NWF** | National Wildlife Federation |
| **EDF** | Environmental Defense Fund | **P2** | Pollinator Partnership |
| **ERC** | Energy Resource Center | **PCA** | Plant Conservation Alliance |
| **EWCL** | Emerging Wildlife Conservation Leaders | **PF** | Pheasants Forever |
| **FHA** | Federal Highway Administration | **Prairie Resto** | Prairie Restorations, Inc. |
| **Field Museum** | Chicago Field Museum | **SWCD** | Soil and Water Conservation District |
| **IDFG** | Idaho Department of Fish and Game | **SWMS** | Southwest Monarch Study |
| **IRVM** | Integrated Roadside Vegetation Management | **TPC** | Tallgrass Prairie Center |
| **ISU** | Iowa State University | **TWA** | Texas Wildlife Association |
| **IVM** | Integrated Vegetation Management | **USDA** | United States Department of Agriculture |
| **JN** | Journey North | **USFS** | United States Forest Service |
| **LBJWC** | Lady Bird Johnson Wildflower Center | **USFWS** | United States Fish and Wildlife Service |
| **MAG** | Monarchs Across Georgia | **USGS** | United States Geological Survey |
| **MCSP** | Monarch Conservation Science Partnership | **WDFW** | Washington Department of Fish and Wildlife |

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|---|---|---|---|
| **MJV** | Monarch Joint Venture | **WHEG** | Wildlife Habitat Evaluation Guide |
| **MLMP** | Monarch Larva Monitoring Project | **WO** | Wild Ones: Native Plants Natural Landscapes |
| **Monarch Lab** | University of Minnesota Monarch Lab | **WSU** | Washington State University |
| **MWfM** | Make Way for Monarchs | **Xerces** | The Xerces Society for Invertebrate Conservation |

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## Monarch Joint Venture Mission and Vision

Recognizing that North American monarch (*Danaus plexippus*) conservation is a responsibility of Mexico, Canada and the United States, as identified in the North American Monarch Conservation Plan, this Joint Venture will work throughout the U.S. to conserve and protect monarch populations and their migratory phenomena by implementing science-based habitat conservation and restoration measures in collaboration with multiple stakeholders.

Our mission will be achieved by coordinating and facilitating partnerships and communications in the U.S. and North America to deliver a combination of habitat conservation, education, and research and monitoring.

The vision of this Joint Venture is abundant monarch populations that will exist for future generations to enjoy. More broadly, we believe in promoting monarchs as a flagship species whose conservation will sustain habitats for pollinators and other plants and animals.