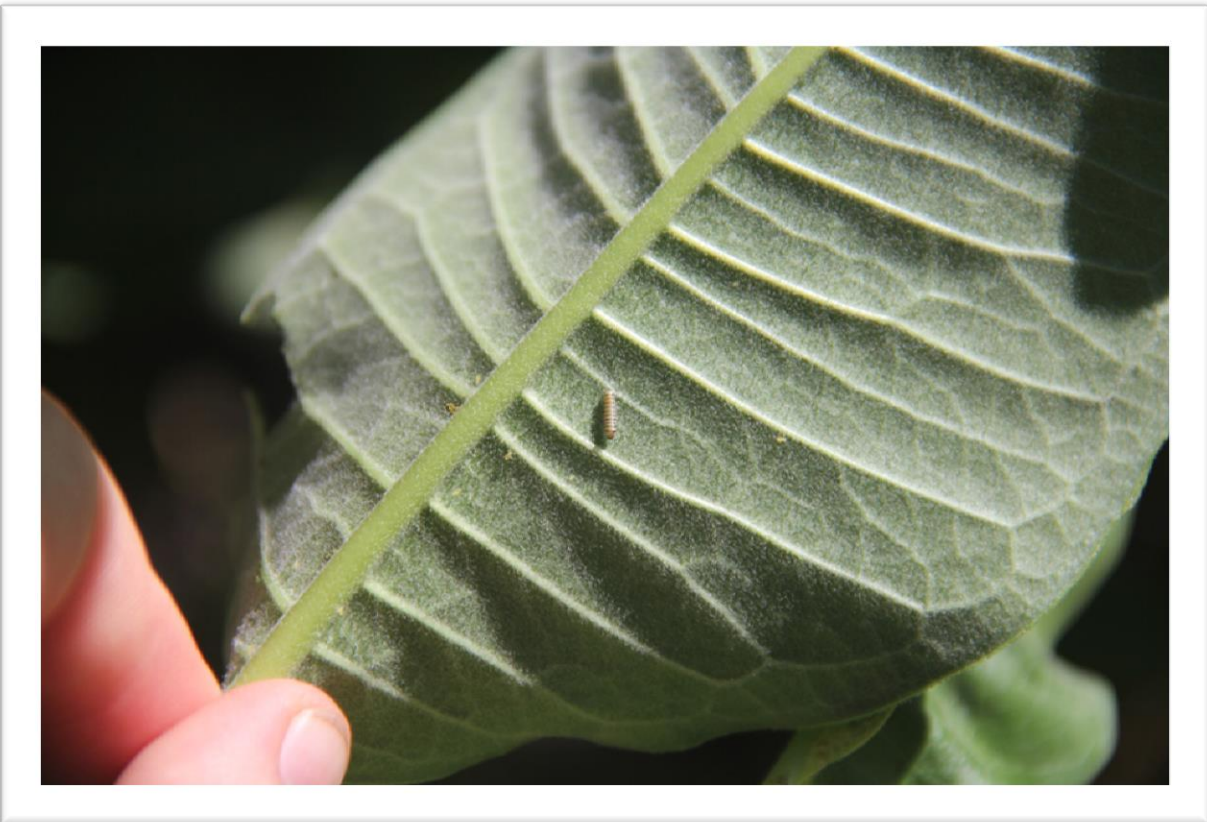


2016 Monarch Conservation Implementation Plan

Prepared by Monarch Joint Venture Coordinator Wendy Caldwell with input from MJV Partners and Steering Committee
1/1/2016



This Implementation Plan was originally derived from the North American Monarch Conservation Plan (CEC, 2008) and is updated annually by the Monarch Joint Venture partnership to identify priority actions for advancing monarch conservation in the U.S.

Monarch Joint Venture 2016 Implementation Plan

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Executive Summary

The 2016 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), currently consisting of 39 partner organizations.

For reference, the 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 is designed to support the above while identifying and prioritizing current important actions for monarch conservation 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.

As a growing partnership, the MJV is excited to be a part of a rapidly growing conservation movement. A 2014 Presidential Memorandum (Creating a Federal Strategy to Promote the Health of Honey Bees and Other Pollinators) includes provisions specifically for monarch butterflies. In addition, the pending petition to the U.S. Fish and Wildlife Service to consider monarchs as a threatened species under the Endangered Species Act is helping to drive monarch conservation efforts. Researchers, NGOs, academic institutions, and agencies have collaborated under the Monarch Conservation Science Partnership to identify targets for monarch conservation. By 2020, the primary objective is to increase eastern monarch population numbers to 6 hectares of area occupied in Mexico, or approximately 225 million individual butterflies. 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 serves as an important conservation focus for the U.S. as well, since the entire annual cycle of breeding, migrating, and overwintering occurs entirely within the boundaries of the U.S. As a flagship species for pollinator and grassland conservation, efforts to create, restore, or enhance habitat for monarch butterflies will benefit a suite of other organisms throughout North America. The charisma of the monarch butterfly provides an opportunity to engage a broad and diverse set of stakeholders in conservation on a large scale.

Any individual or entity involved in monarch conservation is encouraged to utilize 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 to preserve the monarch migration for generations to come. As a national coordinating body, the MJV will help identify opportunities for collaboration between different entities when possible and will guide conservation actions carried out by our partners.

The MJV will use this plan as a guiding document to support ongoing or new conservation actions by partners in the upcoming year (and beyond), recognizing that it will take an “all hands on deck” approach to reach our nation’s population and habitat targets. This plan may also serve to inform other funding sources in an effort to better coordinate monarch conservation efforts throughout the U.S.

MJV priorities 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, as well as improved management 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 to track monarch populations and to inform our conservation work.

Monarch Habitat Conservation, Maintenance and Enhancement

There is evidence that the primary threat to monarchs in the United States is widespread loss of breeding habitat (Pleasants and Oberhauser 2012, Pleasants 2015), which must include milkweed (*Asclepias* spp.), the only viable food source for monarch larvae. While breeding and migratory habitat has been lost throughout the country, the MJV has prioritized work in two regions of the monarch's eastern range: the North Central region (i.e. "Corn Belt") and the South Central region. The Corn Belt region (primarily Iowa, Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Nebraska, Kansas, and Missouri) 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). Additionally, Texas and Oklahoma are high priority states for conservation efforts because they play a significant role in supporting both the spring and fall migrations (Miller et al. 2012, Flockhart et al. 2013).

In the western U.S., there is much still unknown regarding the location of monarch breeding areas and migratory pathways. This population, which resides west of the Rocky Mountains, is also a priority for the MJV, since all stages of the annual cycle of breeding, migrating, and overwintering occur entirely within the boundaries of the U.S. (although there is some interchange between eastern and western populations).

Our approach to mitigating breeding and migratory habitat loss in the U.S. is to identify partners and other parties willing to take action in creating or restoring breeding and migrating habitat. We are working with partners to better understand the native milkweed seed market, increase the availability (and demand) for regionally appropriate milkweed seeds and plugs throughout the U.S., and equip partners with management tools and guidelines for successful habitat restoration and enhancement. We have supported on-the-ground conservation efforts by providing funding for native milkweed and forb seed purchases within the appropriate ecoregion which can be included in existing restoration efforts. We have also provided resources to support the distribution of milkweed plugs, using locally-sourced seed from important monarch host species, at key sites throughout the monarch breeding range. We have recently supported the development of an integrated pest management system for native milkweed seed production, and the creation of milkweed seed production plots.

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. For this reason, we are promoting monarchs as a flagship species 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 is a key component of successful conservation. Our science-based approach to monarch conservation allows us to target our education and outreach efforts to maximize impact on monarch populations. By providing citizen science and conservation trainings in priority areas across the central flyway and western sites, we are building a strong network of volunteers and interest groups. These stakeholders then work to create and restore habitat for monarchs, spread the pollinator conservation message, and contribute to our understanding of monarch populations, habitats, and the successes of our conservation efforts.

Additionally, the MJV has produced an integrated and comprehensive website with numerous outreach materials which are free to download (See Resources section on www.monarchjointventure.org). These materials provide recent and

relevant science-based information about monarchs and their conservation. MJV partners also reach a wide audience through media interviews, articles, webinars, and social media postings.

Research and Monitoring to Inform Monarch Conservation Efforts

The MJV draws together monarch biologists, conservation leaders, academic programs, and citizen scientists working toward the ultimate goal of conserving the monarch butterfly migration. Through research and monitoring, these groups help us to understand monarch populations and habitat availability, which then inform how the MJV prioritizes areas of greatest conservation need.

Monarch and butterfly citizen science efforts engage thousands of volunteers each year in real science. These volunteers, young and old, not only contribute to our understanding of monarch populations and habitat distribution, they inspire others to do the same.

Through MonarchNet (www.monarchnet.org), an aggregation of butterfly citizen science monitoring data, we are able to gain even further insight into monarch population trends. Insight from these programs has helped us to prioritize geographic areas to focus our conservation and monitoring efforts. We have conducted numerous training workshops in these priority areas, including California, Texas, the Midwest, Nevada, and Idaho and more are planned for the upcoming breeding, migrating, and overwintering seasons.

In addition to citizen science monitoring, MJV partners engage in research and analyses to better understand disease in monarchs, impacts of non-native species, qualities of prime monarch habitat, milkweed propagation methods, and best land management practices for monarchs.

The MJV and its partners are also involved in the Monarch Conservation Science Partnership, an effort led by the U.S. Geological Survey to identify and address research priorities. Current objectives of this group are to develop a national monarch and milkweed monitoring strategy, a geospatial model to target restoration projects that will have the greatest potential impact for monarchs, and analyses to identify a minimum viable population size for the eastern migratory population. The MJV has recently added a Science Coordinator, who will help to enhance research and monitoring efforts in the U.S.

Monarch Joint Venture Mission and Vision

Recognizing that North American monarch (*Danaus plexippus*) conservation is a responsibility of Mexico, Canada and the U.S., as identified in the North American Monarch Conservation Plan, this Joint Venture will coordinate efforts throughout the U.S. to conserve and protect monarch populations and their migratory phenomena by developing and 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 to sustain the monarch migratory phenomena into perpetuity, and more broadly to promote monarchs as a flagship species whose conservation will sustain habitats for pollinators and other plants and animals.

Monarch Joint Venture Background

The MJV was established in December 2008 as a partnership-based organization focused on furthering monarch conservation across the continental United States, through a coordinated, collaborative effort. The MJV is broadly inclusive with regard to forming partnerships with organizations interested in monarch conservation, including federal, state and local government agencies; private conservation groups; and others. Each partner helps to fulfill actions laid out in the North American Monarch Conservation Plan and this Monarch Conservation Implementation Plan.

Communication between partners opens doors for new opportunities to engage in monarch conservation and to expand our network through other organizations.

From 2009-2015, MJV has engaged 39 partners and allocated over \$1.9 million for science-based monarch conservation and coordination projects. In addition, over \$400,000 were reported as in-kind support by partner organizations to carry out these projects. Our conservation actions are fully aligned with the goals, objectives; and target actions outlined in the North American Monarch Conservation Plan (CEC, 2008).

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2016 Monarch Conservation Implementation Plan

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.

<i>Objectives</i>	<i>Actions</i>	<i>Priority (1-5, 1 low)</i>	<i>Resources (lists are a work in progress, not complete)</i>
H-1: Maintain milkweed distribution database	1) Evaluate and refine milkweed species distribution databases to guide selection of appropriate species for habitat enhancement work and seek integration of other appropriate databases.	3.5	<ul style="list-style-type: none"> • Biota of North American Program (BONAP): Asclepias page • USDA PLANTS Database • Xerces Society: Western Milkweed Survey • SEINet (Arizona Chapter): Data Portal
H-2: Maintain milkweed plant materials inventory	1) Continue assessment of commercial availability of native, regionally-sourced milkweed seeds and plants.	3.5	<ul style="list-style-type: none"> • Make Way for Monarchs: Monarch Recovery from a Milkweed's Point of View • Tallgrass Prairie Center: Assessing the Milkweed Seed Marketplace for in Iowa
	2) Continuously update and improve milkweed supplier lists to include reliable sources of native, regionally appropriate milkweed plants and seeds.	4.0	<ul style="list-style-type: none"> • Monarch Watch: Milkweed Market Plant Vendor List • Southwest Monarch Study: List of Southwest Nurseries • Xerces Society: Milkweed Seed Finder • Tallgrass Prairie Center: Plant Iowa Native website
H-3: Promote commercial milkweed/forb seed and plant industry, including wholesale capacity and source assessments	1) 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 overall commercial availability of native plant resources for habitat enhancement projects, particularly in priority ecoregions and ecoregions with limited milkweed availability.	4.0	<ul style="list-style-type: none"> • Luna and Dumroese (2013): Monarchs and milkweeds: The current situation and methods for propagating milkweeds • MJV Webinar: Enhancing existing landscapes for monarchs and native pollinators: techniques and case studies for land managers • Tallgrass Prairie Center: Assessing the Milkweed Seed Marketplace for in Iowa • Tallgrass Prairie Center: Native Seed Production Manual • Tallgrass Prairie Center: Natural Selections Program • Xerces Society: Project Milkweed • Xerces Society: Milkweeds: A Conservation
	2) Promote market demand for non-treated (i.e. without systemic insecticides) milkweeds and forbs in a way that supports long-term production and stability with commercial growers. Investigate tools such as forward contracts to make demand of seed more reliable and facilitate communication between buyers and producers.	4.5	

	3) Promote seed increase plots in the commercial native plant industry for recommended species to create long-term sources of native species in priority regions.	4.0	Practitioner's Guide
H-4: Promote native milkweed seed collection or purchase for distribution and restoration, including source assessments	1) Coordinate collection of native seed which is identified as locally sourced, and collaborate with native plant producers or distributors to grow and sell milkweeds appropriate for their ecoregion.	4.5	<ul style="list-style-type: none"> • Bureau of Land Management: Seeds of Success • Monarch Watch: Milkweed Market • Plant Conservation Alliance: 2015-2020 National Seed Strategy • Tallgrass Prairie Center: Native Seed Production Manual • Tallgrass Prairie Center: Natural Selections Program • Xerces Society: Project Milkweed
	2) Expand milkweed plug production efforts, including solicitation, receipt, and cleansing of seeds; and growing and distribution of milkweed plugs.	4.5	
	3) Support procurement of milkweed and nectar plant seeds for use in restoration projects in prioritized conservation areas.	4.0	
H-5: Promote regional, high quality, diverse seed mixes optimal for monarch reproduction and migration	1) Develop and integrate regionally appropriate, diverse native seed mixes into ongoing restoration or enhancement projects. Evaluate seed mix for establishment success, vegetation stability and stand longevity, monarch use throughout the growing season, commercial availability, and attractiveness to consumers and refine recommendations as research progresses (see R-12-2).	4.5	<ul style="list-style-type: none"> • Heather Holm: Pollinators of Native Plants • Lady Bird Johnson Wildflower Center: Native Plant Information Network and plant guides • Native Plant Societies • Natural Resources Conservation Service: Monarch Plant Lists (in Publications and Resources section) • Pollinator Partnership: Ecoregional Planting Guides • Pollinator Partnership: Monarch Fueling Planting Guides (eastern U.S.) • Tallgrass Prairie Center: Designing Native Seed Mixes and Seed Mix Calculator • USDA Science and Technology Webinar: Matching Appropriate Seed to Conservation Practices • Xerces Society: Pollinator Conservation Resource Center
	2) Work with NRCS and other agencies 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 preference regionally sourced native plant materials, and encourage buyers and seed mix designers to include appropriate <i>Asclepias</i> spp. in their mixes.	4.0	
Strategy 2: Create, restore, enhance, and maintain habitat on public and private lands.			
H-6: Provide monarch habitat development guidelines to assist land	1) Provide guidance for prioritizing and obtaining regionally appropriate seeds and plugs for restoration or enhancement projects.	4.0	<ul style="list-style-type: none"> • Monarch Joint Venture: Breeding Habitat Assessment Tool • Pollinator Partnership: Monarch Habitat Development Manuals • Prairie Restorations: Guidelines for Establishing a Prairie • Tallgrass Prairie Center: Prairie Reconstruction
	2) Broadly disseminate and promote regional guidelines on monarch habitat development for different habitat types through online resources and a targeted training program (see E-8) for different land management	3.5	

managers	audiences.		Technical Guides Series #6-10 <ul style="list-style-type: none"> • Xerces Society: Pollinators in Natural Areas • Xerces Society: Pollinator Habitat Installation Guides • Xerces Society: Pollinator Resource Center
H-7: Promote monarch conservation by public agencies	1) 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.	3.5	
	2) Encourage partnerships and cooperation between public and private programs to maximize reach and efficiency.	3.5	
H-8: Promote monarch-conservation on public and private rights-of-way	1) Develop relationships with county, state, and federal roadside management and public and private utility programs (and surrounding private landowners) to encourage inclusion of monarch and pollinator friendly management in ROW areas.	4.0	<ul style="list-style-type: none"> • Baum and Sharber (2012): Fire creates host plant patches for monarch butterflies • Fischer et al. (2015): Enhancing Monarch Butterfly Reproduction by Mowing Fields of Common Milkweed • IVM Partners: Integrated Vegetation Management Partners • Monarchs in a Changing World: Biology and Conservation of an Iconic Butterfly Ch. 17 (2015). Grassland and Roadside Management Practices Affect Milkweed Abundance and Opportunities for Monarch Recruitment • Pollinator Partnership: Monarch Habitat Development Manuals • Tallgrass Prairie Center: Integrated Roadside Vegetation Management • Tallgrass Prairie Center: Hydroseeding Survey of IRVM Counties in Iowa • Xerces Society: Pollinators and Roadsides web page
	2) 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.	4.0	
	3) Encourage the inclusion of pollinator gardens or natural areas and interpretive displays at rest areas and other high visibility areas.	4.0	
H-9: Increase planting and maintenance of small garden habitats for	1) 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.	3.5	<ul style="list-style-type: none"> • Monarch Lab: Schoolyard Garden Grants • MJV Handout: Gardening for Monarchs • MJV Handout: Schoolyard Butterfly Gardens • Monarch Watch: Waystation Brochure

monarchs	2) Facilitate and promote community or regional habitat networks through outreach to local municipalities, urban land managers or landscapers, and relevant businesses, corporate campuses or associations.	4.0	<ul style="list-style-type: none"> • North American Butterfly Association: Butterfly Garden and Habitat Program • National Pollinator Garden Network: Million Pollinator Garden Challenge • National Wildlife Federation: Garden for Wildlife • National Wildlife Federation: Mayors' Monarch Pledge • National Wildlife Federation: Monarch Conservation in America's Cities Guide • Wild Ones: Wild for Monarchs Brochure • Xerces Society: Bring Back the Pollinators
H-10 : Increase monarch habitat in agricultural areas	1) Provide guidance for prioritizing and obtaining regionally appropriate seeds and plugs.	3.5	<ul style="list-style-type: none"> • Pheasants Forever: Honey Bee and Monarch Butterfly Partnership • Pollinator Partnership: Bee Friendly Farming • Tallgrass Prairie Center: Prairies on Farms • USDA NRCS: Using Farm Bill Programs for Pollinator Conservation • See H-6 resources
	2) Develop and promote recommendations for placement within the agricultural landscape that should be targeted for restoration, taking into consideration potential for exposure to pesticides and landowner incentives. For habitat established in intensively farmed landscapes within or near fields treated with pesticides, monitor monarch survival and recruitment.	4.0	
	3) 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.	3.5	
	4) Create and utilize demonstration sites in agricultural areas to promote diverse grasslands and pollinator habitat on or near farms and ranches to provide targeted training for different agricultural sectors (e.g., commodity groups, conservation professionals, technical service providers, seed sales reps, extension, and other trusted sources of information for farmers) (see Education E-8).	4.0	
	5) Disseminate habitat development and maintenance guidelines for agricultural working and non-working lands.	4.0	
	6) Connect landowners with opportunities or incentives	4.0	

	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.		
	7) Investigate and promote agricultural production that provides nectar sources (e.g., red clover cover crop, oil seed crops, prairie hay, delayed haying).	4.0	

Strategy 3: Address overwintering habitat issues in California.

H-11: Assess and manage conditions at western overwintering sites	1) Support continued monitoring of the western monarch population at current and historic overwintering sites in California; use findings to identify priority sites.	4.0	<ul style="list-style-type: none"> Xerces Society: Western Monarch Count Resource Center
	2) Develop and promote technical guidelines for adaptive, site-specific management and conservation of western overwintering sites and define metrics to assess the effectiveness of site management and restoration.	4.5	
	3) Promote special designations in land use plans to protect overwintering sites in California (e.g., California Coastal Commission could designate overwintering sites as Environmentally Sensitive Habitat Areas).	4.5	
	5) Determine impacts of and possible solutions to insect pests and tree diseases on overwintering habitat quality (e.g., pitch canker on Monterey pine, leaf beetle on Eucalyptus).	3.0	

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

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

<i>Objectives</i>	<i>Actions</i>	<i>Priority (1-5), 1 low</i>	<i>Resources (lists are a work in progress, not complete)</i>
E-1: Establish MJV as information clearinghouse for monarch conservation.	1) Maintain easy-to-use website to increase awareness of monarch conservation issues and efforts, and provide clear objectives, messaging, resources, and opportunities for broad participation in monarch conservation.	4.5	<ul style="list-style-type: none"> Monarch Joint Venture: <ul style="list-style-type: none"> www.monarchjointventure.org, www.plantmilkweed.org MJV Publications/Downloads Monarch Conservation Webinar Series MJV Online Resources List
	2) Develop and distribute print and web materials to promote monarch awareness and conservation	4.0	

	guidelines for different audiences.		<ul style="list-style-type: none"> ○ MJV FAQ ○ Partner monarch conservation efforts/projects ○ MJV Communications Plan ○ MJV News and Events
	3) Communicate recent and relevant research, monitoring, habitat, and education efforts and conservation status updates to partners and the general public through various media outlets.	4.5	
	4) Continue to create and share relevant monarch conservation webinars on various topics.	4.5	
	5) Provide Spanish and French translations of important materials and assess demand for those materials.	3.5	
E-2: Expand outreach at conferences, meetings and in the media	1) Attend stakeholder meetings and conferences to engage broad audiences in monarch conservation. Help develop messaging to engage audiences reached at these events.	3.5	<ul style="list-style-type: none"> ● MJV Communications Plan
	2) 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.	3.5	
E-3: Expand communication to different audiences	1) Identify priority audiences for raising monarch conservation awareness.	3.5	<ul style="list-style-type: none"> ● MJV Communications Plan
	2) Explore various communication mechanisms and strategies to reach different priority audiences and evaluate for effectiveness (e.g., social media, radio, TV news, newspaper, magazine, direct communication) to refine future communication priorities.	3.0	
	3) Facilitate development of collaborative, science-based messaging for use with different audiences; share on MJV website and encourage message sharing by partners (e.g., monarchs as a flagship species).	4.0	
	4) Measure change in public interest, support, or participation in conservation activities as a result of outreach efforts.	4.0	
E-4: Mitigate negative perceptions and barriers	1) Develop materials to share information about milkweeds, and to address concerns about weediness and toxicity.	3.5	<ul style="list-style-type: none"> ● MJV website information/resource sections
	2) Develop and promote messaging encouraging inclusion of diverse native plants in restoration efforts,	4.0	

preventing planting or effectiveness of native milkweed	decreased pesticide use, and adoption of pollinator friendly management practices.		
	3) Identify and promote successful models to overcome barriers preventing planting of milkweed or native habitat. Share relevant background research, resources, and language that can be adapted for different situations.	4.0	
	4) Inform audiences about the importance of planting locally-sourced seeds and plugs.	4.0	
	5) 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.	4.0	
E-5: Provide toolkits and customizable templates to increase participation	1) Gather information from partners to identify successful (or not successful) campaigns, resources, messaging, or strategies for implementing conservation activities with different audiences.	4.0	<ul style="list-style-type: none"> MJV website and outreach (a platform for dissemination)
	2) Develop and promote “how-to” templates or toolkits for conservation activities, integrating partner insights into easily customizable frameworks to share broadly. Ensure frameworks have consistent messaging, structure and shareable graphics that can be customized.	4.0	
Strategy 2: Increase learning about monarchs and their habitat in formal and informal settings.			
E-6: Promote formal and informal monarch curricula	1) Identify, evaluate, and recommend existing, relevant curricula or educational activities for different age groups, applying current standards when relevant.	4.0	<ul style="list-style-type: none"> Ba’s Relief, LLC Journey North: Symbolic Migration, informational lessons MJV: Monarch Conservation Webinar Series Monarch Lab: Monarchs and More Curriculum, Schoolyard Ecology Explorations Curriculum, Driven to Discover Monarch Curriculum Monarch Larva Monitoring Project: Online Training Series Monarch Live! A Distance Learning Adventure Texas Wildlife Association Youth On-Demand Webinar The Magic of Monarchs
	2) Integrate monarch citizen science opportunities and curricula into education efforts.	4.0	
E-7: Support educator	1) Expand teacher workshops in priority areas to build network of informal and formal educators throughout	4.0	<ul style="list-style-type: none"> Monarch Lab: North American Monarch Institute Monarch Teacher Network: Teacher workshops

workshops	the breeding and migratory range and facilitate continued support and professional development for trained network.		
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Strategy 3: Foster networking between stakeholders involved in monarch conservation.

E-8: Train, facilitate and support specialist groups	1) Identify networks of potential peer-to-peer ambassadors and develop targeted training programs with basic and advanced information to create networks who can aid in education, habitat development, research, and monitoring efforts nationwide. Tailor programs for audiences and regions.	4.0	<ul style="list-style-type: none"> • Monarch Larva Monitoring Project: Training Framework • Monarch Watch: Conservation Specialist Group
	2) Create science-based toolkits designed for teaching key principles of habitat establishment and management (e.g. demonstration sites), habitat and population monitoring, and education or outreach opportunities to aid specialist groups.	3.5	
E-9: Facilitate information sharing and tracking	1) Effectively catalogue and communicate efforts, resources, and potential partners or opportunities relevant for different Implementation Plan actions or monarch conservation priorities. Connect individuals and organizations with relevant projects or opportunities in their area.	3.5	<ul style="list-style-type: none"> • MJV website: www.monarchjointventure.org • Commission for Environmental Cooperation: North American Monarch Conservation Plan • MJV Communications Plan
	2) Develop strategy for tracking and evaluating monarch conservation activities and effectiveness.	4.0	
	3) Facilitate or encourage continuing communication and cooperation between North American countries.	3.5	

GOAL 3: Research and Monitoring to Inform Monarch Conservation Efforts

*Actions that should be incorporated into a national monitoring framework are indicated with a *.*

Strategy 1: Assess monarch habitat and population status.

<i>Objectives</i>	<i>Actions</i>	<i>Priority (1-5), 1 low</i>	<i>Resources (lists are a work in progress, not complete)</i>
R-1: Improve U.S. overwintering site assessment and monitoring	1) Promote use of habitat assessment tools during California Thanksgiving counts and continue to refine protocol and data sheet based on user feedback.	4.0	<ul style="list-style-type: none"> • Xerces Society: Western Monarch Count Resource Center • Xerces Society: Overwintering Site Habitat Assessment Form
	2) Determine whether existing protocols (e.g. the Western Monarch Thanksgiving Count) adequately estimate monarch population size and develop and implement new protocols if necessary.	3.5	
	3) Identify microclimate requirements of overwintering	4.0	

	monarchs in California.		
R-2: Document known monarch breeding areas in the western U.S.	1) Improve and distribute existing online western milkweed survey to a broad base of recipients, particularly in the Rocky Mountain states. Compile data received and update map of milkweed/breeding locations of in western states.	3.5	<ul style="list-style-type: none"> Xerces Western Milkweed Survey
	2) Identify primary landowners of key breeding sites, and work with them to assess, protect and enhance these areas.	3.5	
R-3: Build and parameterize demographic models	1) Measure population vital rates to determine where within the annual or life cycle the greatest threats occur.	4.0	
	2) Build western population demographic model.	3.5	
R-4: Develop and use breeding habitat assessment tools	1) Field test and finalize monarch breeding habitat assessment tool.	3.5	<ul style="list-style-type: none"> Monarch Lab: Breeding Habitat Assessment Tool Xerces Society: Pollinator Habitat Assessment Form and Guide
	2) Develop on-line scoring system with data storage and retrieval capacities.	3.0	
	3) Assess existing habitat assessment tools targeted for different land uses and geographic regions. Develop additional tools if needed.	3.0	
R-5: Develop and implement a national monitoring program	1) Review MonarchNet and increase capacity for displaying and summarizing data trends and availability.	3.5	<ul style="list-style-type: none"> MonarchNet: http://www.monarchnet.org/
	*2) 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).	4.0	
R-6: Track new habitat as it is created and maintain existing habitat records	1) Estimate acres of existing monarch habitat	4.5	
	2) Create a database to track new habitat creation and devise a strategy to ensure that new habitat is reported.	4.5	
	*3) Evaluate previously reported habitat to determine longevity of reported habitat created. Identify methods used in establishing successful, long term habitats.	4.5	
R-7: Determine areas of highest	1) Repeat isotope study to determine variation in relative importance of different breeding regions.	3.5	

monarch overwintering contributions	2) Analyze citizen science tagging data to provide yearly estimates of monarch migratory success from different regions and monarch generations.	4.0	
Strategy 2: Expand monarch monitoring efforts, data exchange, and data analysis to inform conservation efforts			
R-8: Address data gaps in research and monitoring efforts	*1) Recruit and train monitors (see Education, E-8) to fill temporal and spatial data gaps in existing monarch and butterfly monitoring programs to inform reliable regional estimates of monarch populations and trends.	4.0	<ul style="list-style-type: none"> MJV has supported citizen science training programs and can provide sample agenda and evaluation materials for workshops (monarchs@monarchjointventure.org) MJV Handout: Monarch Citizen Science MJV web page: Citizen Science Opportunities
	2) Use and share appropriate and consistent evaluation tools (e.g., pre- and post-training surveys) to improve training programs.	3.5	
R-9: Coordinate and share tagging data (all tagging programs)	1) Enter, clean, and analyze tagging data.	4.0	<ul style="list-style-type: none"> Monarch Alert: Tagging Program Monarch Butterflies in the Pacific Northwest: Tagging Program Monarch Watch: Tagging Program Southwest Monarch Study: Tagging Program
	2) Develop ways to visualize tagging data on MonarchNet, and share aggregated data to allow wide-scale visualization and use.	3.5	
	3) Develop standard protocol for geo-referencing tagging data (tagging site and recovery location).	4.0	
R-10: Develop monitoring apps to improve volunteer reporting	*1) Continue to develop user-friendly mobile device apps for monarch monitoring programs, encourage collaborative reporting when possible, and integrate with national monitoring framework.	4.0	<ul style="list-style-type: none"> NatureDigger: Monarch SOS app is available for iOS devices as an educational app. Reporting functions predicted to be available spring 2016.
R-11: Maintain western overwintering site database	1) 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.		<ul style="list-style-type: none"> Xerces Society: Western Monarch Count Resource Center
	2) Address data sensitivity issues to develop version of western overwintering site database that can be shared publicly.	3.0	
	3) Maintain Western Monarch Count website and develop capacity for citizen scientists to upload overwintering site monitoring data directly online.	3.5	

Strategy 3: Research to improve creation of monarch breeding and migrating habitats on different scales.

<p>R-12: Determine role of small-scale habitats in monarch conservation (see also R-13)</p>	<p>*1) Determine the potential for “citizen lands” (rural, urban, suburban, exurban) to contribute to monarch population goals. Use social research to understand current and achievable adoption rates, 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.</p>	<p>4.5</p>	
<p>R-13: Increase understanding of relative habitat quality at the patch and landscape scales</p>	<p>1) On the landscape scale, establish regionally appropriate targets for the spatial distribution and scale of monarch habitat. This will require an understanding of what is already there and how milkweed/nectar plant distributions affect monarch reproduction and survival, and empirical and modeling studies of monarch movement and population dynamics.</p>	<p>4.5</p>	
	<p>2) 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.</p>	<p>4.0</p>	
	<p>3) At landscape and patch levels, document and study use of monarch habitat by other beneficial species.</p>	<p>4.5</p>	
<p>R-14: Increase understanding of milkweed propagation and habitat establishment</p>	<p>1) To inform cost-effective habitat establishment, a) determine best management practices for newly-seeded habitat to maximize the rate of milkweed establishment and vigor, b) determine the effects of using plugs vs. seeds, especially for higher cost seeds, c) determine how to manage plants to maximize contributions to local seed bank (“mother plants”), and d) determine when, how, and with what it is best to improve existing habitat vs. undertake restoration from scratch. Use this information to create a decision analysis tree.</p>	<p>4.0</p>	
	<p>2) 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</p>	<p>3.5</p>	

	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.		
R-15: Determine ecosystem services of milkweeds and monarchs	1) Identify ecosystem services provided by monarchs (e.g., role as pollinators and in the food chain, and social value to people) and the ecological role of milkweed to promote support for monarch and milkweed conservation.	3.0	
Strategy 4: Research the effects of diseases, non-native species, and changing environment on monarchs and their habitat			
R-16: Explore effects of non-native milkweed on monarchs	1) Continue to measure the prevalence, species, and management of milkweed in gardens in the southern US, including near California overwintering sites.	4.0	<ul style="list-style-type: none"> Project Monarch Health: Latest Research MJV Handout: Potential Risks of Growing Exotic Milkweed for Monarchs
	2) Develop management recommendations to limit year-round breeding of monarchs in CA and the southern US, encouraging gardeners not to grow <i>Asclepias curassavica</i> , and promoting diverse nectar plants as an alternative.	3.5	
	*3) Continue to assess the prevalence of O.e. (<i>Ophryocystis elektroscirrha</i>) in monarchs in managed gardens throughout the year, and use data to provide recommendations to minimize spread of disease.	4.0	
	4) Determine whether non-migratory behavior is becoming more common for monarchs in parts of the U.S., including 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.	4.5	
R-17: Assess effects of invasive species on monarchs and their habitats.	*1) Assess <i>Vincetoxicum</i> spp (e.g. <i>Cynanchum louisea</i> , <i>Cynanchum rossicum</i>) abundance, attempted use by monarchs and possible control methods in areas where it is currently located.	3.5	<ul style="list-style-type: none"> MJV Handout: Invasive Species Alert
	*2) Assess impacts, occurrence, spread and use of different habitats of non-native herbivores (e.g. <i>Aphis nerii</i>) that negatively impact milkweeds.	3.5	
	*3) Assess effects of fire ants and fire ant control on monarchs.	3.5	
	4) Assess effects of eucalyptus tortoise beetles and eucalyptus longhorned borers (<i>Phoracantha</i> sp.) on the		

	health of trees at monarch overwintering sites.		
R-18: Assess milkweed disease impacts	*1) Assess the extent and impacts of milkweed diseases (e.g., milkweed yellows phytoplasma) and provide recommendations for management. Investigate an inoculum to prevent this disease in restorations.	3.5	
R-19: Assess impact of weather and climate conditions on monarchs and their habitat	*1) Determine influence of topography, weather, microclimate, soil moisture, and other abiotic factors on monarch populations and movements.	3.5	
	*2) Study the effects of the Rocky Mountains on monarch movement, including the amount of interaction between the eastern and western populations and the degree to which interaction is mitigated by landscape features.	3.5	
R-20: Assess effects of chemical additions to habitat	1) Study effects of road salt, insecticides, fungicides, herbicides, and fertilizers on monarchs and milkweed (including associations with mycorrhizal fungi).	3.5	
R-21: Assess effects of other (non-O.e.) pathogens and natural enemies on monarchs	*1) 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.	3.5	<ul style="list-style-type: none"> • Monarch Lab: Publications
	*2) Study monarch interactions with predators and parasitoids to determine the effects of other natural enemies on population dynamics.	3.5	
	3) Analyze citizen science tagging data to provide yearly estimates of monarch migratory success from different regions and monarch generations.	4.0	