

2018

Monarch Conservation Implementation Plan



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Executive Summary

This plan is intended for use by any individual or entity to identify and integrate monarch conservation actions into existing or planned efforts. It will take widespread collaboration between all sectors to reach our nation's monarch conservation targets and preserve the monarch migration for generations to come. This annually updated plan serves as a guiding document to support ongoing or new conservation actions, and may serve to inform other funding sources in an effort to coordinate monarch conservation efforts throughout the U.S.

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 more than 75 organizations working together to conserve the monarch migration. As a national coordinating body, the MJV will help identify opportunities for collaboration and support and guide conservation actions carried out by various conservation stakeholders.

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 effectively and efficiently achieve those actions. The strategies and actions were contributed, prioritized, and reviewed by representatives from MJV partner organizations. MJV personnel synthesized the final plan. If you have any questions or comments 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 U.S. Fish and Wildlife Service is undergoing a [Species Status Assessment](#) to inform their decision about whether or not the species warrants listing under Endangered Species Act. In order to prevent the need for listing, this process continues to drive monarch conservation efforts forward by engaging broader interest and participation. Researchers, non-governmental organizations, academic institutions, and agencies have collaborated under the [Monarch Conservation Science Partnership](#) (MCSP) 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 would be 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 1.3 to [1.8 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 contributing to a nationally coordinated approach at achieving these targets.

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.

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 the monarch range, and conservation of western overwintering sites.
2. Education and outreach to increase interest awareness, and engagement in monarch conservation.
3. Research on and monitoring of monarchs and their habitats to inform 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 host plants (primarily plants of the genus *Asclepias*). For both the eastern and western U.S. populations, the preservation, restoration and enhancement of both breeding and migratory habitat is critical; this habitat contains both native milkweeds and nectar plants. In the eastern range, the North Central region (i.e. “Corn Belt”) and the South Central region have been emphasized as important areas for monarch reproduction and migration. The Corn Belt 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), but more recent analyses have concluded that we need an approach that engages “all hands” and “all regions” to most effectively support the eastern population (Oberhauser et al. 2017, Flockhart et al. 2017, Thogmartin et al. 2017). The South Central region 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., conservation strategies focus primarily on identifying, protecting, and enhancing breeding habitats, migratory pathways, and overwintering areas. 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 conservation. Monarchs 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 biology, population trends and habitat quality and availability. Historically, citizen scientists have contributed greatly to our understanding of monarch biology and ecology, and they 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 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 that formed in 2014 to better

understand threats to monarch populations at the landscape level, model population trends, and develop conservation tools. In collaboration with these efforts, MJV is working to establish a national monitoring strategy, which aims to provide additional information to inform conservation of the species at all scales.

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.

2018 Monarch Conservation Implementation Plan

Priority Ranking Considerations: The actions outlined in this plan are **all** important for monarch conservation. While we recognize that individual or organizational priorities vary, MJV sub-committees and staff have assigned priority rankings with input from 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:

- **Sustain:** Rankings with Sustain indicate that this action is underway and should continue.
- **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 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 for use 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 [contact MJV](#).

Considerations for geographic scope of the plan: Recognizing that three North American countries— Canada, Mexico and the U.S. — 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 strategies (H, E, R, and P) refer to the sections which they fall into. These include Habitat (H), Education (E), Research (R), and Program Development (P). **Habitat** for monarchs, whenever mentioned in the plan, refers to areas that include *both* milkweed and nectar sources. The use of **habitat** also implies use by monarchs, other pollinators, and other wildlife throughout the document.

Section 1: Monarch Habitat Conservation, Maintenance and Enhancement

Objective 1: Create, restore, enhance, and maintain habitat on public and private lands.

<i>Strategy</i>	<i>Actions</i>	<i>Priority</i>	<i>Resources</i>
H-1: Provide guidelines to assist land managers in developing habitat	a) Provide guidance for prioritizing and obtaining regionally appropriate seeds and plugs for restoration or enhancement projects.	Med	<ul style="list-style-type: none"> • CEC: Monarch Conservation Toolbox • Field Museum Urban Monarch Conservation Tools • MJV: <ul style="list-style-type: none"> ○ Breeding Habitat Assessment Tool ○ Downloads and Links: Habitat Management Section ○ Webinar: Designing Seed Mixes for Native Habitat ○ Webinar: Enhancing existing landscapes for monarchs and native pollinators ○ Webinar: Habitat Restoration Fundamentals ○ Webinar: The Three Pillars of Habitat Management • NRCS: Monarch Habitat Development Project • NWF (and other partners): How to plan a statewide monarch conservation summit • P2: Monarch Habitat Development Manuals • Prairie Resto: Guidelines for Establishing a Prairie • TPC: Prairie Reconstruction Tech Guides Series #6-10 • USFWS: Partners for Fish and Wildlife Program • Xerces: <ul style="list-style-type: none"> ○ Pollinators in Natural Areas ○ Pollinator Habitat Installation Guides ○ Pollinator Resource Center ○ Western monarch BMPs and guidelines
	b) Broadly disseminate regionally tailored guidelines on habitat development for different habitat types through online resources and a targeted training program (see E-8) for different land management audiences.	High	
	c) Provide regionally tailored guidelines on management techniques for enhancing existing habitat areas. Encourage managers to take into consideration broad conservation goals for each project.	High	
H-2: Promote monarch habitat	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,	Sustain (High)	<ul style="list-style-type: none"> • 2014 Presidential Memorandum • 2016 Executive Order: Directing Steps to Reverse Pollinator Decline and Restore Pollinator Health in MN

development on public lands	monitoring opportunities, resource opportunities, and educational programming.		<ul style="list-style-type: none"> • Bureau of Land Management: Pollinator Initiative • Department of Defense: DoD Pollinator Initiatives • High-Level Working Group for Monarch Conservation • MAFWA: Mid-America Monarch Conservation Strategy • NPS: Pollinator Website • NRCS: Monarch Habitat Development Project • NRPA: Parks for Monarchs • NWF: State Monarch Summit Planning Guide • P2: Public Lands Learning Center • PCA: 2015-2020 National Seed Strategy • Regional Wildlife Agency coordination through AFWA • State and local wildlife and agency pollinator initiatives • USFS: Monarch Butterfly Program • USFWS: Monarch Butterfly Conservation Initiative
	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 to inform habitat conservation on public lands.	High	
H-3: Promote monarch-conservation on public and private rights-of-way and other utilities	a) Encourage roadside management authorities and public and private utility programs (and surrounding private landowners) to employ monarch friendly management practices (i.e. solar, pipeline, electric).	High	<ul style="list-style-type: none"> • Baum and Sharber (2012) • CTIP: Roadside Revegetation – An Integrated Approach to Establishing Native Plants • Enhancing Monarch Butterfly Reproduction by Mowing Fields of Common Milkweed. • EPRI: Power-in-Pollinators Initiative • ERC: Rights-of-Way as Habitat Working Group • FHA: Resources for Pollinator-Friendly Practices • Fischer et al. (2015) • IVM Partners • MJV <ul style="list-style-type: none"> ○ Downloads and Links: Rights of Way Section ○ Downloadable signs and displays ○ Mowing: Best Practices for Monarchs handout
	b) Provide recommendations and best management practices for habitat development to all levels of ROW and utility decision makers, taking into consideration limitations managers face and the stage of the construction project when relevant.	Med	
	c) Encourage the inclusion of pollinator gardens or natural areas with interpretive displays and educational opportunities at rest areas and other high visibility areas. (See E-3)	High	

	d) Promote integrated vegetation management to assess and control invasive species in ROW and utility areas.	Med	<ul style="list-style-type: none"> ○ Webinar: Designing and Creating Outdoor Signs for Monarch Waystations and Pollinator Gardens ○ Webinar: Enhancing existing landscapes for monarchs and native pollinators ○ Webinar: Monarchs and Roadsides ○ Webinar: MCSP Desktop and Online Planning Tools ○ Webinar: Solar with Monarch Habitat – a win-win in the land of milkweed and honey ● “Monarch Highway Partnership: I-35 State DOTs and other agencies ● Monarchs in a Changing World: Biology and Conservation of an Iconic Butterfly (2015) Chapter 17 ● P2: Monarch Habitat Development Manuals and Roadside Technical Manuals ● TPC: Integrated Roadside Vegetation Management ● TPC: Hydroseeding Survey of IRVM Counties in Iowa ● Xerces: Pollinators and Roadsides web page ● Xerces: FHA Literature Review
	e) Influence policy change to allow for or incentivize increased conservation practices in ROW and utility areas. (See Education E-6)	Med	
H-4: Increase planting and maintenance of habitats for monarchs in developed areas (urban, suburban, exurban)	a) Provide guidelines for small scale garden or habitat development 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. (See E-1, E-3 and E-7)	High	<ul style="list-style-type: none"> ● NPSOT: Garden Grants ● MAG: Pollinator Habitat Grants ● Monarch Lab: Schoolyard Garden Grants ● MJV: <ul style="list-style-type: none"> ○ Webinar: Conserving Monarchs in an Urban Setting ○ Webinar: Designing and Creating Outdoor Signs for Monarch Waystations and Pollinator Gardens ○ Gardening for Monarchs ○ Webinar: Monarch Gardens & Community Action ○ Schoolyard Butterfly Gardens ● Monarch Watch: Waystation Brochure

	b) Support community habitat networks through outreach to municipalities, urban land managers or landscapers, and relevant businesses, corporate campuses or associations. (See Education Objective 3).	High	<ul style="list-style-type: none"> • NABA: Butterfly Garden and Habitat Program • NPGN: Million Pollinator Garden Challenge • NWF: <ul style="list-style-type: none"> ○ Garden for Wildlife ○ Mayors' Monarch Pledge ○ Monarch Conservation in America's Cities Guide • SWMS: Monarch Waystation information and Southwest Regional Guides • USFWS, Field Museum: Urban Monarch Landscape Conservation Design • WO: Wild for Monarchs Brochure • Wildlife Habitat Council • Xerces: Bring Back the Pollinators
H-5: Increase monarch habitat in agricultural areas	a) Develop recommendations for targeting habitat placement within the agricultural landscape, taking into consideration potential for exposure to pesticides. (See R-12 and R-19)	High	<ul style="list-style-type: none"> • CEC: Monarch Conservation Toolbox • BBHF: NextGen Habitat Project • EDF: Monarch Habitat Exchange • EFC Systems: AgSolver • Keystone Monarch Collaborative • MJV: <ul style="list-style-type: none"> ○ Monarch Habitat on Farms ○ Breeding Habitat Assessment Tool ○ Webinar: Habitat Restoration Fundamentals ○ Webinar: Enhancing existing landscapes for monarchs and native pollinators • NRCS: <ul style="list-style-type: none"> ○ Monarch Habitat Development Project ○ Using Farm Bill Programs for Pollinator Conservation ○ Monarch WHEGs • P2:
	b) Identify and promote existing and potential agricultural production systems compatible with monarch and other monarch-compatible wildlife habitat, and devise voluntary 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 planning, installation and maintenance guidelines for working and non-working agricultural lands. (See E-1-3, E-7)	High	

	e) Increase capacity for those working with landowners or land managers to promote and utilize existing pollinator-friendly conservation programs or practices within the agricultural landscape. (See E-9)	High	<ul style="list-style-type: none"> ○ Monarch Habitat Development Manuals ○ Bee Friendly Farming ● Prairie Resto: Guidelines for Establishing a Prairie Restoration Agriculture, by Mark Shepard ● TPC: <ul style="list-style-type: none"> ○ Prairie on Farms ○ Prairie Reconstruction Tech Guides Series #6-10 ○ Iowa Prairie Seed Mix Calculator ○ Natural Selections: Source Identified Seed ● Xerces: <ul style="list-style-type: none"> ○ Pollinators in Natural Areas ○ Pollinator Habitat Installation Guides ○ Pollinator Resource Center ○ Guidance to Protect Habitat from Pesticide Contamination ● USFWS Partners for Fish and Wildlife Program
	f) Investigate current policies and make recommendations to enhance opportunities for habitat creation, especially through the Farm Bill. (See E-6)	High	
	g) Investigate and promote agricultural practices that provides nectar sources (e.g. cover crops, grazing management, prairie hay, delayed haying).	Med	
	h) Provide guidance for prioritizing and obtaining regionally appropriate seeds and plugs.	Med	

Objective 2: Develop regionally appropriate *Asclepias* and nectar resources for habitat enhancement on public and private lands.

Strategy	Actions	Priority	Resources
H-6: Update and maintain resources depicting milkweed current distribution and native range by species	a) Evaluate milkweed species distribution databases and work to fill gaps to guide selection of appropriate species for habitat development.	Sustain (Low)	<ul style="list-style-type: none"> • BONAP: Asclepias page • Flora of North America • iNaturalist groups: <ul style="list-style-type: none"> ○ Texas Milkweed and Monarchs: Observations ○ Milkweeds of the National Park Service • Milkweed is Asclepias • MNTaxa: The State of MN Vascular Plant Checklist • SEINet (Arizona Chapter): Data Portal (historic data) • USDA PLANTS Database • Xerces: Western Monarch Milkweed Mapper Survey
H-7: Maintain inventory of commercially available milkweed and nectar plant materials	a) Update and improve native plant supplier lists to include reliable sources of native, regionally-appropriate milkweed and nectar plants and seeds.	Sustain (High)	<ul style="list-style-type: none"> • Monarch Watch: Milkweed Market Plant Vendor List • MWfM: Monarch Recovery from a Milkweed's Point of View • SWMS: List of Southwest Nurseries • TPC: <ul style="list-style-type: none"> ○ Assessing the Milkweed Seed Marketplace in IA ○ Iowa Seed Calculator ○ Plant Iowa Native website • Xerces: Milkweed Seed Finder
	b) Assess commercial availability of native, regionally sourced milkweed and nectar plants and seeds and promote best practices for propagation (see R-12).	Med	
H-8: Promote commercial native seed and plant industry	a) Increase the ability of regional seed suppliers to address the increased demand of plant materials by capacity in plant materials development and botany and improving communications throughout the seed supply chain.	High	<ul style="list-style-type: none"> • Luna and Dumroese (2013) • Iowa Living Roadway Trust Fund • MJV <ul style="list-style-type: none"> ○ Get Involved: Nurseries and Growers ○ Webinar: Growing Milkweed for Monarch Conservation • TPC: <ul style="list-style-type: none"> ○ Native Seed Production Manual ○ Natural Selections Program ○ Assessing the Milkweed Seed Marketplace in IA
	b) Demonstrate long-term market demand for non-treated (i.e. without systemic insecticides) milkweeds and forbs and align this with supply. Investigate tools like forward contracts.	Sustain (High)	

	c) Increase dissemination of information throughout the industry and seed supply chain.	High	<ul style="list-style-type: none"> • PCA National Seed Strategy for Rehabilitation & Restoration • Xerces: <ul style="list-style-type: none"> ◦ Project Milkweed ◦ Milkweeds: A Conservation Practitioner's Guide
	d) Provide platform for sharing milkweed and native plant propagation experiences and lessons. (See R-12)	Sustain (Med)	
H-9: Promote native seed collection or purchase for distribution and habitat development	a) Coordinate collection of native, identifiably locally sourced seed and collaborate with native plant producers or distributors to grow and sell regionally appropriate species of milkweed and nectar plants.	High	<ul style="list-style-type: none"> • BLM: Seeds of Success • DBG: Great Milkweed Grow Out • Monarch Flyway: Wild Collection • Monarch Watch: Milkweed Market • PCA: 2015-2020 National Seed Strategy • P2: Seed Collection Webinars and Training • TPC: <ul style="list-style-type: none"> ◦ Native Seed Production Manual ◦ Natural Selections Program • Xerces: Project Milkweed
	b) Expand milkweed and nectar plant plug production efforts, including solicitation, receipt, cleansing of seeds, growing and distribution of plugs.	High	
	c) Support procurement of milkweed and nectar plant seeds for use in restoration projects.	High	
H-10: Promote regional, high quality, diverse seed mixes for habitat development projects	a) Develop and integrate site appropriate, diverse native seed mixes into restoration projects. Evaluate mixes for establishment success, vegetation stability, stand longevity, seasonal monarch use, commercial availability, and attractiveness to consumers and refine recommendations as research progresses (See R-7, R-11, R-12).	High	<ul style="list-style-type: none"> • Heather Holm: Pollinators of Native Plants • LBJWC: Native Plant Information Network • MJV: <ul style="list-style-type: none"> ◦ NRCS collaboration on CRP evaluation (ongoing) ◦ Webinar: Designing Seed Mixes for Native Habitat • Native Plant Societies • NRCS: Seed Mix Planning Tools • P2: Ecoregional Planting Guides and Monarch Fueling Planting Guides (eastern U.S.) • TPC: <ul style="list-style-type: none"> ◦ Designing Native Seed Mixes ◦ Seed Mix Calculator ◦ Seed mix design and establishment mowing. • USDA Webinar Matching Seed to Conservation Practices • Xerces: <ul style="list-style-type: none"> ◦ Pollinator Conservation Resource Center ◦ 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 (including milkweeds) for use in conservation program seedings. (See R-11)	High	
	c) Work with large seed buyers on model bids to ensure important species are consistently requested to increase production and drive down costs for those species.	Med	

Objective 3: Address overwintering habitat issues in the United States.

<i>Strategy</i>	<i>Actions</i>	<i>Priority</i>	<i>Resources</i>
H-11: Assess and manage habitat conditions at U.S. overwintering sites	a) Routinely assess habitat conditions and engage conservation partners at or near overwintering sites.	Sustain (High)	<ul style="list-style-type: none"> • MJV webinars: <ul style="list-style-type: none"> ○ Conservation of Monarchs in the Western U.S. ○ Monarch Overwintering Biology • Xerces Society: <ul style="list-style-type: none"> ○ Protecting California’s Butterfly Groves Management Guidelines for Monarch Butterfly Overwintering Habitat ○ State of the Monarch Butterfly Overwintering Sites in California ○ Western Monarch Count Resource Center ○ With USFWS: Western Monarch Habitat Suitability Assessment Project <p>Examples: CDFW, SWCDs or land trusts could hold conservation easements; CA Coastal Commission could designate overwintering groves as Environmentally Sensitive Habitat Areas.</p>
	b) Develop and implement technical guidelines and conservation plans for adaptive, site-specific management and conservation of overwintering sites (See R-1).	High	
	c) Promote special designations in land use plans or develop conservation easements (on private lands) to protect overwintering sites.	High	

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

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

Strategy	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	<ul style="list-style-type: none"> ● MJV: <ul style="list-style-type: none"> ○ Communications Plan ○ Downloads and Links ○ FAQs ○ Monarch Conservation Webinar Series ○ News and Events ○ Partner monarch conservation projects ○ www.monarchjointventure.org ○ www.plantmilkweed.org
	b) Contribute recent and relevant research, monitoring, habitat, and education efforts, along with best practices guidelines to communicate 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; prioritize based on demand.	High	
	e) Facilitate connections to smaller scale coordination entities (i.e. state or regional, sector-based).	Sustain (High)	
E-2: Engage all audiences to increase monarch conservation actions through focused education and outreach	a) Develop and/or utilize collaborative, science-based communications strategies tailored to different audiences (i.e. geographic, sector, age based).	High	<ul style="list-style-type: none"> ● CEC: Monarch Butterfly Communication and Education ● MJV Audience Get Involved pages ● MJV Communications Plan ● MJV Working Groups ● Monarch Conservation Webinar Series ● NWF: Butterfly Heroes ● USFWS: Human Dimensions Project ● Paper: Restoring monarch butterfly habitat in the Midwestern US: 'all hands on deck'
	b) Use social science surveying to identify priority audiences, approaches, and messaging for increasing monarch conservation actions. (See R-14)	High	
	c) Leverage partners and social networks to communicate conservation needs to various audiences using audience-specific, science-based messaging.	High	
E-3: Promote toolkits and customizable	a) Identify campaigns, resources, messaging, or strategies tailored for different audiences and model them for use, replication or adaptation.	High	<ul style="list-style-type: none"> ● MJV: <ul style="list-style-type: none"> ○ Communications/Outreach Working Group ○ Downloadable signs and displays

<p>templates for easy and consistent communication</p>	<p>b) Develop and promote “how-to” templates or toolkits for habitat conservation, education, or research actions, integrating partner insights into easily customizable resources, tools, or displays to share broadly.</p>	<p>High</p>	<ul style="list-style-type: none"> ○ Downloads and links <ul style="list-style-type: none"> ▪ Template presentations – educate others ○ MJV website and outreach (as a platform for dissemination of these materials) ○ Monarch Communicator’s Guide (in progress)
	<p>c) Create science-based toolkits or programs designed for trained specialists to teach key principles of habitat establishment and management, botany, habitat and population monitoring, and other education or outreach topics to various audiences, based on the values and experiences of those audiences. (See Education Objective 3, R-11, R-12)</p>		
<p>E-4: Mitigate negative perceptions and barriers limiting or preventing monarch conservation actions</p>	<p>a) Promote habitat restoration or enhancement from an ecosystem perspective by encouraging inclusion of diverse native plants, decreased pesticide use, and adoption of best management practices.</p>	<p>High</p>	<ul style="list-style-type: none"> ● Million Pollinator Garden Challenge ● MJV: <ul style="list-style-type: none"> ○ Downloads and Links: <ul style="list-style-type: none"> ▪ Habitat Management Section ▪ Milkweed Section ▪ Nectar Plants Section ○ Get Involved Audience Pages ○ Monarch and Milkweed Misconceptions Handout ○ Power Map (in progress) ○ Success Stories Map ○ Webinar: The Three Pillars of Habitat Management ● USFWS: Spread Milkweed Not Myths ● Wild Ones: Guidelines for Selecting Native Plants – Local Ecotype Guidelines
<p>b) For situations met with resistance, identify and promote successful, relevant examples including relevant background research, resources, and messaging that can be adapted for different situations. (See E-3)</p>	<p>b) For situations met with resistance, identify and promote successful, relevant examples including relevant background research, resources, and messaging that can be adapted for different situations. (See E-3)</p>	<p>Med</p>	
<p>c) Inform audiences about the benefits of planting locally sourced seeds and plugs.</p>	<p>c) Inform audiences about the benefits of planting locally sourced seeds and plugs.</p>	<p>High</p>	
<p>d) Provide information on local accessibility of plant materials and equipment, and local instructions for habitat installation and maintenance to inform expectations of implementing good quality habitat. (See H-1)</p>	<p>d) Provide information on local accessibility of plant materials and equipment, and local instructions for habitat installation and maintenance to inform expectations of implementing good quality habitat. (See H-1)</p>	<p>High</p>	
<p>e) 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.</p>	<p>e) 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.</p>	<p>High</p>	

	f) Share materials to address concerns about weediness and milkweed toxicity, particularly in agriculture, home and community settings.	High	
	g) Use social surveying to understand real and perceived barriers to monarch conservation and work with relevant partners to address identified issues. (See R-14)	High	
E-5: Expand outreach at conferences and meetings	a) Attend and participate in stakeholder meetings and conferences to disseminate consistent information and engage broad audiences in monarch conservation.	Med	<ul style="list-style-type: none"> ● MJV: <ul style="list-style-type: none"> ○ Communications Plan ○ Get Involved Audience Pages ○ Power Map (in progress)
	b) Maintain inventory of events, meetings, or other opportunities to engage various audiences.	Med	
	c) Maintain a geographic list of presenters, educators, or monarch conservation ambassadors to broaden reach.	Sustain (Med)	
E-6: Improve outreach to media and elected officials	a) Provide and share current press releases, interviews, targeted articles and science-based recommendations for distribution to media outlets and elected officials.	High	<ul style="list-style-type: none"> ● MJV partner press releases, reports and resources ● MJV: <ul style="list-style-type: none"> ○ Get Involved Audience Pages ○ Monarch Communicator's Guide (in progress)
	b) Encourage greater publicity for monarch conservation activities and partnerships across scales and sectors.	High	
	c) Keep talking points up to date and easily accessible, with regional specifications or considerations.	Sustain (Med)	
E-7: Improve accessibility of scientific information	a) Translate scientific research for various audiences to highlight key takeaways and encourage appropriate action based on scientific findings.	High	<ul style="list-style-type: none"> ● MCSP ● MJV News ● MJV Partner Memos ● MonarchNet
	b) Distribute regionally appropriate key messages from scientific research to conservation stakeholders. (See H-5)	High	

Objective 2: Increase learning about monarchs and their habitat in formal and informal settings.

Strategy	Actions	Priority	Resources
<p>E-8: Provide monarch education for both formal and informal audiences</p>	<p>a) Integrate monarch citizen science opportunities into education efforts.</p>	<p>High</p>	<ul style="list-style-type: none"> ● Ba’s Relief, LLC ● JN: <ul style="list-style-type: none"> ○ Symbolic Migration ○ Informational lessons ● MJV: <ul style="list-style-type: none"> ○ Downloads and Links: Education section ○ Get Involved: Study Monarchs ○ MJV/NCTC Monarch Conservation Webinars ● Monarch Lab: <ul style="list-style-type: none"> ○ Monarchs and More Curriculum ○ Schoolyard Ecology Explorations Curriculum ○ Driven to Discover Monarch Curriculum ○ North American Monarch Institute ● MLMP: Online Training Series and Regional Trainers ● Monarch Live! A Distance Learning Adventure ● Monarch Teacher Network: Teacher workshops ● Monarchs Across Georgia ● NWF: School Case Studies and Funding Resources and Lego’s Monarch Mission curriculum ● TWA Youth On-Demand Webinar The Magic of Monarchs ● USDA NRCS field offices
	<p>c) Identify, evaluate, and recommend existing, relevant curricula or educational activities for different age groups, applying current standards and integrating core curricula into monarch education when relevant.</p>	<p>High</p>	
	<p>d) Host or support monarch conservation educational events or celebrations for the general public (e.g. youth groups, garden clubs, plant sales, monarch festivals, etc.)</p>	<p>Med</p>	
	<p>e) Expand and evaluate collaborative teacher and environmental education workshops (train-the-trainer) to strengthen monarch learning networks. (See E-9)</p>	<p>High</p>	
	<p>f) Develop and evaluate methods to train contractors, producers, partners and individuals on proper establishment and maintenance of habitat. Use habitat demonstration plots and field events and collaborate with trusted partners to effectively reach targeted audience. (See Habitat Strategies)</p>	<p>High</p>	

Objective 3: Foster networking between stakeholders involved in monarch conservation.

<i>Strategy</i>	<i>Actions</i>	<i>Priority</i>	<i>Resources</i>
E-9: Expand and connect network of specialists to support monarch conservation	a) Provide communication, networking, and relationship building opportunities for monarch and conservation specialist groups to share resources (i.e. toolkits) (See E-3)	Sustain (High)	<ul style="list-style-type: none"> ● MJV: <ul style="list-style-type: none"> ○ Communications/Outreach Working Group ○ Downloads and Links: MJV Handouts Section ○ Get Involved Audience Pages ○ Habitat Working Group ● MLMP: Training Network ● Monarch Watch: Conservation Specialist Group
	b) Provide support materials to specialists to aid in education/outreach efforts.	Med	
E-10: Facilitate information sharing and transparent tracking of conservation efforts	a) Effectively catalogue and communicate monarch conservation efforts, research, resources, and potential partners or opportunities. Connect individuals and organizations with relevant projects or opportunities.	Sustain (High)	<ul style="list-style-type: none"> ● MJV website: https://monarchjointventure.org/ <ul style="list-style-type: none"> ○ Monarch Conservation Efforts Map (in progress, building on the EWCL: Monarch Highway “Power Map” Project) ● CEC: <ul style="list-style-type: none"> ○ Engaging Farmers and Other Landowners to Support Monarch Butterfly and Pollinator Conservation ○ Monarch Conservation Toolbox ○ North American Monarch Conservation Plan ● Listservs <ul style="list-style-type: none"> ○ DPLEX ○ Western Monarchs ○ Pollinator Partnership ○ MJV Partners ● Trilateral Working Group for Communications ● USFWS: Conservation Efforts Database for Monarch Conservation Project (in development)
	b) Facilitate or encourage continued communication and cooperation between U.S., Canada, and Mexico. Actively address geographic differences in conservation actions and education messages between nations and regions.	Sustain (High)	

Section 3: Research and Monitoring to Inform Monarch Conservation Efforts

Strategies that have trinational considerations are indicated with **.

Objective 1: Study monarch habitat and population status.

Strategy	Actions	Priority	Resources
R-1: Improve U.S. overwintering site assessment and 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.	Sustain (High)	<ul style="list-style-type: none"> ● Xerces: <ul style="list-style-type: none"> ○ Western Monarch Count Resource Center ○ Overwintering Site Habitat Assessment Form ● 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 timing. Develop and implement new protocols if necessary.	Low	
R-2: Assess risks and inform habitat and population targets **	a) Update population and habitat models with new information as it becomes available, considering potential exchange between populations.	High	<ul style="list-style-type: none"> ● Cheryl Schultz (WSU), Xerces, and USFWS <ul style="list-style-type: none"> ○ Paper (Schultz et al. 2017): Citizen science monitoring demonstrates dramatic declines of monarch butterflies in western North America ● MCSP Publications ● MonarchNet Library ● Paper: Monarch butterfly population decline in North America: identifying the threatening processes (Thogmartin et al. 2017)
	b) Utilize existing Population Viability Analyses to construct biological target(s) and inform conservation strategies.		
	c) Validate and improve monarch movement models by measuring monarch recruitment to areas of known and varied milkweed distribution.	Med	

	d) Assess parameters for obtaining increased precision of stage-based demographic model, including migration success, fecundity of overwintered females, and immature survival in eastern and western populations, taking into account geographic differences.	High	<ul style="list-style-type: none"> ● Paper: A trans-national monarch butterfly population model and implications for regional conservation priorities (Oberhauser et al. 2016) ● Paper: Local and cross-seasonal effects of climate and land-use on breeding abundances of a migratory species (Saunders et al. 2017) ● Paper: Can roadside habitat lead monarchs on a route to recovery? (Kasten et al. 2016)
R-3: Document known monarch breeding areas and migratory pathways **	a) Improve documentation and visualization of potential breeding locations across the range.	High	<ul style="list-style-type: none"> ● MJV Webinars: <ul style="list-style-type: none"> ○ Southwestern Monarchs ○ There and Back Again – the compasses monarchs use to get to and return from Mexico. ● MonarchNet Library ● Monarch Watch: Tagging Program ● NPS: Southwest Exotic Plant Management Team developing monarch/milkweed mapping project in southwestern U.S. ● Pacific Northwest: Tagging Program ● SWMS (AZ, NV, NM, CA deserts, UT, CO) ● Xerces and USFWS Western Monarch and Milkweed Habitat Suitability Assessment Project, Model and Western Milkweed Survey and Occurrence Database ● Western Habitat Suitability Model (produced from Habitat Assessment Project listed above; Dilts, et al., in prep)
	b) Build on western habitat suitability model through site monitoring and research into habitat preferences.	Med	
	c) Support ongoing tagging efforts and analyses to improve knowledge of monarch movement within and across regions.	Sustain (Med)	
	d) Develop and encourage standard protocol for geo-referencing tagging data.	High	
R-4: Develop, validate, and improve breeding habitat assessment tools	a) Coordinate, standardize, and validate monarch habitat assessment or evaluation tools.	High	<ul style="list-style-type: none"> ● EDF: Habitat Quantification Tool for Habitat Exchange ● MCSP Integrated Monitoring Program ● MJV: Breeding Habitat Assessment Tool ● NRCS: Monarch WHEGs (Midwest and S. Great Plains) ● Xerces: Pollinator Habitat Assessment Form and Guide ● USGS: Monarch Conservation Planning Tools
	b) Contribute site assessment data to ongoing monitoring or tracking efforts. (See also R-5 and R-7).	Sustain (Med)	
	c) Identify existing habitat assessment tools and make connections to integrate conservation actions that benefit multiple species.	Low	

R-5: Maintain records of habitat availability and monarch conservation efforts	a) Estimate existing habitat available in different landscapes.	High	<ul style="list-style-type: none"> ● MJV: Power Map (in progress) ● Monarch Lab: <ul style="list-style-type: none"> ○ Midwest roadside milkweed assessment ○ With Prairie Resto, NRCS: Evaluating monarch habitat, restoration, and management in the Midwest ○ With NRCS: Evaluating CRP as monarch habitat ○ With the Field Museum: Urban habitat monitoring ● USFWS: Monarch Conservation Database for Monarch Conservation (in development) ● ROW as Habitats Working Group conservation efforts database for utilities and others to track accomplishments
	b) Maintain a database to track habitat projects, (including habitat quality) through time. Devise a strategy to ensure that habitat is reported thoroughly, including practices or projects designed for other species that also benefit monarchs.	Sustain (High)	
	c) Track and evaluate monarch conservation education, outreach, and research activities broadly through time.	Sustain (Med)	
R-6: Determine areas of highest monarch overwintering contributions **	a) Analyze tagging data to provide yearly estimates of monarch migratory success from different regions.	High	<ul style="list-style-type: none"> ● “Divergent Migration Destinations and Multiple Overwintering Strategies of <i>Danaus plexippus</i> in the Southwest United States” by Morris et al (in progress) ● Paper: Density estimates of monarch butterflies overwintering in central Mexico (Thogmartin et al. 2017) ● Paper: Regional climate on the breeding grounds predicts variation in the natal origin of monarch butterflies overwintering in Mexico over 38 years (Flockhart et al. 2017) ● Monarch Alert ● Monarch Watch ● Morris et al. (2015) ● Southwest Monarch Study ● University of Guelph isotope study (in progress)
	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 determine proportion of western monarchs that overwinter in Mexico using stable isotopes and cardenolide fingerprinting.	Med	

Objective 2: Expand monitoring, data exchange, and data analyses to inform conservation efforts.

<i>Strategy</i>	<i>Actions</i>	<i>Priority</i>	<i>Resources</i>
R-7: Implement National Monitoring Program to address data gaps **	a) Depict temporal and spatial information needs and train monitors (see E-8) to gather data to inform reliable estimates of habitat and population trends.	High	<ul style="list-style-type: none"> ● MCSP Integrated Monitoring Program ● MJV: <ul style="list-style-type: none"> ○ Handout: Monarch Citizen Science ○ Get Involved: Citizen Science Opportunities ○ Webinar: Contributions of Monarch Citizen Science and Program Overviews ● MLMP: Training resources ● Xerces, USFWS, IDFG, WDFW Western Monarch Milkweed Mapper
	b) Use and share appropriate and consistent evaluation tools to improve training program delivery and content.		
	c) Connect standard monitoring protocols and data with current research studies and existing citizen science programs to expand potential uses and statistical power.		
	d) Leverage compatible information needs to draw data from a variety of biological monitoring efforts.		
R-8: Analyze data across scales to detect habitat/population trends **	a) Improve access to existing data.	High	<ul style="list-style-type: none"> ● MCSP Integrated Monitoring Program ● MonarchNet
	b) Aggregate and standardize existing data and coordinate analyses, incorporating programs that monitor monarch breeding, migrating and overwintering numbers and survival, as well as habitat attributes.	High	
R-9: Improve monitoring apps to increase data collection	a) Develop or improve user-friendly mobile device apps for monarch and habitat monitoring programs, encourage collaborative reporting when possible, and integrate with National Monitoring Program.	High	<ul style="list-style-type: none"> ● iNaturalist ● JN mobile app ● Monarch Migration mobile app ● Naturedigger: Monarch SOS for iOS ● Unified butterfly recorder (Reiman Botanical Garden (IA)) ● USFWS/MJV data entry app for MCSP IMS
R-10: Maintain western overwintering site database; share results	a) Improve western count database to address data sensitivity issues, improve information sharing, allow third-party data entry, and track habitat assessments.	Med	<ul style="list-style-type: none"> ● Monarch Alert ● Xerces: <ul style="list-style-type: none"> ○ Western Monarch Count Resource Center ○ State of the Monarch Butterfly Overwintering Sites in CA ○ Protecting California's Butterfly Groves
	b) Continue to publish and share resources to get important information into hands of land managers.	Sustain (High)	

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

<i>Strategy</i>	<i>Actions</i>	<i>Priority</i>	<i>Resources</i>
R-11: Increase understanding of relative habitat quality at the patch and landscape scales using monitoring data	a) On the landscape scale, establish regionally appropriate targets for the spatial distribution and scale of monarch habitat.	High	<ul style="list-style-type: none"> ● Cheryl Schultz (WSU) and Tyler Grant/Steve Bradbury (ISU) are looking at monarch movement to build on Zalucki papers (see references). ● DBG is studying use of monarch habitat by other beneficial species in the Southwest. ● MCSP IMS ● MJV/Monarch Lab: NRCS collaboration to evaluate CRP (in progress) ● TPC: Pollinator habitat evaluation projects
	b) Determine how milkweed and nectar plant diversity, abundance and distribution affect monarch reproduction, survival, and movement at patch and landscape scales.	High	
	c) For habitat established in intensively farmed landscapes within or near fields treated with pesticides, assess pesticide exposure and monarch survival.	High	
	d) At landscape and patch scales, document and study use of monarch habitat by other beneficial species.	Med	
	e) Improve understanding of regionally appropriate milkweed and nectar plant species optimal for monarchs.	Low	
R-12: 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	<ul style="list-style-type: none"> ● ISU research ● Monarch Watch, MJV: Growing Milkweed for Monarch Conservation ● Monarch Watch: Milkweed Market ● TPC studies and resources ● USFWS Monarch Conservation Database (in progress) ● Xerces: Milkweeds: A Conservation Practitioner's Guide
	b) Determine the effects of using plugs vs. seeds regionally, especially for higher cost seeds.	Med	
	c) Develop regional tools to inform when, how, and what resources are needed to best improve existing habitat vs. restore habitat from scratch.	High	
	d) Identify natural factors that limit milkweed distribution (elevation, soil, light, latitude, temperature, precipitation) to inform region- and site-specific species lists. For sites that lack milkweed entirely, determine what barriers exist to natural colonization (e.g., lack of local seed source,	Med	

	competition, inadequate soil moisture, or disturbance). Tailor interventions to fit the situation.		
	e) 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	
R-13: Leverage benefits of monarch conservation for other issues	a) Identify shared geospatial priorities and leverage actions in areas that benefit multiple environmental issues and human dimensions of natural resource management.	High	<ul style="list-style-type: none"> ● Possible issues to leverage: <ul style="list-style-type: none"> ○ Pollinators, birds, game species, other wildlife ○ Water quality, pollination, carbon storage, soil health ○ Solar or wind energy ○ Aesthetics, health, outdoor recreation, green space
R-14: Improve understanding of social factors influencing monarch conservation	a) Conduct stakeholder analyses, assessing the effectiveness of efforts to engage them.	High	<ul style="list-style-type: none"> ● Field Museum Urban Monarch Conservation Guidebook ● MCSP: Monarch Conservation Planning Tools ● Paper: Restoring monarch butterfly habitat in the Midwestern US: 'all hands on deck' (Thogmartin et al. 2017) ● USFWS: Human Dimensions Project
	b) Identify social science research relevant to monarch conservation. Focus study in areas where concern is highest and where habitat is needed most.	Low	
	c) Assess organizational structure and processes to determine the most effective methods for collaboration.	Low	
	d) Use social research to understand current and achievable adoption rates of habitat conservation action by sector.	Med	

Objective 4: Study the effects of diseases, non-native species, and changing environment on monarchs and their habitat

<i>Strategy</i>	<i>Actions</i>	<i>Priority</i>	<i>Resources</i>
R-15: Improve understanding of winter breeding in the U.S.	a) Determine status of non-migratory populations in the U.S. and monitor whether non-migratory behavior is becoming more common and increasing prevalence of O.e. in those areas.	High	<ul style="list-style-type: none"> ● Monarch Alert ● Monarch Health: Latest Research ● MJV: <ul style="list-style-type: none"> ○ Potential Risks of Growing Exotic Milkweed for Monarchs ○ Webinar: Assessment of Exotic Milkweed and the Spread of Disease in Monarchs ● P2 Ecoregion Guides ● USFWS project in southern California to explore non-migratory behavior, contact Samantha Marcum. ● Xerces Society: Nectar Plant Lists
	b) Assess the diapause status of migrating monarchs and develop standard, repeatable, non-disruptive protocols.	Low	
	c) Continue to measure the prevalence, species, and management of milkweed in areas where it has potential to grow year-round, particularly in areas near overwintering sites	Sustain (Med)	
	d) Develop management recommendations to limit year-round breeding of monarchs in CA and the southern US, encouraging gardeners and growers not to grow <i>Asclepias curassavica</i> , and promoting diverse nectar plants as an alternative.	Med	
R-16: Assess effects of plant pests and diseases, herbivory and non-native species and provide management guidance	a) Assess effects of fire ants and fire ant control on monarchs.	High	<ul style="list-style-type: none"> ● MJV Handout: Invasive Species Alert ● Examples: Assess effects of insect pests 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 by herbivores (e.g. <i>Aphis nerii</i>) that negatively influence milkweeds.	Low	
	c) Determine impacts of and possible solutions to insect pests and tree diseases, and evaluate qualities of different tree species in overwintering habitats.	High	
	d) Assess <i>Vincetoxicum</i> spp (e.g. <i>Cynanchum louisea</i> , <i>Cynanchum rossicum</i>) abundance, attempted use by monarchs and possible control methods.	Low	

	e) Assess impacts of invasive plant species on monarch habitat and disseminate to the public	Low	
	f) Assess the extent and impacts of milkweed diseases and provide recommendations for management.	Low	
R-17: Assess impact of weather and climate conditions on monarchs and their habitat **	a) Explore the influence of climate change and other environmental factors on monarchs and their habitat across scales.	Med	<ul style="list-style-type: none"> ● Zipkin, Ries, Oberhauser study of resources and climate under climate change scenarios (in progress) ● MJV: <ul style="list-style-type: none"> ○ Threats – climate change ○ Webinar: Monarchs and Climate Change ● Monarch Net: Library – search ‘climate’ ● Morris et.al. (2015) ● University of Texas at San Antonio Biodiversity and Ecological Sustainability Laboratory ● WWF: Climate Vulnerability Report
	b) Design a research program to determine the influence of topography, weather, wind, microclimate, soil moisture, and other abiotic factors on monarch populations and movements in the context of varying land management approaches.	Med	
R-18: Assess effects of chemical additions to habitat on monarchs	a) Use typical timing of application and monarch presence to prioritize research on various chemical effects on monarchs.	High	<ul style="list-style-type: none"> ● ISU project studying neonicotinoid use and monarchs, contact Steve Bradbury. ● MJV: <ul style="list-style-type: none"> ○ Risks of Neonicotinoid Use to Pollinators handout ○ Threats –Pesticides webpage ● NAPPC: Vector borne disease control effects on pollinators paper (Ginsberg et.al, 2017) ● Purdue University project to assess toxicity levels of common agricultural pesticides and other agricultural chemicals on monarch larvae, contact Ian Kaplan ● P2: pesticide application training ● University of Minnesota Emilie Snell-Rood research on road salts and heavy metals. ● U.S. EPA regulations
	b) Study effects of road salt, insecticides, fungicides, herbicides, and fertilizers on monarchs and milkweed (including associations with mycorrhizal fungi) and develop and distribute recommendations for mitigating risks, especially to key stakeholders (pesticide applicators, ROWs, etc.).		
	c) Review existing literature on impacts to other similar taxa to determine potential impact of chemical inputs.		
	d) Determine exposure level risks based on various factors such as chemicals used, timing and application technique, other environmental factors, etc. and establish recommended buffer distances between habitat and pesticide application based on findings.		

R-19: Assess effects of pathogens and natural enemies on monarchs	a) Track monarch interactions with predators and parasitoids to determine the effects of other natural enemies on population dynamics, and encourage further participation from citizen scientists and partners.	Sustain (Med)	<ul style="list-style-type: none"> ● MJV Webinars: <ul style="list-style-type: none"> ○ Monarch Parasitoids ○ Assessment of Exotic Milkweed and the Spread of Disease in Monarchs ● MLMP: Activity 3 ● Monarch Lab: Publications ● Project Monarch Health
	b) Study the prevalence and transmission of monarch pathogens.	Low	
	c) Continue to assess the prevalence of O.e. (<i>Ophryocystis elektroscirrha</i>) in monarchs throughout the year, and provide recommendations to minimize spread of disease based on findings.	Sustain (Med)	
R-20: Assess effects of captive rearing on monarchs	a) Compare the prevalence of disease in wild and captive-reared monarchs.	Med	
	b) Support data collection through existing monarch citizen science programs that collect long-term data on disease and parasitism trends.	Sustain (Med)	
	c) Evaluate the effects of captive rearing on monarch fitness (e.g. size, number of eggs laid, flight ability).	Med	
	d) Broadly survey to collect information about the motivation and context for captive rearing, average number of monarchs raised, and rearing conditions.	Med	

Section 4: Monarch Joint Venture Program Development

<i>Strategy</i>	<i>Actions</i>	<i>Priority</i>
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) 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 MJV priorities and mission.	Med
	b) Expand outreach to invite collaboration and partnership with organizations that can contribute to MJV mission.	
P-3: Improve communications	a) Maintain and refine MJV communications plan.	High
	b) Maintain MJV Communication/Outreach and Agriculture working groups and expand working group structure to other topics to improve coordination and engagement of MJV partners and other stakeholders.	
	c) Encourage use of MJV Partner Listserv to share relevant monarch conservation activities and opportunities between partners.	
	d) Sustain 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) Develop and share annual report demonstrating MJV partnership accomplishments.	
P-5: Continue support for MJV core staff team	a) Develop capacity building program for MJV core team to expand coordination capabilities.	High
	b) Annually update operational plan with priority objectives for MJV personnel, leadership, and partners.	
	c) Support training and development opportunities for staff and partners.	

Resource Abbreviations

Abbreviation	Organization	Abbreviation	Organization
AFWA	Association of Fish and Wildlife Agencies	Monarch Lab	University of Minnesota Monarch Lab
BBHF	Bee and Butterfly Habitat Fund	MWfM	Make Way for Monarchs
BLM	Bureau of Land Management	NABA	North American Butterfly Association
BONAP	Biota of North America Plant Atlas	NCTC	National Conservation Training Center
CDFW	California Department of Fish and Wildlife	NPGN	National Pollinator Garden Network
CEC	Commission for Environmental Cooperation	NPS	National Park Service
DBG	Desert Botanical Garden	NPSoT	Native Plant Society of Texas
DoD	Department of Defense	NRCS	Natural Resources Conservation Service
DOT	Department of Transportation	NWF	National Wildlife Federation
EDF	Environmental Defense Fund	P2	Pollinator Partnership
EPRI	Electric Power Research Institute	PCA	Plant Conservation Alliance
ERC	Energy Resource Center	PF	Pheasants Forever
EWCL	Emerging Wildlife Conservation Leaders	Prairie Resto	Prairie Restorations, Inc.
FHA	Federal Highway Administration	SWCD	Soil and Water Conservation District
Field Museum	Chicago Field Museum	SWMS	Southwest Monarch Study
IDFG	Idaho Department of Fish and Game	TPC	Tallgrass Prairie Center
IRVM	Integrated Roadside Vegetation Management	TWA	Texas Wildlife Association
ISU	Iowa State University	USDA	United States Department of Agriculture
IVM	Integrated Vegetation Management	USFS	United States Forest Service
JN	Journey North	USFWS	United States Fish and Wildlife Service
LBJWC	Lady Bird Johnson Wildflower Center	USGS	United States Geological Survey
MAFWA	Midwest Association of Fish & Wildlife Agencies	WDFW	Washington Department of Fish and Wildlife
MAG	Monarchs Across Georgia	WHEG	Wildlife Habitat Evaluation Guide
MCSP	Monarch Conservation Science Partnership	WO	Wild Ones: Native Plants Natural Landscapes
MJV	Monarch Joint Venture	WSU	Washington State University
MLMP	Monarch Larva Monitoring Project	Xerces	The Xerces Society for Invertebrate Conservation

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