



# Conservation Priorities for Western Monarchs in California • 2026



# Contributors

## CALIFORNIA COASTAL COMMISSION

Rachel Pausch, Ecologist

## CALIFORNIA DEPARTMENT OF FISH AND WILDLIFE

Scott Gardner, Wildlife Branch Chief  
Pete Figura, Wildlife Diversity Program Manager  
Michelle Selmon, Lands Program Manager  
Dan Applebee, Conservation and Recovery Unit Supervisor  
Ryan Bourbour, Pesticide Investigations Coordinator  
Krista Hoffmann, Integrated Pest Management Coordinator  
Hillary Sardiñas, Pollinator Coordinator  
Julea Shaw, Environmental Scientist  
Kimiora Ward, Terrestrial Invertebrate Listing Coordinator

## CALIFORNIA DEPARTMENT OF FOOD AND AGRICULTURE

Kevi Mace, Office of Pesticide Consultation and Analysis Supervisor  
Patricia Bohls, Biodiversity Coordinator

## CALIFORNIA DEPARTMENT OF PARKS AND RECREATION

Ron Melcer, Environmental Program Manager, Natural Resources Div.  
Dena Spatz, Senior Wildlife Biologist, Natural Resources Division

## CALIFORNIA DEPARTMENT OF PESTICIDE REGULATION

Jill Townzen, Pesticide Evaluation Branch Chief  
Brigitte Tafarella, Ecotoxicology Program Manager

## CALIFORNIA DEPARTMENT OF TRANSPORTATION

Luz Quinnell, Senior Wildlife Biologist  
Melinda Molnar, Office of Fish and Wildlife Connectivity Chief

## WILDLIFE CONSERVATION BOARD

Rebecca Fris, Deputy Executive Director  
Hayley Pechner, Environmental Scientist  
Scott McFarlin, Restoration and Development Manager

## BUREAU OF LAND MANAGEMENT

Erin McConnell, Branch Chief, Biological Resources in Div. of Natural Resources  
Christina Lund, California State Botanist

## NATURAL RESOURCES CONSERVATION SERVICE

Jon Gustafson, State Resource Conservationist  
Jesse Bahm, State Biologist

## UNITED STATES FISH AND WILDLIFE SERVICE

Adam Johnson, Assistant Regional Director  
Melissa Burns, Western Monarch Coordinator

## UNITED STATES FOREST SERVICE

Patricia Krueger, Regional TES Species Program Leader



# Acknowledgements

The Collaborative thanks Darrin Thome, USGS Associate Regional Director; Michelle Hladik, USGS Research Chemist; Jay Diffendorfer, USGS Applied Ecologist; Wayne Thogmartin, USGS Quantitative Ecologist; National Park Service Pacific West Region Deputy Regional Director Katariina Tuovinen; NPS Landscape Ecologist Matthew Nicholson; NRCS retired State Biologist Thomas Moore; Peggy Wilcox and Roland Sosa from the United States Navy Region Southwest, Department of Defense, for their contributions in meetings discussing key actions and gaps.

**Disclaimers:** *The report content was written by contributors from the agencies listed above. The Executive Summary and Conclusion were drafted, in part, using the artificial intelligence engine Government Chat GPT based on the report content. These sections were thoroughly reviewed and approved before being incorporated into the document.*

*This report does not necessarily reflect the official views of each contributing agency.*

**Recommended citation:** California Multi-Agency Monarch and Pollinator Collaborative. 2026. *Priority Action and Gap Analysis Report*. Sacramento, CA. 83 pp.

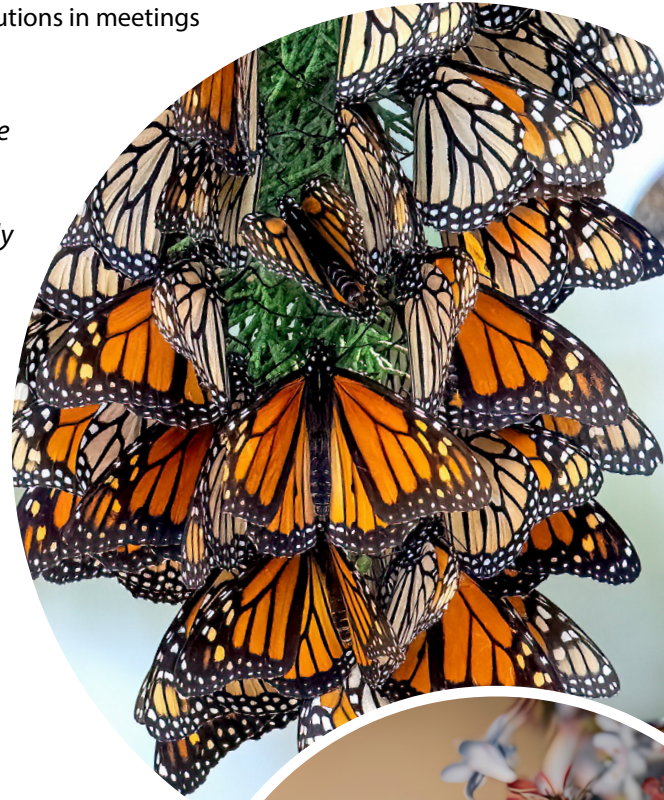
**Design by:** Meredith Fleener, CDFW

**For questions or additional information about this report contact:**

Hillary Sardiñas, CDFW Pollinator Coordinator, at [Hillary.Sardinas@wildlife.ca.gov](mailto:Hillary.Sardinas@wildlife.ca.gov)

Julea Shaw, CDFW Lands Fostering Biodiversity Coordinator, at [Julea.Shaw@wildlife.ca.gov](mailto:Julea.Shaw@wildlife.ca.gov)

Melissa Burns, USFWS Western Monarch Coordinator, at [Melissa\\_Burns@fws.gov](mailto:Melissa_Burns@fws.gov)



# Acronyms and Abbreviations

**BLM** - Bureau of Land Management

**BMPs** - Best Management Practices

**Caltrans** - California Department of Transportation

**CCC** - California Coastal Commission

**CDFW** - California Department of Fish and Wildlife

**CDFA** - California Department of Food and Agriculture

**Collaborative** - Multi-Agency Monarch and Pollinator Collaborative

**DoD** - Department of Defense

**DPR** - California Department of Pesticide Regulation

**EQIP** - Environmental Quality Incentives Program

**ESHA** - Environmentally Sensitive Habitat Area

**IMMP** - Integrated Monarch Monitoring Program

**IPM** - Integrated Pest Management

**MBPR** - Monarch Butterfly and Pollinator Rescue Program

**MJV** - Monarch Joint Venture

**Motus** - Motus Wildlife Tracking System

**NPS** - National Park Service

**NRCS** - Natural Resources Conservation Service

**PHP** - Pollinator Habitat Program

**RCD** - Resource Conservation District

**ROW** - Right-of-way

**State Parks** - California Department of Parks and Recreation

**UC IPM** - University of California Integrated Pest Management

**USFS** - U.S. Forest Service

**USFWS** - U.S. Fish and Wildlife Service

**USGS** - U.S. Geological Survey

**WAFWA** - Western Association of Fish and Wildlife Agencies

**Western Monarch Summit** - 2022 Western Monarch Butterfly Conservation Summit

**WCB** - Wildlife Conservation Board

**Xerces Society** - The Xerces Society for Invertebrate Conservation

**50-year monarch conservation plan** - Western Monarch Butterfly Conservation Plan, 2019—2069

# Executive Summary



Many of California's native invertebrate pollinator species are at risk due to a multitude of threats including habitat loss, pesticide use, unpredictable weather conditions, and disease. This includes the iconic western monarch butterfly, whose numbers have fallen to the lowest on record over the past five years.

The California Multi-Agency Monarch and Pollinator Collaborative (Collaborative), comprised of 13 state and federal agencies, came together to identify key collaborative actions agencies and other partners can take to slow the decline of monarch butterflies in California.

Members undertook a multi-year analysis of the Western Association of Fish and Wildlife Agencies (WAFWA) Western Monarch Butterfly Conservation Plan (2019—2069) and recommendations from the 2022 Western Monarch Butterfly Conservation Summit in Washington DC to identify relevant actions, pinpoint gaps, and prioritize efforts based on agency capacity and species need.

The Collaborative sorted its recommended actions into six focal areas: Habitat, Research, Monitoring, Outreach and Education, Funding, and Collaboration. Partners then selected five high-priority actions to be accomplished within the next 1—3 years that will form the initial focus of our joint efforts:

**1. DEVELOP A STANDARD DEFINITION OF MONARCH HABITAT IN THE WEST:**

A clear and measurable definition will help establish effective conservation goals for monarch habitats.

**2. TRACK IMPLEMENTATION AND SUCCESS OF HABITAT PROJECTS:**

Developing a new, user-friendly database will help document progress and share effective restoration methods.

**3. CENTRALIZE EXISTING POLLINATOR RESOURCES:**

Bringing key resources together such as training materials, educational tools, and best management practices into an online platform will make information more accessible.

**4. IMPROVE NATIVE PLANT MATERIAL AVAILABILITY:**

A more consistent supply and variety of locally adapted native plant species will improve pollinator-focused habitat restoration projects.

**5. DEVELOP A WESTERN MONARCH DEMOGRAPHIC MODEL:**

This scientific tool will enhance understanding of population dynamics and help target conservation strategies to vulnerable life stages.

The Collaborative will prioritize the implementation of the five near-term actions through dedicated working groups and cooperative projects. This will involve developing specific implementation plans, fostering external partnerships, seeking funding opportunities, and implementing communication strategies.

Beyond the near-term priorities, we outline additional actions within each focal area that address critical needs including pesticide research and reduction, identification of migratory habitats, enhanced monitoring protocols, tribal outreach and inclusion, sustainable funding mechanisms, and strengthened interagency collaboration. We also highlight existing efforts by Collaborative Partners that demonstrate each agency's ongoing commitment to monarch conservation.



Key identified gaps include the need to more thoroughly address the threat from pesticides including expanding research objectives, focusing on rangelands as a priority landscape, addressing impacts to monarch habitats from wildfire, and improving coordination with California Native American tribes.

We plan to update this report every five years. A recurring review process will ensure the report remains relevant and incorporates new research findings, evaluates progress, and adapts strategies as needed. The commitment to regular updates underscores our adaptive and long-term approach to monarch and broader pollinator conservation in California.

Collectively, the actions in this report provide a strategic roadmap for the Collaborative to catalyze effective and coordinated conservation action. By focusing on shared priorities, addressing critical gaps, and committing to ongoing evaluation and adaptation, we aim to significantly contribute to the recovery of monarch butterflies and the broader health of California's vital pollinator populations.

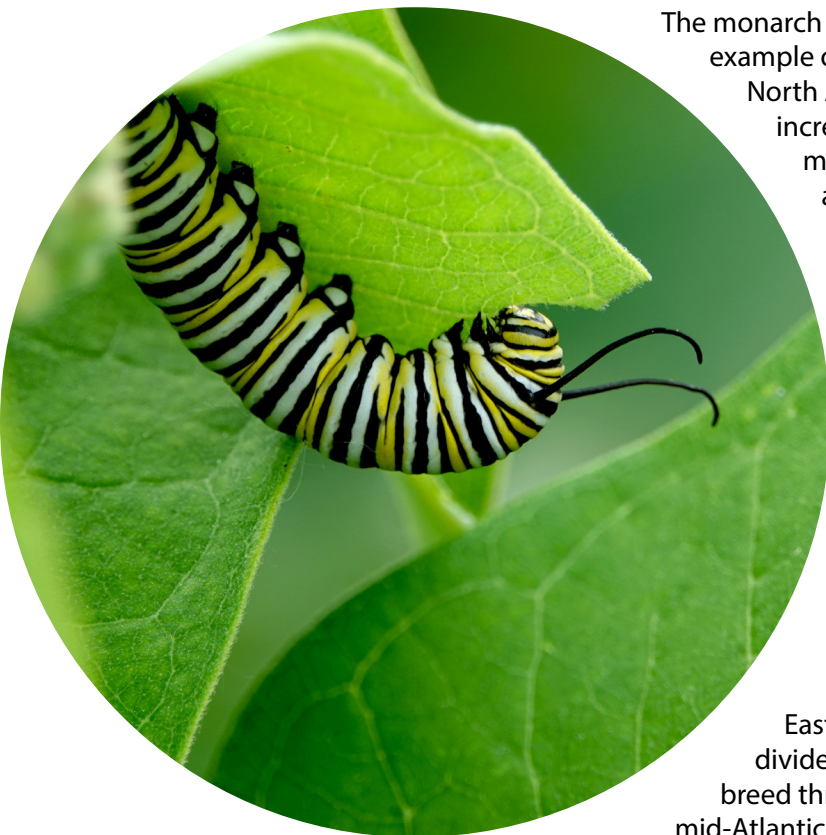
# Table of Contents

Contributors .....	2
Acknowledgments.....	3
Acronyms and Abbreviations.....	4
Executive Summary.....	5
Table of Contents .....	7
Introduction .....	8
<u>Monarch and Pollinator Decline</u> .....	8
<u>The California Multi-Agency Monarch and Pollinator Collaborative</u> .....	10
Identifying Shared Priorities.....	11
Process.....	11
Conceptual Model.....	12
Gaps.....	14
Priority Organization .....	15
Near-Term Priority Actions .....	15
Additional Priorities by Focal Area .....	17
<b>Habitat</b> .....	17
<b>Research</b> .....	22
<b>Monitoring</b> .....	27
<b>Outreach &amp; Education</b> .....	32
<b>Funding</b> .....	37
<b>Collaboration</b> .....	39
Conclusion .....	44
Next Steps .....	45
Plan for Regular Report Updates .....	46
References.....	47
Table A1-1: Habitat.....	50
Table A1-2: Research .....	54
Table A1-3: Monitoring.....	63
Table A1-4: Outreach & Education.....	68
Table A1-5: Funding.....	75
Table A1-6: Collaboration .....	78

# Introduction

## MONARCH AND POLLINATOR DECLINE

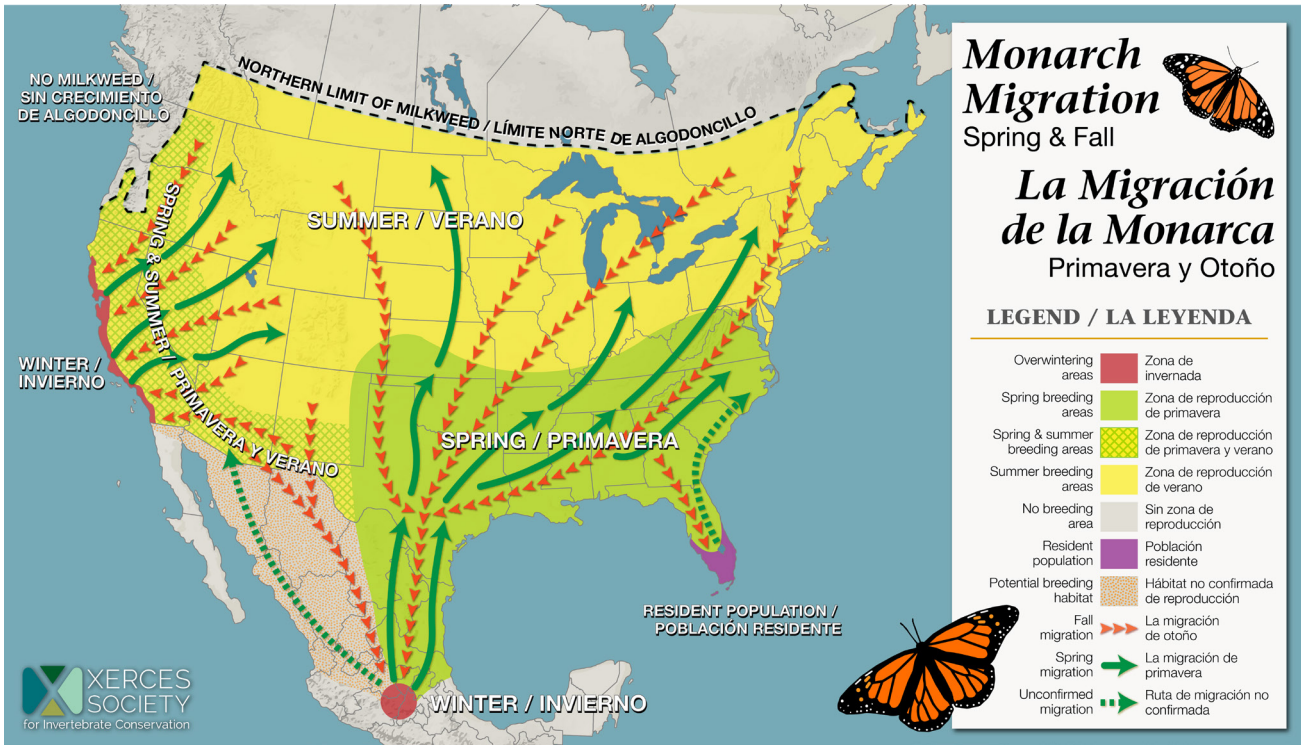
Pollinating insects provide critical ecosystem services, including pollination of more than 85% of all flowering plants (Ollerton et al. 2011) and 35% of agricultural crops (Klein et al. 2007). However, some pollinators are experiencing steep declines. In California, butterflies have declined on average 1.6% per year over the past 20 years (Forister et al. 2021). Eight bumble bee species are considered Species of Greatest Conservation Need in the California State Wildlife Action Plan (CDFW 2025), four of which have been petitioned for listing under the California Endangered Species Act. Widespread pollinator loss threatens to destabilize both natural and agricultural systems by reducing biodiversity and critical ecosystem functions such as cross-pollination (Potts et al. 2016).



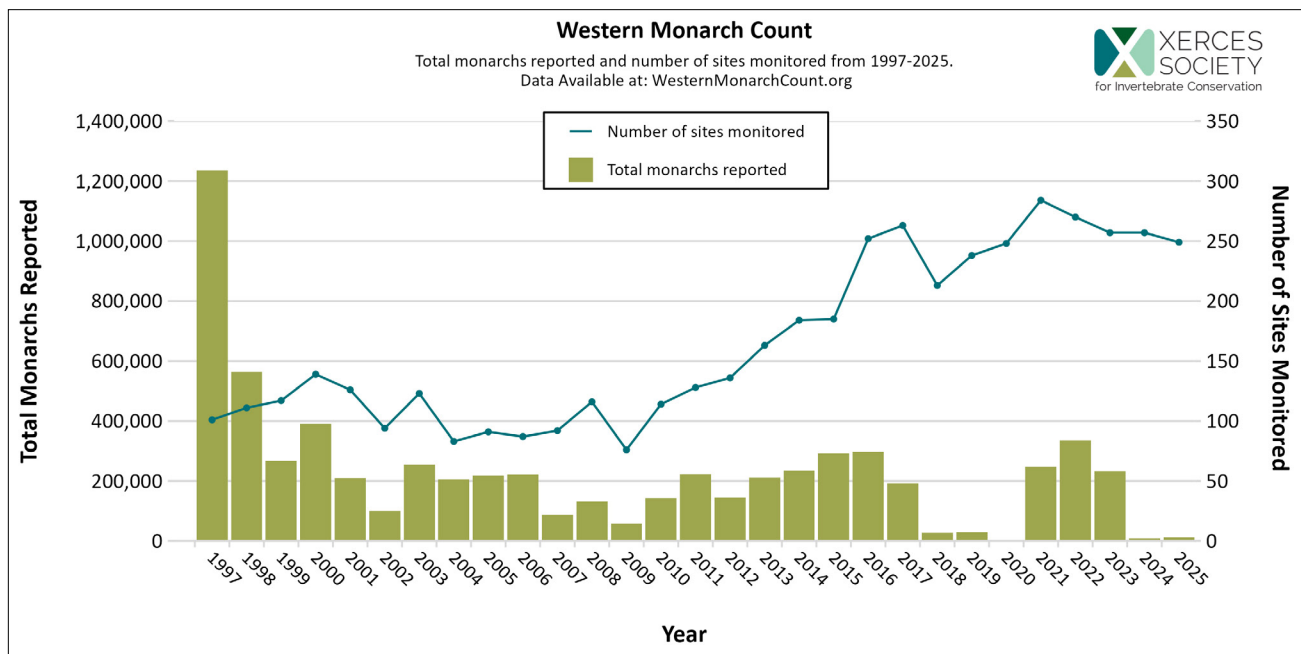
The monarch butterfly (*Danaus plexippus plexippus*) is an iconic example of a pollinator species that is in steep decline across North America. A charismatic species that undertakes incredible long-distance migrations and relies on milkweed (*Asclepias sp.*) as its host plant, monarchs are recognizable due to their black and orange warning coloration indicating their toxicity to predators. In the West, the monarch's range is extensive and includes a variety of landscapes and habitats, from natural to urban. Its broad distribution makes it an ideal “umbrella” or focal species, whose conservation can benefit other species and habitats. Adopting this umbrella approach, we identified actions aimed at stemming monarch declines, with the goal of simultaneously stimulating conservation of other pollinators that face similar threats and occur within monarch breeding and migratory habitats.

Eastern and western monarch populations are divided by the Rocky Mountains. In the east, monarchs breed throughout southern Canada, the U.S. midwest and mid-Atlantic, and overwinter in Mexico. The smaller western population breeds throughout the U.S. southwest and northwest, overwintering along the California coast. While both populations are in decline, the western population has experienced extreme population fluctuations over the past two decades, dipping below 30,000 individuals in several years (the modeled extinction threshold- the point below which the population is not expected to recover; Schultz et al 2017). In 2020 and again in 2024, fewer than 10,000 butterflies were counted in the annual population census (Figure 2; Xerces Society 2025). In 2021, their numbers increased to over 230,000 but as of 2025, the population still has not rebounded and remains near historic lows. While the reasons for the fluctuations have not been definitively identified, severe weather events and high temperatures have been hypothesized to be a factor (Crone et al. 2019).

The decline of pollinator species- including monarchs- has multiple interacting drivers, including irregular climate patterns, disease, pesticide use, and habitat loss (e.g., Dicks et al. 2021). Addressing these stressors requires innovative, collaborative approaches and partnerships to maximize conservation effectiveness through the sharing of information and identifying appropriate measures to enhance and accelerate pollinator conservation in California.



**FIGURE 1.** Migratory pathways and overwintering habitats for eastern and western monarch butterfly populations. Credit: Xerces Society for Invertebrate Conservation. Used with permission.



**FIGURE 2.** Total monarchs reported (green bars) and number of sites monitored (blue line) as part of the annual western monarch overwintering count coordinated by the Xerces Society. Credit: Xerces Society for Invertebrate Conservation. Used with permission.

## THE CALIFORNIA MULTI-AGENCY MONARCH AND POLLINATOR COLLABORATIVE

The California Multi-Agency Monarch and Pollinator Collaborative is a partnership of 13 state and federal agencies including the Bureau of Land Management, California Coastal Commission, California Department of Food and Agriculture, California Department of Fish and Wildlife, California Department of Parks and Recreation, California Department of Pesticide Regulation, California Department of Transportation, California Wildlife Conservation Board, National Park Service, Natural Resources Conservation Service, U.S Fish and Wildlife Service, U.S. Forest Service, and U.S. Geological Survey. Additionally, the Department of Defense has participated in an unofficial capacity. Collectively, Collaborative member agencies own or manage approximately 50% of California's land area. The Collaborative is open to other land management agencies interested in joining as official members. We also welcome ongoing collaboration, dialogue, and shared learning with all entities that support pollinator health and habitat in California. Partners in the Collaborative came together in 2021 with the goal of increasing the pace and scale of monarch and pollinator conservation in California through integrated science, policy, and natural resource management. Representatives of the partner agencies meet regularly to share information and develop conservation strategies.

Specifically, the Collaborative aims to:

- A. Strengthen existing pollinator conservation efforts by leveraging the collective resources of the Partners and other entities.
- B. Promote and provide access to quality, up-to-date pollinator-related science to address shared priority conservation investments and needs.
- C. Identify and implement monarch and pollinator conservation strategies that enhance multiple ecosystem services to increase the resiliency of natural and agricultural systems in the state.
- D. Enhance information sharing between Partners to improve the efficiencies around best management practice adoption and implementation.
- E. Increase capacity, reach, and consistency of communication and messaging to the public that raises awareness of threats to and activities that benefit monarchs and other pollinators.

The Collaborative is composed of two entities: the Management Oversight Group (MOG), comprised of executives and/or managers from participating agencies who prioritize actions, research needs, and other activities needed to meet the Collaborative's objectives; and the Technical Advisory Committee (TAC), comprised of staff from participating agencies who support the objectives set forth by the MOG. The MOG directed the TAC to develop this report to further objectives C and D, with the goal of catalyzing monarch and pollinator conservation to address the current crisis.

# Identifying Shared Priorities

## PROCESS

One of the Collaborative’s main goals is to identify, promote, and collaborate on ecosystem-based management research and actions that can be applied within each Partner’s jurisdiction to support pollinator conservation in California. Instead of developing new actions, Partners decided to review existing monarch-focused documents, specifically the [Western Monarch Butterfly Conservation Plan, 2019—2069](#) (hereafter referred to as the “50-year Monarch Conservation Plan”) and the [2022 Western Monarch Butterfly Conservation Summit Recommendation](#)



[Summary](#) (hereafter “Western Monarch Summit”). The 50-year Monarch Conservation Plan was developed by the Western Association of Fish and Wildlife Agencies (WAFWA) to serve as a compilation of conservation strategies aimed at promoting monarch butterflies in the West. The Western Monarch Summit was coordinated by Senator Jeff Merkley (Oregon) who brought together key researchers, agency personnel, and other partners (e.g., resource conservation districts, non-profits) to identify high-priority actions to catalyze monarch conservation in the west.

Specifically, Partners identified (1) existing actions— those that agencies were already engaged in, (2) needed actions— those that were not currently being implemented but were recognized as being important to monarch conservation in California, and (3) additional actions— gaps that had not been included in the 50-year Monarch Conservation Plan or Western Monarch Summit recommendations but were believed to be critical. For each existing and new action, partners then identified the following (these factors for each action found in the tables in the Appendix):

- **Dependencies:** Actions or information needed to begin work on a given action.
- **Timeframe to initiate:** When implementation for a given action should begin.
- **Timeframe to completion:** Anticipated length of time to complete an action.
- **Deliverables:** Outcomes from engaging in a given action.
- **Success metrics:** Ways to measure whether a given action achieved its stated objective.
- **External partners:** Potential partners outside the Collaborative who could contribute to the implementation of a given action.

Next, each agency in the Collaborative ranked the actions to determine priority actions using the following scale: 0— not a priority, 1— low priority, 2— moderate priority, and 3— high priority. The rankings were summed and those with the highest scores were then narrowed down to develop a list of near-term priority actions that could be implemented in the next 1—3 years that would form the focus of the Collaborative’s activities in the short term (See Priority Actions section). Members then met to discuss

the rankings and approve them. In some cases an action that was not ranked highly was elevated (e.g., “Create early season milkweed habitat” was ranked as a medium priority but increased to a high priority in recognition of the importance of the early-season resource on monarch population dynamics and the existing work Collaborative members were doing on the topic). To review the additional information compiled by the Collaborative, see the Appendix.



Our comprehensive analysis of the 50-year Monarch Conservation Plan, Western Monarch Summit summary, and subsequent prioritization took over a year to complete. This report highlights the results of that process, specifically the near-term and high priority actions organized by focal area (Habitat, Research, Monitoring, Outreach and Education, Funding, and Collaboration). Lower priority actions are not included in the report but can be found in the tables in the Appendix. We plan to revise the priority actions as we make progress toward completing objectives and as new information and research becomes available (See Plan Update section). The Collaborative hopes this report can be used by entities beyond our partner agencies to help identify and implement key actions to promote monarch conservation in California.

## CONCEPTUAL MODEL



**FIGURE 3.** Partners developed a model of the key focal areas we used to organize monarch conservation actions: Habitat, Research, Monitoring, Outreach and Education, Funding, and Collaboration.

The 50-year monarch conservation plan identifies several focal landscapes including agriculture, natural, urban/industrial areas, and transportation and utility right-of-ways (ROWs). Upon review, Partners determined that many of the actions identified within these areas were duplicative and could apply across the identified landscape types. We decided to reorganize the actions into the following focal areas: habitat, research, monitoring, outreach and education, funding, and collaboration. Our recommended reorganization was shared with the WAFWA committee responsible for updating the 50-year Monarch Conservation Plan and were adopted with minor changes; the updates are reflected in the [5-year plan](#).

### FOCAL AREAS:

**Habitat:** Protection, enhancement, and/or restoration actions, including activities that support such actions (e.g., developing plant materials) and can be applied across a variety of land use types.

**Research:** Applied research that furthers monarch conservation.

**Monitoring:** Protocols and other methods to track monarch populations and/or project implementation so activities can be evaluated and adapted to increase success.

**Outreach and Education:** Methods to reach various interested parties to spread information about monarch conservation strategies.

**Funding:** This section recognizes the importance of funding to facilitate conservation actions and build capacity and highlights new and existing funding sources.

**Collaboration:** Strategies to improve communication and collaboration between partners.



## GAPS

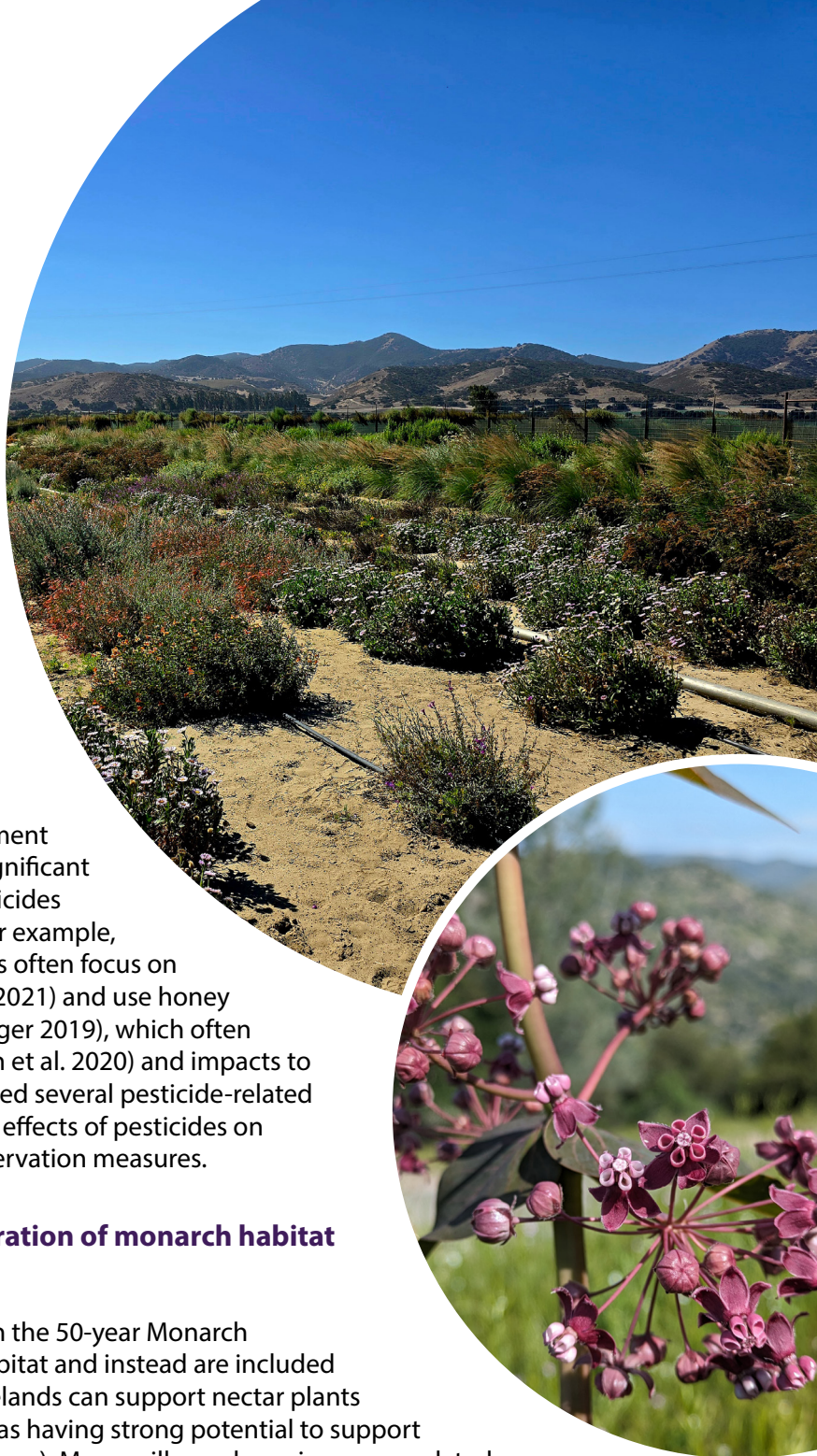
The Collaborative identified topics that were missing from the existing plans we reviewed but that we considered important to understanding monarch life history and/or implementing conservation actions. Partners developed new actions to address these gaps which centered around four topics:

### **GAP 1: Increasing understanding of and reducing impacts from pesticides.**

Pesticides are recognized as a significant threat to monarchs in the West (e.g., Crone et al. 2021). Widespread contamination of milkweeds across a range of landscapes has been documented. (Halsch et al. 2020). Despite the potential impacts to monarchs, pesticide-related actions in existing plans only focused on education and implementation of best management practices during application events. There is a significant need to improve understanding of the risks pesticides pose to monarchs through targeted research. For example, pesticide toxicity data are limited in that analyses often focus on single chemicals (e.g., Iwasaki and Hogendoorn 2021) and use honey bees as surrogates (e.g., Thompson and Pamminer 2019), which often doesn't reflect field-realistic exposures (e.g., Main et al. 2020) and impacts to other taxa, including butterflies. Partners identified several pesticide-related research priorities to help better understand the effects of pesticides on monarchs that could refine on-the-ground conservation measures.

### **GAP 2: Increasing conservation and restoration of monarch habitat on rangelands.**

While there are four rangeland-specific actions in the 50-year Monarch Conservation Plan, rangelands are not a focal habitat and instead are included under both agricultural and natural lands. Rangelands can support nectar plants and milkweeds and are considered by the NRCS as having strong potential to support monarch conservation (Moore, T., 2025, pers. comm.). Many milkweed species are correlated with grasslands in California (Dilts et al. 2019), including on grazed lands. Insecticide applications tend to be applied less frequently on rangelands, though herbicides are still used to combat weed infestations (Black et al. 2011). For example, cheatgrass (*Bromus tectorum*), an invasive species, threatened native plant communities in rangelands (Young and Clements 2009). Practices like avoiding plants while in bloom can help reduce impacts to pollinators from herbicide applications (Xerces Society, 2018). Despite some threats in rangelands, they are an important focal vegetation management type for monarch conservation action.



### **GAP 3: Addressing the threat posed by wildfire to monarch habitats and evaluating potential impacts from fuel reduction strategies.**

Wildfires have increased in size, frequency, and severity over the past twenty years and are predicted to continue intensifying throughout California (Safford et al. 2022). Pyrodiversity (the outcome of complex interactions and feedbacks between fire regimes, biodiversity and ecosystem effects; Bowman et al. 2016) has been shown to increase pollinator diversity (e.g., Ponisio et al. 2016) and milkweeds often respond positively to fire. However, high intensity fire with short return intervals could negatively impact habitats. For example, plant regeneration and native species cover were reduced in chaparral with a high frequency of repeat burns (Gruppenhoff and Safford 2024). Western monarch overwintering sites have also been impacted by wildfires, including the Woolsey fire in 2018 and the Palisades fire in 2025, which affected sites in coastal State Parks. Non-native, highly flammable eucalyptus is the dominant tree species at most overwintering sites and fuel reduction efforts in eucalyptus stands have been limited to date. The impacts of fuel reduction techniques on monarch habitat have not been assessed. Addressing this worsening threat is a critical component of forward-looking monarch conservation while meeting state-wide commitments to wildfire and forest resiliency objectives. The California Wildfire & Forest Resilience Task Force (<https://wildfiretaskforce.org/>) was created by the office of Governor Newsom to fast-track vegetation practices for the purpose of fuel management. The CA Wildfire Taskforce has identified appropriate methods to manage fuel loads and has required state-wide fuels management objectives to meet state-wide commitments for wildfire and forest resiliency objectives, although further research will be required to ensure fuel reduction techniques benefit and do not harm monarchs and their habitats.

### **GAP 4: Engaging with California Native American tribes.**

As the original stewards of California since time immemorial, tribes are key partners that are often engaged in monarch conservation as land managers, decision-makers, and holders of Traditional Ecological Knowledge. California tribes were not previously engaged, and ways to include traditional practices, perspectives, and management actions were not emphasized in the 2019 50-year Monarch Conservation Plan. Partners developed action OE-1 in Outreach and Education as a starting point to address this oversight.

## **PRIORITY ORGANIZATION**

The Collaborative identified priority actions within each focal area of the Conceptual Model. From those focal area priority actions, partners selected a short list of five near-term priority actions the Collaborative can accomplish within the next 1—3 years. The Collaborative considers the below near-term priority actions to be of equal importance. Additional priority actions the Collaborative plans to address in the future are described below by focal area.

## **NEAR-TERM PRIORITY ACTIONS**

**Priority Action: Develop shared definitions of what constitutes monarch breeding and migratory habitat in the West.**

**FOCAL AREA: HABITAT**

While monarch overwintering habitat in the western U.S. has been largely defined (e.g., by the Xerces-led [boundary delineation project](#), in the [State of Monarch Butterfly Overwintering Habitat in California report](#), and in Fisher et al. 2018), breeding and migratory habitat in the west is not well described. In the

east, increased water availability supports large expanses of milkweeds with high stem densities. In the West, however, milkweed stands are smaller and less dense. While studies in the monarchs' eastern range have determined the number of stems required to develop adult butterflies, such research has not been replicated on western milkweed species. Similarly, the density and distribution of nectar plants required during migration is poorly documented. To set appropriate habitat objectives it is imperative to develop a set of definitions of monarch breeding (e.g., host plant) and migratory (e.g., nectar plant) habitats in the West that are widely accepted and applied.

**Priority Action: Explore mechanisms to enable a more consistent supply of seed mixes and plants for habitat-based monarch conservation projects.**

**FOCAL AREA: HABITAT**

The use of ecologically-appropriate, genetically diverse native plant materials is a key determinant of successful establishment and persistence of habitat restoration plantings, especially in the face of shifting environmental conditions. Development of suitable plant materials can be a multi-year process and funding timelines don't align with the realities of planning and implementing these complex projects, which can sometimes force managers to obtain seeds that are not derived from appropriate stock. Developing comprehensive approaches focusing on increasing plant material availability across California's diverse ecosystems is necessary to create resilient pollinator habitats. Forward contracting (contracts that lock in prices at future dates when products are delivered) is one mechanism that would provide more certainty to native plant producers while ensuring agencies have access to approved seed mixes. Other strategies include creating seed co-ops, creating regional "work-horse" mixes that can be adopted by various land managers, and participating in [California Native Seed Strategy](#) regional working groups.

**Priority Action: Track implementation and success of habitat restoration, enhancement, and preservation projects.**

**FOCAL AREA: MONITORING**

A framework with clear metrics along with a tool for tracking efforts and outcomes are required to help quantify progress towards habitat goals articulated in this report. Restoration practitioners can also use it to monitor and measure habitat and share successful restoration methods. Funders could benefit because they could use the tool to help evaluate the impact of their investments. Developing a comprehensive, easy-to-use tool would aid in comparing outcomes and implementing adaptive management to better support on-the-ground monarch conservation.

**Priority Action: Compile existing training, educational tools, and best management practices into a centralized location.**

**FOCAL AREA: OUTREACH & EDUCATION**

Numerous resources for monarch conservation exist, but are distributed across websites and other locations. A comprehensive website or other centralized clearinghouse would make existing documents, educational tools, trainings, and best management practices more accessible to land managers, agency biologists, educators, and other interested parties. Partners currently opportunistically compile key resources on the [Collaborative's website](#), however, a more deliberate effort to compile relevant information in an organized and searchable format would be beneficial.

## Priority Action: In collaboration with other partners, find funding to develop a full-annual-life-cycle demographic model of western monarchs and conduct sensitivity analyses.

### FOCAL AREAS: FUNDING AND RESEARCH

While genetic analyses have shown that the eastern and western monarch populations are connected, the degree to which the eastern population can provide demographic rescue to the western population, particularly in years when the population has plummeted, is unknown. To understand the potential role of demographic rescue, it is necessary to develop a spatially implicit stage-based demographic matrix model simulating the multi-generational annual cycle for the western population similar to the Oberhauser et al. (2017) model for the eastern population. Additionally, a sensitivity analysis could be used to investigate proportional connectedness throughout the southwestern U.S. and determine how many individuals would need to flow from east to west to ensure the continued persistence of the western migratory population. Because the demographic model is stage-based and spatial in nature, this sensitivity analysis will help identify life stages and regional locations most amenable to targeted conservation interventions.

## ADDITIONAL PRIORITIES BY FOCAL AREA

This section provides a brief overview of additional high- and medium-priority actions that were not identified as near-term priorities but are still important to monarch conservation objectives. Lower priority actions are included in the tables in the Appendix. We also highlight activities Partners are already implementing to highlight key actions and demonstrate their ongoing commitment to monarch conservation.



## HABITAT

### Overview

Western monarchs require habitat for breeding, migration, and overwintering. Although comprehensive definitions for monarch breeding and migratory habitats in the West are still needed (see Near-term Priority Actions section), at their most basic level breeding habitat consists of healthy stands of milkweed, the species' obligate host plant, and nectar plants.

Migratory habitat includes nectar plants to fuel the fall re-migration, and possibly riparian areas with shade and water to help monarchs avoid extreme heat events. In California monarchs typically overwinter in stands of trees in coastal locations that shelter them from inclement weather helping them survive this "super generation" which spans from approximately October through March. Overwintering habitat has recently been defined as having three zones: core, shelter and support. The core zone is where butterflies cluster. The shelter zone is composed of trees, other vegetation, and topographic features that provide wind protection and other microclimatic conditions that support clustering; it also demarcates the edges of an overwintering site. The support zone is the area around a site that provides additional resources such as nectar resources or wind breaks.

The actions in this section focus on incentivizing habitat restoration, increasing the availability of nectar resources, targeting milkweed to support the critical first breeding generation, and reducing fuel buildup, given several overwintering sites have been lost to wildfire in recent years.



## High Priority Actions

### **H-1 Increase monarch and pollinator habitat via incentive and easement programs administered by Collaborative partners.**

One way to increase the voluntary creation of monarch and pollinator habitat is through incentive and easement programs that can add thousands of acres of monarch and pollinator habitat. As described in the Habitat Existing Efforts section, some of the Collaborative members currently employ such programs. A key to this strategy's success is continued funding for these programs as well as determining where to incentivize which types of habitat to most effectively contribute to monarch conservation goals.

### **H-2 Protect existing nectar resources and restore nectar resources to invaded or degraded areas and riparian areas (which have been identified as migratory corridors in the West).**

Though specific migratory pathways have not been defined for monarchs, models indicate that riparian areas may be important (McIntyre et al. 2024). Some riparian areas have been invaded by invasive species or have otherwise become degraded; they could be made more valuable to monarchs and pollinators if restored or connected to create more continuous corridors. Nectar resources are a critical but overlooked resource needed for monarchs. Conserving existing monarch nectar resources and creating additional resources can fuel their migration.

### **H-3 Manage fuel within overwintering sites using outcomes from research.**

Droughts, storms, and other phenomena can increase tree mortality or limb loss overwintering sites. This can cause an accumulation of highly flammable fuels, increasing the risk of catastrophic wildfire. If trees in monarch groves burn, monarchs may not return to the site in the future. This makes it critical that we manage fuel levels at overwintering sites. Working with researchers and managers who have identified appropriate methods is key to manage fuel loads while maintaining habitat quality and meeting state-wide fuels management objectives.

### **H-4 Create early-season milkweed habitat in the first-priority zone.**

The recent period of monarch extreme population fluctuations that began in 2017—2018 and continued through 2020 appeared to be linked to higher winter temperatures that caused many overwintering individuals to break diapause (Crone, E., 2021, pers. comm.) or not reach overwintering sites at all and instead join a novel resident (winter-breeding) population along the California coast (James 2024). For the individuals that did overwinter but left sites earlier, researchers have hypothesized that there may have been insufficient milkweed available on the landscape to support the first breeding generation (Crone 2021). To help address this potential issue, the Xerces Society for Invertebrate Conservation (Xerces Society), in collaboration with partners including CDFW, State Parks, and USFWS, developed a priority zone map for developing monarch habitat in California (Figure 4). The first-priority zone includes the “Early Breeding Zone” where increasing early-season milkweed will support the first generation of caterpillars from monarchs that just completed overwintering. Four species of milkweed (*A. californica*, *A. cordifolia*, *A. erosa*, and *A. vestita*) have been identified as key early-season species to plant in this zone.





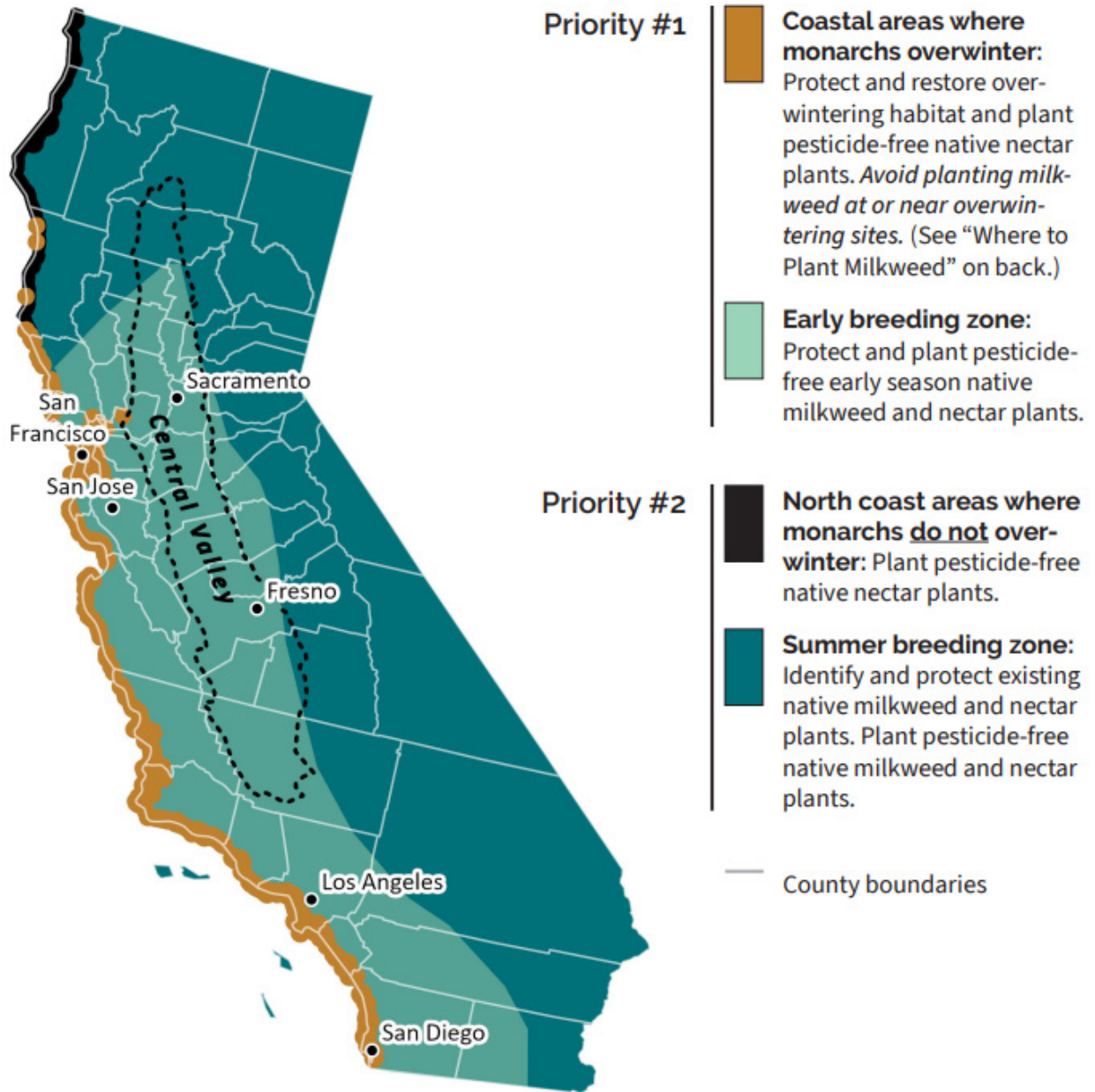
### Medium Priority Actions

- Implement practices identified through research or BMPs that protect habitat from pesticides, focusing on habitats that can function as movement corridors.
- Develop advice for managing overwintering sites with dead trees and fire hazards in the ROWs.
- Protect overwintering sites that are not on public lands through purchase or easements.
- Collect native seed and make it available to partners and native plant nurseries (when appropriate).
- Refine habitat goals in collaboration with the WAFWA Monarch and Native Insect Pollinator working group to improve and standardize how we measure success.
- Revise the top 50 list of priority overwintering sites that the Xerces Society developed to incorporate additional sites that support the monarch population and add whether a site has protection to the list.
- Incorporate monarch and pollinator habitat protection and enhancement into land management plans.

### Existing Habitat Efforts

Partners have engaged in habitat restoration projects throughout the state, including those featured in the CDFA and Caltrans Case Studies. Additional highlights include:

- CDFW's work with River Partners (a non-profit restoration group) to restore monarch habitat across 1500 acres on its properties, many of which occur in agricultural areas or rangelands;
- USFWS funding early-season milkweed restoration on working lands in partnership with the Central Coast Joint Venture;
- NRCS' Environmental Quality Incentives Program (EQIP) wildlife initiative has focused funding towards monarch projects in 2025 (NRCS Case Study in the funding section). Over the last 8 years NRCS has supported more than 300 projects for pollinators and monarchs across California.



**FIGURE 4.** Priority zones for recovering monarchs in the West, including key recommended actions within each zone. Credit: Xerces Society for Invertebrate Conservation, U.S. Fish and Wildlife Service, U.S. Forest Service, Western Association of Fish and Wildlife Agencies, California Association of Resource Conservation Districts, Monarch Joint Venture, California State Parks, California Department of Fish and Wildlife, San Diego Zoo Wildlife Alliance. Used with permission.



## CASE STUDY: California Department of Food and Agriculture

**Project Title:** Pollinator Habitat Program  
**Category:** Habitat & Funding

**Action:** Increase monarch and pollinator habitat developed via incentive and easement programs administered by Multi-Agency Collaborative partners.

**Project Summary:** The Pollinator Habitat Program (PHP) was established by the Budget Act of 2021 (Senate Bill 170, Skinner) to address the urgent need for pollinator habitat establishment across agricultural lands in California. With an allocation of \$15 million for fiscal year 2021-2022, this program aims to provide funding to experienced organizations to work with farmers and ranchers to install habitat and implement management practices that support pollinators. These habitats help to promote biodiversity, promote pollinator populations, and improve agricultural productivity. PHP prioritizes the planning and establishment of native habitats, using locally appropriate native plant seed mixes where possible. Higher rates are available to participating growers if the pollinator habitat includes milkweed.

**Next Steps:** PHP is ongoing with a grant term into 2026.

**Photo:** Pollinator habitat installed through the Pollinator Habitat Program surrounded by organic agriculture. Patricia Bohls, Biodiversity Coordinator, CDFA.

## CASE STUDY: California Department of Transportation

**Project Title:** Monarch Butterfly Candidate Conservation Agreement for Energy and Transportation Lands (Monarch CCAA)

**Category:** Habitat



**Action:** Increase monarch and pollinator habitat via incentive and easement programs administered by Collaborative partners.

**Project Summary:** The Monarch Candidate Conservation Agreement with Assurance (CCAA) is the first nationwide agreement to promote voluntary conservation for the monarch butterfly through USFWS. By enrolling in the Monarch CCAA, energy and transportation partners commit to manage monarch butterfly habitat on their right-of-ways in exchange for receiving regulatory assurances if the monarch butterfly is federally listed. Caltrans is a partner and received its Certificate of Inclusion, identifying enrolled lands and designating 8% of these enrolled lands as adopted lands for monarch habitat. The Monarch CCAA is

a voluntary agreement designed to provide conservation benefits for monarch butterflies and specifically addressing potential unintended effects from certain maintenance and modernization actions. Under the Monarch CCAA, Caltrans designates adopted acres for implementation of conservation actions to avoid and minimize impacts on monarch and its habitat while also restoring monarch habitats. Additionally, the Monarch CCAA offers regulatory assurance for covered activities and has the flexibility that allows Caltrans to update both enrolled lands and adopted acres, thus facilitating continuous adaptive management of its implementation.

**Next Steps:** Caltrans provides an annual update to the Monarch CCAA Implementation and Monitoring Plan to identify adopted acres as annual interim targets that will “ramp up” over the next five years. Caltrans proposes implementing beneficial vegetation management practices that will restore monarch habitats by following Caltrans policies, procedures, standard practices, and specifications. Caltrans will also conduct annual habitat monitoring surveys in areas where conservation measures are applied to comply with the Monarch CCAA.

**Photo:** Caltrans staff conducting annual habitat monitoring surveys. Caltrans.



## RESEARCH

### Overview

Significant knowledge gaps limit our understanding of monarch habitat use and key stressors, which, in turn, limit our ability to appropriately target conservation actions. Focused research can address these gaps, subsequently improving management strategies and mitigation. Both the 50-year Monarch Conservation Plan and the Western Monarch Summit recommendations stress the importance of better

understanding the impacts to monarch populations and habitats from climate stressors and the need for research that improves our understanding and modeling of monarch demographics. The Western Monarch Summit recommendations put additional emphasis on including the potential effects of pesticides in demographic modeling. The WAFWA plan includes specific actions to determine the geographic areas and habitats most beneficial to monarchs and to increase knowledge of BMPs to implement monarch and pollinator conservation on multiple-use and working lands.



Many of the actions highlighted in this section involve research and information synthesis on monarch habitat use within overwintering sites and migratory pathways, including whether nectar is a limiting resource for monarchs. Five of the six high priority actions relate to research into the impacts of pesticide exposure, highlighting this topic as an area of growing interest, opportunity, and importance. Research should also focus on climatic stressors like wildfire on monarch populations, as well as how successful various strategies are in mitigating impacts from fire, pesticides, and other factors. Supporting new research while synthesizing existing information will improve our understanding of how monarchs interact with their environment, aid in the development of habitat modeling, and inform best management practices to mitigate impacts to monarchs.

## High Priority Actions

### **R-1 Support research on pesticide mixture impacts on monarchs and other pollinators.**

Most assessments of pesticide toxicity are based on exposure to a single pesticide compound. In reality, monarchs and other pollinators are likely exposed to multiple pesticide compounds over their lifetime, and in many cases simultaneously. Research into which combinations of pesticides monarchs are exposed to and the impacts of those pesticide combinations is important to understanding the potential real-world effects of exposure and informing best management practices for application and mitigation strategies.

### **R-2 Study the costs and benefits of glyphosate, other herbicides, and non-chemical approaches as tools for restoration.**

Herbicides are a common tool in managing non-native invasive plants to meet habitat conservation goals. Given the recent surge in public, scientific, and regulatory interest in the potential non-target impacts of the widespread use of glyphosate, there is a need to identify weed management methods that optimize both efficacy and environmental safety. Research into the risks, effectiveness, and cost of different herbicides and non-chemical strategies for managing weeds and invasive plants would help land managers make science-based decisions for habitat restoration while protecting monarchs and other pollinators.

### **R-3 Study toxicity impacts on a wider array of pollinators than honey bees, including butterflies.**

The majority of studies on the toxicity of pesticides to insect pollinators are conducted with honey bees, which are often used as a surrogate organism for insect pollinators in pesticide risk assessments. However, uncertainty remains regarding whether honey bees are more or less sensitive to pesticides than butterflies and other invertebrate pollinator species. Developing species-specific pesticide toxicity data would reduce this uncertainty and ultimately strengthen scientific assessments supporting best management practices and pesticide mitigation strategies for monarchs. Additionally, toxicity studies on different butterfly life stages (e.g., larval, adult) could help identify times when certain pesticides might have greater toxic effects.

### **R-4 Develop a shared pesticide risk to pollinators ranking list.**

There is currently conflicting pesticide safety information from various lists and rankings such as the [UC IPM's Bee Precaution tool](#) and "[How to Prevent Bee Poisoning from Pesticides](#)", and these lists do not contain information on all common pesticides. Synthesizing current data on pesticide toxicity to pollinators, and filling gaps in toxicity information for relevant pesticides would help to develop a more robust pesticide ranking. Science-based rankings are important to inform and recommend best practices for land management and conservation efforts.

### **R-5 Study pesticide residues from drift and run-off in protected areas.**

Milkweed in natural, urban, and agricultural areas is often contaminated with pesticides (Halsch et al. 2020), which could lead to lethal and sublethal effects in monarch caterpillars. To help mitigate potential impacts it is important to understand the levels of pesticides on the landscape, including in protected areas where pollinator and monarch habitat is being conserved and/or restored. USFWS, in partnership with USGS, has already initiated studies to assess pesticide presence on several National Wildlife Refuges.

CDFW, in partnership with CDFA and funding from DPR, will be conducting a focused study on its lands in the San Joaquin Valley that will investigate variables related to ambient pesticide concentrations, such as proximity to pesticide applications (See Existing Research Efforts).

**R-6 Synthesize existing data and use it to develop a habitat model to identify locations to target for surveys, restoration, and conservation with a focus on connectivity.**

To prioritize locations for restoration, research should utilize and synthesize existing monarch butterfly occurrence, milkweed and floral availability, and geospatial data relating to stressors such as pesticide exposure risk. The outcome of such a synthesis would be a map of occupied areas and suitable-but-unoccupied habitat areas isolated from nearby habitat. The map will aid in identifying locations to target habitat restoration and land preservation efforts.

**Medium Priority Actions**

- Use pesticide use reporting data (PUR) to identify areas where there could be high monarch and pollinator exposure to pesticides.
- Conduct studies to evaluate nectar plant use by monarchs during different parts of their lifecycle.
- Identify spring and fall migratory pathways, including using Motus as a tool. The Motus Wildlife Tracking System (Motus) is a collaborative network of automated radio telemetry receivers throughout North America.
- Participate in the “super-study” of factors including monarch clustering behavior in overwintering sites being developed by a variety of partners, led by Xerces.
- Research pesticide and other contaminant exposure to monarchs in ROWs.
- Combine the DPR PRESCRIBE database with CDFW sensitive species data.
- Study how to avoid harm to monarchs while reducing fire risk/fuel buildup.
- Research and better understand first-generation monarch habitat use and migratory patterns with a focus on spring and fall time periods.
- Determine which non-eucalyptus trees can be used at monarch overwintering sites.
- Develop a Motus study to evaluate between-site monarch movement during the overwintering period.





## Existing Research Efforts

There are several efforts by Partners to better understand pesticide impacts (See CDPR and USGS Case Studies):

- USFWS, in partnership with USGS, is currently using passive samplers on National Wildlife Refuges to look at potential pesticide exposure (USGS Case Study).
- CDFW and CDFA are expanding on the USFWS/USGS study to examine pesticide contamination on lands with greater or lesser agricultural influence, based on pesticide use and proximity, in the San Joaquin Valley, with funding from DPR.
- USGS is currently expanding efforts to look at monarch exposure to pesticides in partnership with the University of Nevada, Reno.
- USGS is conducting greenhouse studies on how monarch larvae uptake pesticides through milkweed, with a focus on neonicotinoids. This data will provide potential toxicity values.
- DPR contracted with CDFW and USGS to monitor pesticide occurrence in grasses, soils, and grasshoppers on CDFW Wildlife Areas bordering agricultural lands.

Several Partners have existing grant programs that can fund projects that examine pesticide exposure or pathways to reduce exposure, such as integrated pest management (IPM) strategies (see DPR Case Study):

- DPR's [Sustainable Pest Management \(SPM\) Grants Program](#) annually funds projects that advance sustainable pest management practices through integrated pest management (IPM) research, knowledge, tools, outreach, and implementation in agricultural, urban, or wildland settings.
- CDFA's [Biologically Integrated Farming Systems Program](#) funds on-farm demonstration, evaluation, and outreach of innovative, biologically based farming systems that employ sustainable pest management strategies.

There are also a number of studies underway related to habitat use:

- State Parks is working with USGS to evaluate microhabitat site selection at Pismo Beach, which will clarify how monarchs use overwintering sites.
- USFS is in the process of identifying forestry practices that will ensure overwintering habitat is available at different elevations to help plan for future environmental conditions.
- USFS is discussing locations to study fire impacts on monarch habitat in breeding sites, a project that would be in partnership with The Xerces Society.
- The USFWS Center for Pollinator Conservation is collaborating with researchers to learn more about early-season milkweed use and restoration BMPs.
- Through funding from CDFA, the California Native Plant Society will develop and share science-based protocols for propagating California native plants. This project will focus on species important to pollinators in all phases of their life cycles, specifically ones that will grow well in agricultural regions of the state. These protocols will be free and publicly accessible.



## CASE STUDY:

### U.S. Geological Survey

**Project Title:** Agricultural chemical occurrence in National Wildlife Refuges of north-central California

**Category:** Research & Monitoring

**Action:** Study pesticide residues from drift and run-off in protected areas.

**Project Summary:** This study (Lenard et al. 2025) deployed silicone sampling bands at five wildlife refuges in north-central California to help understand pesticide contamination in protected areas. Thirty-six agricultural chemicals were detected, with 12 pesticides common across all plots sampled. Even samples taken at the furthest points from the refuge boundary were contaminated, calling into question whether National Wildlife Service refuges embedded in an agricultural matrix are capable of serving as a refuge from the effects of agricultural chemical contamination.

**Next Steps:** Continuing efforts include the collection of milkweed and other floral resources to measure their pesticide residues. These data will be compared to the results of the silicone bands to understand the types and quantities of pesticides that are present in plants that monarchs and other pollinators rely on.

**Photo:** Silicone bands placed on the wildlife refuge landscape. Angie Lenard (University of Nevada, Reno).

## CASE STUDY:

### California Department of Pesticide Regulation

**Project Title:** Ecosystem Monitoring Contracts and SPM Grants

**Category:** Research & Monitoring; Funding



**Action:** Study pesticide residues from drift and run-off in protected areas.

**Project Summary:** DPR provides annual ecosystem monitoring contract funding aimed at better understanding pesticide movement in the environment and improving DPR's ongoing pesticide evaluations. DPR currently has an ecosystem monitoring contract with CDFW and USGS that focuses on identifying pesticide drift into natural areas, by sampling soil, vegetation and invertebrates. DPR is also funding a study on CDFW Ecological Reserves and Wildlife Areas that is expected to add to the findings of pesticide drift on National Wildlife Refuges (described in the USGS Case Study).

DPR's SPM Grants Program provides funding for projects that advance sustainable pest management (SPM) practices through integrated pest management (IPM) research, knowledge, tools, outreach, and implementation in agricultural, urban, or wildland settings.

**Next Steps:** The ecosystem monitoring contract with CDFW and USGS will be completed early 2026. Solicitation for FY 26-27 ecosystem monitoring contracts is targeted for late 2025. DPR plans to open 2027 SPM Grants solicitation in Summer 2026

**Photo:** Grasshopper ready for pesticide testing. CDFW.



## MONITORING

### Overview

Monitoring monarch populations and habitats can inform conservation and management actions. The annual community science effort to monitor monarchs at overwintering sites is particularly important as it helps track trends in population and habitat use that managers can use in decision-making. Monitoring monarchs during the breeding and migratory seasons can assist land managers in targeting critical areas for restoration by answering key questions such as which habitats monarchs use during their migration, which nectar and pollinator plants are monarch-dependent, and how population size changes over time. Consistent monitoring of both restored and protected habitats helps ensure that habitat quality is maintained over time. Further, monitoring results can be incorporated into long-term management plans that guide on-the-ground efforts to maintain functional monarch habitats, including overwintering, breeding, and migratory habitats. Therefore, monitoring data can help identify successful best management practices and restoration actions that can be applied in other locations. Monitoring of other pollinator populations, such as rare butterflies and bees, can also help identify emerging issues and initiate the development of strategies to target their conservation. In some cases, efforts to monitor other pollinator species can provide information on habitat monarchs utilize (e.g., the California Bumble

Bee Atlas collects data on flowering plants). It is also helpful to compare trends in monarchs to other pollinators to understand the scope of their decline and how interconnected they may be with other species that are facing similar threats. We therefore identified additional actions related to non-monarch pollinators.

## High Priority Actions

### **M-1 Ensure that all partner-managed overwintering sites are monitored annually for butterflies and that numbers are included in the Western Monarch Count.**

Monitoring through the [Western Monarch Count](#), an annual population census conducted by community science volunteers and coordinated by The Xerces Society, is critical for assessing the progress toward recovery goals. Partners that own/manage overwintering sites should contribute reliable, consistent data to inform conservation efforts. Fine-scale monitoring can provide an understanding of how monarchs utilize habitat, allowing for enhanced design and targeted restoration projects. Given the long-term nature of this program, it is important to identify funding sources that can help it persist into the future to provide continuous trend data.

### **M-2 Expand the Motus network to key locations to monitor the monarch population.**

Tracking the western monarch's migration can help target conservation efforts. Monarchs can be tagged with lightweight nanotags that transmit unique radio signals, allowing scientists to track individual butterflies as they migrate if they are in proximity to existing Motus stations. Although the network of Motus stations is growing, coverage is still limited in several crucial monarch migration corridors. Adding strategically placed stations and tagging monarchs at overwintering sites and throughout the West during their fall migration will help answer numerous outstanding questions, such as the specific habitats used by monarchs throughout their overwintering period in California. The same Motus stations would also allow tracking of other taxa, such as migratory birds and bats.

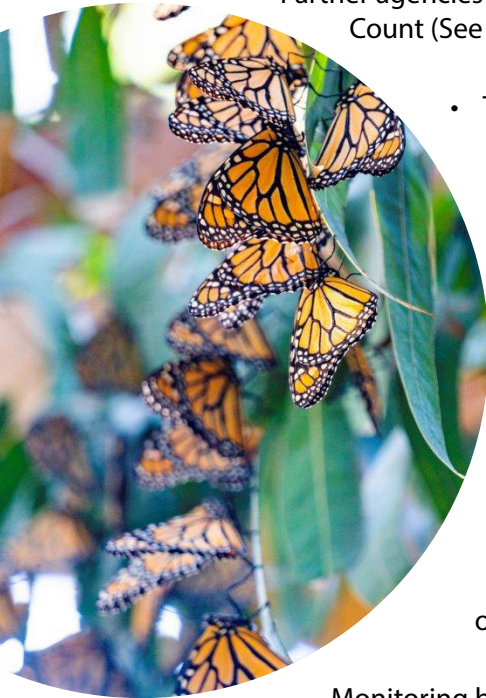
## Medium Priority Actions

- Develop a shared methodology to assess the success of management actions in overwintering sites.
- Prioritize surveying milkweed and nectar resources on public lands, including rangelands, to better understand these plants' geographic and temporal distribution. Use this information to identify priority zones for management actions.
- Train agency staff to participate in annual overwintering counts.
- Train staff on how to assess overwintering habitat.
- Public agencies that manage overwintering sites should conduct annual habitat assessments
- Develop electronic, shareable apps and forms (e.g., Survey123) to assist with habitat assessments that build off the western monarch count overwintering habitat assessment forms.
- Continue adding data to [Western Monarch Milkweed Mapper](#) and [iNaturalist](#) so long as it does not jeopardize the privacy of landowners should monarchs be federally or state listed.

- Include effects from wildfires, drought, and other climate-related impacts in monitoring protocols.
- Participate in the new long-term [California Bumble Bee Atlas](#) data collection effort starting in 2026; train agency biologists to survey and promote the project to the public through outreach/interpretive programs.
- Use information from the Powell Center-funded Butterfly Trends Project to develop a long-term monitoring plan and survey protocol for priority butterfly species (Edwards et al. 2025).

## Existing Monitoring Efforts

Partner agencies that own/manage overwintering sites are engaged in the Western Monarch Count (See State Parks, CDFW, and BLM Case Studies):



- The Los Padres National Forest developed a monitoring program that assesses tree planting survival and success in overwintering sites.
- In 2023, the Xerces Society conducted habitat and fuel assessments at four CDFW-owned overwintering sites. Future monitoring can build on these in-depth assessments to compare conditions after implementing management actions.
- The Xerces Society, in partnership with State Parks and CDFW, received Wildlife Conservation Board grants to protect and restore high-quality overwintering habitat and monitor monarch habitat use and movement.
- Pismo Beach State Park developed a management plan directing monitoring and management actions. This plan will serve as a model for managing priority overwintering sites within other State Parks (see State Parks Case Study).

Monitoring breeding and migratory habitats has been less consistent. Partners monitor these habitats using different methods and evaluate success using various metrics. Using a standard set of monitoring protocols and metrics will aid in identifying trends and inform management, especially if data is collected using a shared project tracking tool (Priority Action 2). One example of a standardized monitoring protocol is the [Integrated Monarch Monitoring Program](#) (IMMP), developed by USGS in partnership with the Monarch Joint Venture (MJV). The IMMP has been applied on BLM lands throughout California (see BLM Case Study). Adoption by other agencies can increase the utility of monitoring monarch habitat use over time.

Several agencies participate in efforts to monitor other pollinator species, including:

- CDFW and BLM partner with Xerces on the California Bumble Bee Atlas, a community science project that non-lethally surveys the state's bumble bees to determine trends in abundance and distribution that can support management actions.
- USGS headed an effort funded by the John Wesley Powell Foundation to assess butterfly trends across the US, understand benefits and drawbacks of different data sources, and recommend protocols for surveys of common and at-risk butterflies (Edwards et al. 2025).



## CASE STUDY:

### State Parks

**Project Title:** Monarch Butterfly Overwintering Site Management Plan for Pismo State Beach

**Category:** Research & Monitoring

**Actions:** Ensure that all partner-managed overwintering sites are monitored annually for butterflies and that numbers are included in the Western Monarch Count.

**Project Summary:** Monitoring and research of overwintering monarchs at Pismo State Beach (Oceano Dunes District) has been in place since the 1980s. Starting in 2018, State Parks staff initiated more intensive monitoring of overwintering monarchs' use of the grove, in part, to inform the Monarch Butterfly Overwintering Site Management Plan for Pismo State Beach, which supports management of overwintering monarchs in both the short- and long-term. Part of this process involved detailed mapping of the grove's trees. Each tree was identified, measured for diameter, geolocated using GPS, and assigned a unique ID number. This allows State Parks the ability to track the health of individual trees and monarch use of them over time, and to adaptively manage the grove.

When overwintering monarchs are present (October through February), staff regularly monitor the butterflies using protocols developed by Xerces. An ESRI Field Maps app is used to record data including but not limited to the number of monarchs, the tree number, and height associated with each cluster. All data is digitized in a State Park geodatabase and shared with Xerces. After each overwintering season, site walks are done with park staff and other partners to assess grove suitability for monarchs and prioritize management actions for the upcoming season.

**Next Steps:** Finalize the 5-year update of the 2020 Monarch Butterfly Overwintering Site Management Plan for Pismo State Beach. The new plan will incorporate updated population information based on systematic monitoring, legal status updates, updates to restoration actions and needs, and lessons learned. By executing the goals within this plan, Oceano Dunes District is continuing to provide high-quality habitat and aid in the recovery of the species.

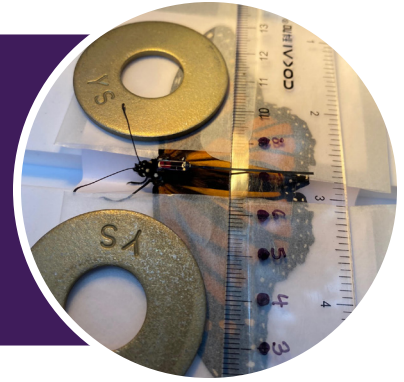
**Photo:** Pismo State Beach Monarch Grove. California State Parks

## CASE STUDY:

### California Department of Fish and Wildlife

**Project Title:** Expanding the Motus network to detect monarch migratory pathways and movements between overwintering sites

**Category:** Research & Monitoring



**Actions:** Identify spring and fall migratory pathways, including using Motus as a tool; Expand the Motus network to key locations to monitor monarch population

**Project Summary:** Traditional GPS tracking devices are too large to track small animals like insects. Technological breakthroughs have enabled the use of lightweight radio transmitters that can be attached to butterflies and bumble bees. The Motus Wildlife Tracking System is a network of stations that passively collect data from species tagged with these devices. Since its initiation, the Motus network has provided novel information on a range of species, such as data on how fast and far individuals travel, as well as where they are moving during key parts of their lifecycle. The California Department of Fish and Wildlife, in partnership with California State Parks, successfully piloted the technology on monarch butterflies at overwintering sites in Montaña de Oro State Park in winter 2023. Since then, it has been collaborating with researchers to ensure that the techniques minimize impacts to tagged individuals.

CDFW has been installing Motus stations throughout the state on Department lands and working with partners to fill in gaps in key locations along the coast and potential monarch migration routes. Along with partners from the Western Association of Fish and Wildlife Agencies, Oregon Department of Fish and Wildlife, Idaho Fish and Game, Washington Department of Fish and Wildlife, and the American Bird Conservancy, CDFW received funding from a competitive State Wildlife Grant to retrofit existing stations to detect signals from tagged monarchs.

**Next Steps:** CDFW began retrofitting stations in 2025. Once stations have been updated, monarchs will be tagged in the middle of the overwintering period to help determine their intrasite movements and their spring migratory pathways. Partners at Fish and Wildlife Agencies in Washington and Idaho will tag monarchs in the late summer to reveal their fall migratory corridors. All data associated with this project is open source and will be accessible from the Motus website: <https://motus.org/>

**Photo:** Monarch being tagged with a Cellular Tracking Technology Blu+ tag. CDFW.



## CASE STUDY:

### Bureau of Land Management

**Project Title:** Using the IMMP to evaluate milkweed on BLM lands and early-season milkweed trials

**Category:** Monitoring & Habitat

**Actions:** Adopt IMMP as a standardized monitoring strategy on partner lands including monarch-focused restoration sites; Create early-season milkweed habitat in the first-priority zone.

**Project Summary:** In 2025, Monarch Joint Venture (MJV) conducted 160 surveys on BLM land using the Integrated Monarch Monitoring Program (IMMP). Technicians documented over 9,000 milkweed plants and 27,000 stems within survey plots on BLM land. Over 514 flowering plant species were recorded, as well as 17 monarch sightings (10 occurred directly on BLM land and 7 nearby).

Red Boot Ecology completed seedling establishment trials for *Asclepias cordifolia* to compare the efficacy of direct seeding and container planting and developed best management practices for propagating *A. cordifolia* in restoration plantings.

**Next Steps:** In 2026, MJV will complete baseline data collection, monitoring any plots that were not visited in 2025. At the end of the field season, all results will be synthesized into a final report, including metrics such as 1) the distribution, frequency, and density of monarch host plants, 2) the frequency and diversity of flowering plant species, 3) observed monarch occurrences, behaviors and plants used, and 4) recommended best practices for establishing *Asclepias cordifolia*, based on findings from Red Boot Ecology's establishment studies.

**Photo:** Heart leaf milkweed (*A. cordifolia*) in Bakersfield. Anna Haggenjos.



## OUTREACH & EDUCATION

### Overview

While there are three high priority Outreach and Education actions, overall this focal area has the highest number of total actions due to the importance of providing information to managers and the public to enable scientifically-based management, generate additional participation in community science projects, and stimulate advocacy for monarch conservation. Not surprisingly, education is also a major focus of the 50-year Monarch Conservation Plan. When conducting outreach, it is important to be inclusive of the general public and multiple interest groups, including agricultural producers, tribes, and public and private land managers, and staff at Partner agencies.

Given the high public interest in monarchs, there is already a significant amount of material on various aspects of conservation and management. Therefore, developing new information or content may be less important than effectively sharing existing information with target audiences.

## High Priority Actions

### **OE-1 Engage Native American tribes in outreach.**

Appropriate, meaningful and timely outreach is essential to establishing respectful and collaborative relationships with California Native American tribes and should lead to more effective and sustainable practices that align with tribal values, perspectives, and traditions to promote mutual benefits. Continued outreach will help provide opportunities for tribal engagement, build enduring relationships to support collaboration on future opportunities, and facilitate the incorporation of Traditional Ecological Knowledge and practices into project planning and implementation. Specific actions include engaging tribes whose ancestral lands include monarch overwintering habitat areas and incorporating monarch and other pollinator conservation into discussions with tribes already working with Multi-Agency Collaborative partners.

### **OE-2 Develop core messages on key topics that partners can be shared with staff, the public, and local businesses such as plant nurseries. Specific topics could include which appropriate species to plant for monarch habitat, and messaging specific to agriculture and rangelands.**

Core messages are information on key topics that are important to monarch conservation. By identifying, developing, and sharing core key messages, Partners can help reduce confusion associated with which actions benefit monarchs. Examples of existing core messages that can be built or disseminated include the WAFWA Western Monarch and Native Insect Pollinator Working Group's [monarch fact sheets](#).

### **OE-3 Incorporate educational material about protecting pollinators from pesticides into pesticide applicator education classes and other forums like pesticide application trainings held by partner agencies.**

Pesticide applicator training is required to obtain and maintain pesticide application licenses. Focusing on informing licensed applicators about potential impacts to pollinators from pesticides and key mitigations and best practices, offers the opportunity to reach a critical group that has direct impacts on pollinators in urban and agricultural environments.

## Medium Priority Actions

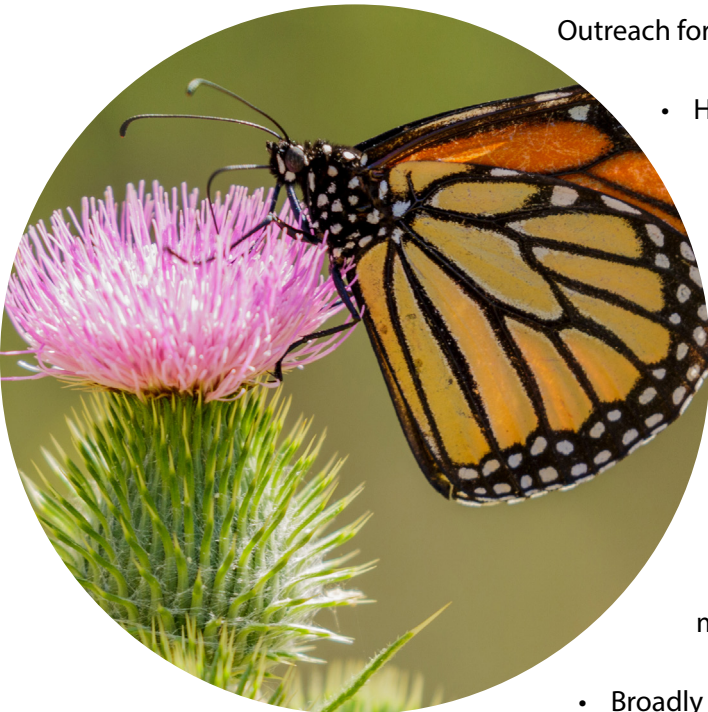
Outreach for the General Public:

- Encourage the public to visit monarch overwintering sites to inspire connection with local populations and advance local knowledge and stewardship of the habitat.
- Focus social media campaigns on annual “Western Monarch Day” and “Pollinator Week.”
- Develop and provide educational pamphlets at public wildlife areas, parks and reserves about monarchs, their habitat, and conservation.



- Increase or update interpretive signage at overwintering sites open to the public, including by using the Western Monarch Trail sign templates, where appropriate, and providing signage at rest stops and scenic highway overlooks.
- Develop and publish information about monarch conservation activities on partner websites, using pre-existing resources where possible. Distribute regionally specific planting guides for home gardens.
- Provide outreach resources about opportunities to engage in community science projects (e.g., Western Monarch Milkweed Mapper, Western Monarch Count, Southwest Monarch Tagging Project, etc.).
- Educate the public on the impacts of pesticides used around the home and local neighborhoods on local pollinators.
- Train interpretive staff on communicating with the public about monarchs and other pollinators.

#### Outreach for Agencies, Partners, and the General Public:



- Host a field trip to native plant nurseries for Partners and agencies interested in growing their own plant materials or increasing their awareness of plant material availability and propagation.
- Encourage elected officials to visit monarch habitat.
- Work with the California Naturalist program to add pollinator content.
- Work to update perception of Eucalyptus as an undesirable non-native species given its importance to monarch overwintering in certain settings and train partner agency staff in the appropriate use of the species for monarch and wildlife habitat.
- Broadly distribute overwintering site maps with the three core zones (core, shelter, and support zones) to management agencies and the public.
- Share relevant resources developed by Collaborative or partner agencies with County Agricultural Commissioners.
- Develop templates for grazing leases that incorporate pollinator-friendly practices.

- Develop and deliver training for ranchers on the safety of milkweed for cattle, for incentive programs like EQIP and Conservation Stewardship Program that can support monarch conservation, and on nectar plants that support pollinators.
- Work with communication experts to determine how to message science-based site management to help overcome local stumbling blocks to effective management.
- Share outcomes of Multi-Agency Collaborative assessments with partners and the public.
- Develop maps or other shared resources to help identify monarch habitat along migratory corridors.
- Promote monarch and pollinator conservation in the incentive and easement programs administered by Multi-Agency Collaborative Partners.
- Provide public and agency outreach emphasizing that monarch overwintering sites are protected by the California Coastal Commission as Environmentally Sensitive Habitat Areas (ESHA).
- Once the DPR PRESCRIBE update is completed (see applied research section) conduct training and publicize the updated sensitive species data.
- Provide regionally tailored guidelines on management techniques for enhancing existing natural areas.
- Publicize the synthesized pollinator risk ranking list (see applied research section) that will be developed to address conflicting ranks between existing lists such as UC IPM's Bee Precaution tool and How to Prevent Bee Poisoning from Pesticides.

## Existing Outreach and Education Efforts

Partners are already engaged in a wide variety of outreach and education efforts throughout the state:

- DPR's PRESCRIBE [database](#) helps pesticide users identify potential endangered species habitats in their area and provides information on applicable pesticide use limitations.
- Caltrans works internally with its District Maintenance and Environmental staff to provide training on the Monarch CCAA, including developing a monarch species card.
- CDFW recorded a monarch-focused training through their internal workshop platform to help staff identify key parts of the monarch lifecycle, important habitats, and potential mitigation strategies to ameliorate impacts.
- State Parks and NPS conduct significant outreach to the public on a regular basis, including monarch-focused education at key overwintering sites like Pismo Beach and Natural Bridges, which have over 100,000 visitors each year.
- CDFW developed a pollinator-focused interpretive sign that has been installed at Ecological Reserves and Wildlife Areas throughout the state.

## CASE STUDY:

### California Coastal Commission

**Project Title:** Incorporating pollinator habitat protection into Local Coastal Programs

**Category:** Outreach & Education



**Action:** Work with local governments desiring to protect pollinator habitat by incorporating those protections into Local Coastal Programs

**Project Summary:** Within areas of the California Coastal Zone where local governments issue coastal development permits, the California Coastal Commission relies on key partnerships with those local jurisdictions to ensure development is consistent with the California Coastal Act. Local governments wishing to protect pollinator habitat, including monarch overwintering sites, can amend their Local Coastal Programs to include specific protections for monarch habitat. Local governments can also require best management practices (BMPs) for development occurring near these habitats. BMPs include avoiding work during the winter months when monarchs are present, identifying predominant wind direction and protecting windbreak trees.

**Next Steps:** Continue to work with local governments on BMPs for development near monarch overwintering habitat, as well as assist with desired changes to Local Coastal Programs that can codify habitat protections.





## FUNDING

### Overview

Expanding and restoring monarch and pollinator habitat throughout California is a priority for all Partners. However, the lack of consistent funding and the shortage of dedicated staff time are often barriers to effective and timely monarch and pollinator conservation. Traditional grant programs often only allow two- to four-year project timelines, making implementing large-scale, long-term projects difficult. The actions identified in this section can address these limitations by developing funding mechanisms that are more comprehensive and flexible.

### High Priority Actions

#### **F-1 Explore opportunities to continue and expand the ability of the Wildlife Conservation Board (WCB) to fund monarch and pollinator conservation in California.**

The WCB has been a major driver in funding monarch and pollinator habitat restoration projects since the establishment of the Monarch Butterfly and Pollinator Rescue Program (MBPR) in 2018. The WCB continues to prioritize monarch and pollinator conservation as outlined in their 2025-2030 strategic plan update, with the goal of investing in at least three projects per year that have a primary purpose of conserving or restoring native pollinator habitat. Newly approved funding through 2024's Proposition 4 can be used to fund MBPR projects and further support this action. Additional state funding would help increase conservation efforts, particularly in light of recent cuts to federal programs.

### Medium Priority Actions

- Develop a list of funding mechanisms that can support long-term, multi-species monitoring and research.
- Work to find funding to increase capacity for pollinator-focused positions within partner agencies.
- Develop a funding working group to explore how to leverage existing opportunities and support multi-phase projects.
- Explore alternative sources of funding such as a state license plate and pollinator stamps to generate long-term, sustainable funding sources.
- Explore opportunities to expand monarch and pollinator conservation in new or existing public/private partnerships and programs (e.g., incentive programs).

### Existing Funding Efforts

Many Partner agencies currently have grant or incentive programs whose purpose is the protection, restoration, and enhancement of pollinator habitat (See WCB and NRCS Case Studies). For pesticide research-related grants, see the Pesticide Existing Efforts section. Several of these programs also provide technical support (trained staff that can aid in planning and implementation) to help increase the potential for project success.

- CDFA's Pollinator Habitat Program is aimed at the establishment of pollinator habitat on agricultural lands and provides technical support to farmers (see CDFA Case Study in the Habitat section).
- NRCS offers multiple financial incentives to growers including the EQIP, Conservation Stewardship Program, and Agricultural Conservation Easement Program, all of which support the development of pollinator habitat on farm and rangelands throughout California (see NRCS Case Study).
- Multiple programs within the USFWS (e.g., Coastal, Partners for Fish and Wildlife, and Ecological Services) fund habitat conservation across the country and specifically invest in pollinator habitat projects in California.
- CDFW's Nesting Bird Habitat Incentive Program includes provisions to increase pollinator habitat on lands that are fallowed due to drought.



**CASE STUDY:**  
**Wildlife Conservation Board**  
**Project Title:** Pollinator Habitat Restoration Grants  
**Category:** Funding

**Action:** Provide grants for the purpose of restoring, enhancing, and protecting monarch and pollinator habitat.

**Project Summary:** Since the establishment of the Monarch Butterfly and Pollinator Rescue Program (MBPR) in 2018, WCB has provided approximately \$10.5 million in grant funding towards pollinator habitat restoration grants, which will result in approximately 7,000 acres of monarch and pollinator habitat restored or enhanced.

A portion of the awarded funding has been allocated to two grants to the Xerces Society to support their Habitat Kits Program, which provides climate-smart native plants to partners to develop their own pollinator habitat. In addition to supporting the Habitat Kits Program, funding from this grant is being utilized by the Xerces Society to collaborate with native plant industry partners to ensure that appropriate plant materials are available for restoration, and to provide technical assistance to a variety of partners such as the Natural Resource Conservation Service, working lands partners, Regional Conservation Districts (RCD), state agencies, and others.

Through the Xerces Society and RCD grants, approximately 3,800 acres will be restored, protected, or managed specifically for monarchs, including the restoration of more than 115 acres of overwintering sites; 17 management plans will be developed for overwintering sites; at least 125 monarch and pollinator conservation plans will be written for NRCS clients; at least two additional pollinator forage species will

be made commercially available; multiple workshops will be developed on wildfire prevention fuels, overwintering habitat issues, and more.

**Next Steps:** Continue to fund monarch and pollinator habitat restoration grants. Proposition 4 is a newly approved funding source that can be used to fund MBPR projects.

**Photo:** Habitat kit partner California State Parks, pick up plants and signage during a distribution event in California. Giovanni Di Franco/Xerces Society.

## CASE STUDY:

### Natural Resources Conservation Service

**Project Title:** Environmental Quality Incentives Program (EQIP) Wildlife Initiative

**Category:** Habitat & Funding



**Action:** Increase wildlife habitat on private lands throughout CA.

**Project Summary:** Ten percent of the 2018 EQIP Farm Bill funding was identified by Congress to be spent on wildlife. CA NRCS spends the majority of this funding through the CA Wildlife Initiative which has focused categories for declining species (including pollinators and monarchs). Many of the projects benefit multiple species and often provide monarch and pollinator habitat even when those species are not the primary focus. These projects vary from planting of hedgerows to restoration of riparian habitat. Over the last 8 years NRCS has supported more than 300 projects for pollinators and monarchs across California.

**Next Steps:** Continue funding wildlife habitat improvements on private lands with an emphasis on pollinators and monarchs with restoration and enhancement goals.

**Photo:** Monarch visiting milkweed. NRCS.



## COLLABORATION

### Overview

Monarchs occur throughout California and the western U.S., overlapping a broad geography and multiple jurisdictions (Figure 1). Given their widespread nature and the pervasiveness of threats across various scales, one of the primary goals identified by both the 50-year Monarch Conservation Plan and the DC Summit is to bring partners together to share information and collaborate to increase the efficacy of monarch conservation efforts. Collaboration is key for making meaningful progress toward all actions highlighted in this report. Sharing information, including challenges and successes, is one of the main

strategies we identified to streamline and accelerate monarch conservation efforts. Working groups can enhance information sharing on specific priority areas while aligning members on strategic initiatives. Many of the high and medium priority actions in this section involve participating in existing working groups and strategies to build collaborative approaches to threat amelioration and habitat creation.

## High Priority Actions

### **C-1 Institute annual project check-ins to identify and share both successes and lessons learned.**

Sharing on-the-ground practices that work as well as those that do not work can save time and money. This strategy directly ties into Priority Action 2– Tracking. By sharing information in real time directly with interested parties to avoid replicating mistakes. For example, CDFW’s 2022 early-season milkweed planting project was negatively impacted by gophers coming over the root cages to nibble plant stems. The Central Coast Joint Venture added above-ground cages to avoid this outcome, leading to increased plant establishment. Reviewing challenges and successes is also a key part of adaptive management, so lessons can be applied to projects to increase their effectiveness in real time.

### **C-2 Participate in pollinator-focused working groups such as the CNPS/BLM CA Seed Strategy to help increase seed resource availability in CA.**

As highlighted in the habitat section, developing regionally appropriate plant materials is crucial to creating resilient monarch habitats. The [California Seed Strategy](#) builds bridges across groups and focuses on specific actions that ameliorate challenges associated with bringing new plant species into production. Participating in this group will help ensure restoration projects have access to plant materials to speed up on-the-ground conservation actions.

### **C-3 Participate in 30x30 working group(s) to help integrate pollinator conservation as a key focal area.**

[30x30](#) is a goal to help accelerate voluntary conservation of lands and coastal waters worldwide. It has been adopted by a number of states, including California, where the Natural Resources Agency leads efforts to track conserved lands. One of the primary objectives of the initiative is to conserve and restore biodiversity. Pollinators contribute to ecosystem resiliency and some are keystone species. Highlighting the importance of pollinators and expanding goals to encompass pollinator conservation will strengthen the 30x30 framework and tie existing pollinator habitat conservation efforts into a robust framework that state agencies and various partner groups are already working toward.

### **C-4 Hold periodic meetings in overwintering sites to foster coordination and to inspire champions of monarch conservation.**

Site visits contextualize the social and developed landscapes overwintering habitat occurs within while allowing partners to understand better the unique microclimatic conditions and strategies necessary to tackle challenges associated with grove management. Further, viewing clustering monarchs inspires continual work towards conservation objectives.

## Medium Priority Actions

Working groups are key forums for sharing information and coordinating with partners to improve conservation management targeting. Many conservation working groups are collaborations between many partners and help align efforts across partners.

- Participate in the quarterly Monarch Overwintering Managers meetings co-facilitated by Xerces and USFWS.
- Enhance partnerships with organizations outlined in the WAFWA 50-year monarch conservation plan.
- Participate in the Monarch Plant Materials working group co-facilitated by CDFW and Xerces as it works to expand the foci from early-season milkweeds to other species, such as nectar plants that provide much-needed resources during spring and fall migration, and host plants that support other at-risk pollinator species.
- Participate in other local or landscape-level partnerships (e.g., DoD Sentinel Landscapes; San Joaquin Monarch Collaborative).
- Partner with relevant stakeholders including agricultural producers to develop Voluntary Local Programs or Safe Harbor Agreements (CDFW), Conservation Benefit Agreements (USFWS), or Conference Reports (NRCS) that provide take coverage for listed or candidate pollinator species.
- Coordinate with overwintering site owners focusing on landowners adjacent to agency-owned properties.
- Participate in pesticide-related working groups (e.g., DPR Sustainable Pest Management; San Joaquin Valley Monarch Collaborative).



## Existing Collaborative Efforts

By its nature, the California Multi-agency Monarch and Pollinator Collaborative brings state and federal partners together to address pollinator conservation. In addition, partners from our member agencies participate in many of the working groups highlighted in the Actions above as well as in other groups, such as regional Resource Conservation District-led monarch working groups that bring local partners together to collaborate on conservation objectives. The U.S. Fish and Wildlife Service is spearheading a geographically-focused effort to bring partners together in the San Joaquin Valley to increase pollinator habitat on working lands (See USFWS Case Study). National Parks is collaborating with One Tam, itself a regional cooperative partnership in Marin County, to advance monarch conservation and educational objectives (See NPS Case Study).





## CASE STUDY:

### U.S. Fish and Wildlife Service

**Project Title:** San Joaquin Valley Monarch Collaborative

**Category:** Collaboration

**Action:** Foster collaboration, align common objectives, implement science-based strategies, and align funding to enhance and restore habitats and support sustainable agricultural and land management practices for monarchs and other at-risk pollinators within the San Joaquin Valley.

**Project Summary:** The Collaborative aims to: (1) develop and implement a regional approach to monarch and pollinator habitat restoration and conservation within the San Joaquin Valley, (2) partner with landowners, conservation organizations, and other entities to identify and develop opportunities to increase breeding and migratory habitat for monarch butterflies and other key pollinating species, and (3) create a sustainable market for native plant materials.

**Next Steps:** Implement the near-term and mid-term actions identified in the Collaborative's *San Joaquin Valley Western Monarch Conservation Strategy: A Five-Year Plan for Success*.

**Photo:** Annual pollinator habitat in bloom at Bird Ranch in the San Joaquin Valley.  
Brian MacInnes, Valley Eco.

## CASE STUDY:

### U.S. National Parks Service

**Project Title:** Project Title: Golden Gate Monarch Butterfly Habitat Enhancement Project

**Category:** Collaboration, Outreach, Habitat, Monitoring



**Action:** Provide outreach resources about opportunities to engage in community science projects (e.g., Western Monarch Milkweed Mapper, Western Monarch Count, Southwest Monarch Tagging Project, etc.); Prioritize surveying milkweed and nectar resources on public lands, including rangelands, to better understand these plants' geographic and temporal distribution. Use this information to identify priority zones for management actions.

**Project Summary:** The National Park Service and the Golden Gate National Parks Conservancy in partnership with the One Tam collaborative in Marin County, and with support from the CA Wildlife

Conservation Board are working to 1) improve overwintering habitat for monarchs on or adjacent to lands managed by the National Park Service by conducting assessments of existing stand conditions at three historically occupied sites to prioritize sites for long-term management, complete site management plans for two of the assessed sites, and begin management plan implementation actions including removal or trimming of hazard trees, understory brush and invasive species removal, planting nectar plants, and planting native trees that will eventually join or replace the existing canopy trees currently or historically used by overwintering monarchs; 2) improve breeding habitat for monarchs on lands managed by Marin County Parks by completing assessments of existing/historical populations of narrow leaf milkweed to prioritize locations to target for future augmentation planting, complete site management plans, explore genetic viability analysis of Marin's wild and select garden populations of narrow leaf milkweed to identify suitable seed sources for wild population augmentation plantings, and initiate management plan implementation including removal of invasive species and planting narrow leaf milkweed raised from suitable seed stock and planting nectar plants in or near breeding habitat; and 3) increase community understanding of and support for western monarch conservation in Marin County with an emphasis on participatory stewardship and monitoring opportunities for youth, underserved communities, and other key audiences through Parks Conservancy's Rising Environmental Youth Leaders program and other education and outreach programming.

**Next Steps:** 1) Continue project efforts described above through March 2027; 2) continue to support One Tam partner agency monarch and other pollinator habitat restoration and conservation efforts across a variety of project and program areas; and 3) share lessons learned and key findings with regional stakeholders including Xerces Society, California Department of Fish and Wildlife, California Native Plant Society, US Fish and Wildlife Service, and others.

**Photo:** Staff from multiple agencies planting monarch butterfly nectar plants and milkweed in monarch breeding habitat, Marin County. Parks Conservancy.



# Conclusion

This report represents a significant step forward in the collaborative effort to address the alarming decline of monarch butterflies and other vital pollinators in California. The multi-year analysis undertaken by Collaborative members, focusing on the WAFWA Western Monarch Butterfly Conservation Plan 2019—2069 (called the 50-year Monarch Conservation Plan throughout the document) and the

recommendations from the 2022 Western Monarch Butterfly Conservation Summit in Washington DC, has identified shared priorities and critical gaps in current conservation strategies. The reorganization of conservation actions into the focal areas of Habitat, Research, Monitoring, Outreach and Education, Funding, and Collaboration provides a cohesive and cross-cutting framework for addressing pollinator decline.

This structure recognizes that effective conservation requires a multi-faceted approach that integrates on-the-ground habitat work with robust scientific understanding, effective monitoring, broad public engagement, adequate financial support, and strong interagency partnerships.



The near-term top priority actions identified in this report lay a foundation for future conservation success. Building a common definition of monarch breeding and migratory habitat in the West is paramount for setting clear and measurable habitat objectives. Simultaneously, tracking the implementation and success of habitat projects through a user-friendly database will allow for adaptive management and the sharing of effective restoration techniques. Making existing knowledge more accessible by compiling training, educational tools, and best management practices into a centralized location will empower land managers, educators, and the public to take informed action. Addressing the issue of plant material availability through forward contracts with native plant nurseries and exploring other mechanisms will ensure the long-term success of habitat restoration efforts. Finally, investing in our understanding of the species through developing a demographic model of the western monarch for the full annual life cycle and conducting sensitivity analyses will provide important insights for targeted conservation strategies.

Beyond these immediate priorities, the report outlines a comprehensive set of additional important actions within each focal area. These actions address critical gaps and other needs such as understanding pesticide impacts, identifying key migratory corridors, improving monitoring protocols, engaging with Tribal communities, securing sustainable funding sources, and fostering stronger collaborative relationships. The existing efforts and case studies highlighted within each section demonstrate the ongoing commitment of the Collaborative's Partners and provide a valuable springboard for future initiatives.

## NEXT STEPS

Moving forward, the Collaborative will prioritize the implementation of the identified near-term top priority actions. The following are the key next steps:

### Phase 1: Immediate Action (Next 6—12 Months)

- 1. Habitat Definition Working Group:** Participate in a dedicated working group composed of experts from research institutions, restoration practitioners, and agency biologists to develop a scientifically sound and broadly applicable definition of monarch breeding, migratory, and overwintering habitat in the western context. This group will leverage existing research and data while addressing the unique ecological characteristics of the western monarch range.
- 2. Habitat Tracking Tool Development:** Work with partners to develop a user-friendly database or tracking tool to record and monitor the implementation and outcomes of monarch and pollinator habitat restoration, enhancement, and preservation projects across California. This will involve identifying key data fields, exploring existing technological platforms, and ensuring accessibility for all relevant parties. Creating and maintaining this platform will require ongoing funding.
- 3. Centralized Resource Platform Development:** Continue updating and refining a comprehensive and easily navigable online platform (e.g., a dedicated section on the Collaborative's existing website or a new standalone site) to house existing training materials, educational resources, synthesized best management practices, and relevant research findings related to monarch and pollinator conservation. This will require a coordinated effort to identify, curate, and organize existing materials on a regular basis to ensure the information remains up-to-date.
- 4. Native Plant Material Availability Strategy:** Work with representatives from native plant nurseries, seed producers, and agency procurement specialists to explore and develop strategies for increasing the consistent supply of locally appropriate native plant materials for monarch and other pollinator conservation projects. This will include evaluating the feasibility of forward contracts, seed co-ops, and regional seed mix development.
- 5. Demographic Modeling Initiative:** Initiate a collaborative project with quantitative ecologists and monarch researchers to develop a comprehensive demographic model for the western monarch butterfly. This effort will involve identifying key data needs, securing necessary data sources, and conducting sensitivity analyses to inform targeted conservation interventions. To initiate this task, grant funding will be sought to hire a researcher to lead the modeling.

### Phase 2: Ongoing Implementation and Expansion (Years 1—3)

- Actively pursue the additional high-priority actions identified within each focal area, leveraging the expertise and resources of Collaborative partners.
- Foster and expand partnerships with external partners, including non-governmental organizations, academic institutions, private landowners, agricultural groups, and Tribal communities, to enhance the reach and impact of the Collaborative's conservation efforts to identify ongoing and new priorities.

- Seek and secure funding to support the implementation of priority actions and build long-term capacity for monarch and pollinator conservation in California.
- Develop and implement communication strategies to raise public awareness, engage interested parties, and promote the adoption of best management practices.
- Establish clear success metrics for each priority action and regularly evaluate progress to inform adaptive management strategies.

## PLAN FOR REGULAR REPORT UPDATES

Recognizing that monarch and pollinator conservation is an evolving field with new research emerging and ecological conditions changing, the Collaborative is committed to reviewing this report at least every five years. This commitment to regular reviews and updates will ensure the report remains a relevant and effective guiding document for the Collaborative’s work and for broader conservation efforts across California.

The report update process will involve the following steps:

- 1. Data Collection and Literature Review:** Partners will gather information on progress made towards the implementation of priority actions, new research findings, changes in pollinator populations and threats, and emerging conservation strategies.
- 2. Interested Party Engagement:** Partners will solicit input from external partners and other interested parties to identify new priorities, gaps, and opportunities for collaboration as well as get feedback on existing priorities.
- 3. Priority Re-evaluation:** Based on the collected information and input from interested parties, Partners will review and revise the existing priority actions, identifying completed actions, adjusting timelines, and incorporating new priorities as needed.
- 4. Gap Analysis Update:** The gap analysis will be revisited to identify any newly emerging gaps in conservation efforts or areas where further research or action is required.
- 5. Report Revision and Dissemination:** The report will be updated to reflect the revised priorities, updated gap analysis, and progress made. The updated report will be disseminated to Collaborative partners, interested parties, and the public through the Collaborative’s website and other relevant channels.

This commitment to regular updates will ensure that the Collaborative remains adaptive, responsive, and at the forefront of monarch and pollinator conservation in California, ultimately contributing to the long-term health and resilience of pollinator populations and the state’s natural and agricultural ecosystems.

# References

Black, SH, M Shepherd, and M Vaughan. 2011. Rangeland management for pollinators. *Rangelands*, 33(3): 9-13.

Bowman DMJS, GLW Perry, SI Higgins, CN Johnson, SD Fuhlendorf, and BP Murphy. 2016 Pyrodiversity is the coupling of biodiversity and fire regimes in food webs. *Phil. Trans. R. Soc. B* 371: 20150169. <http://dx.doi.org/10.1098/rstb.2015.0169>

California Department of Fish and Wildlife (CDFW), 2015. California State Wildlife Action Plan, 2015 Update: A Conservation Legacy for Californians. Edited by Armand G. Gonzales and Junk Hoshi, PhD. Prepared with assistance from Ascent Environmental Inc., Sacramento, CA.

Crone, EE. 2021. Presentation on monarch decline at UC Berkeley's Essig Brunch. Berkeley, CA.

Crone, EE, and CB Schultz. 2021. Resilience or catastrophe? A possible state change for monarch butterflies in western North America. *Ecology Letters*, 24(8): 1533-1538.

Crone, EE, EM Pelton, LM Brown, CC Thomas, and CB Schultz. 2019. Why are monarch butterflies declining in the West? Understanding the importance of multiple correlated drivers. *Ecological Applications*, 29(7): e01975.

Dicks, LV, TD Breeze, HT Ngo, D Senapathi, J An, MA Aizen, P Basu, D Buchori, LGaletto, LA Garibaldi, and B Gemmill-Herren. 2021. A global-scale expert assessment of drivers and risks associated with pollinator decline. *Nature Ecology & Evolution*, 5(10): 1453-1461.

Dilts, TE, MO Steele, JD Engler, EM Pelton, SJ Jepsen, SJ McKnight, AR Taylor, CE Fallon, SH Black, EE Cruz, and DR Craver. 2019. Host plants and climate structure habitat associations of the western monarch butterfly. *Frontiers in Ecology and Evolution*, 7: 188.

Edwards, CB, EF Zipkin, EH Henry, NM Haddad, ML Forister, KJ Burls, SP Campbell, EE Crone, J Diffendorfer, MR Douglas, and RG Drum. 2025. Rapid butterfly declines across the United States during the 21st century. *Science*, 387(6738): 1090-1094.

Fisher, A, K Saniee, C Van der Heide, J Griffiths, D Meade, and F Villablanca. 2018. Climatic niche model for overwintering monarch butterflies in a topographically complex region of California. *Insects*, 9(4): 167.

Forister, ML, CA Halsch, CC Nice, JA Fordyce, TE Dilts, JC Oliver, KL Prudic, AM Shapiro, JK Wilson, and J Glassberg. 2021. Fewer butterflies seen by community scientists across the warming and drying landscapes of the American West. *Science*, 371(6533): 1042-1045.

Gruppenhoff, AR, and HD Safford. 2024. High fire frequency in California chaparral reduces postfire shrub regeneration and native plant diversity. *Ecosphere*, 15. 10.1002/ecs2.70128: 10.1002/ecs2.70128.

Halsch, CA, A Code, SM Hoyle, JA Fordyce, N Baert, and ML Forister. 2020. Pesticide contamination of milkweeds across the agricultural, urban, and open spaces of low-elevation northern California. *Frontiers in Ecology and Evolution*, 8: 162.

Iwasaki, JM, and K Hogendoorn. 2021. Non-insecticide pesticide impacts on bees: a review of methods and reported outcomes. *Agriculture, Ecosystems & Environment*, 314: 10742.

James, DG. 2024. Monarch butterflies in western North America: a holistic review of population trends, ecology, stressors, resilience and adaptation. *Insects*, 15(1): 40.

Klein, AM, BE Vaissiere, JH Cane, I Steffan-Dewenter, SA Cunningham, C Kremen, and T Tschardt. 2007. Importance of pollinators in changing landscapes for world crops. *Proceedings of the Royal Society B: Biological Sciences*, 274(1608): 303-313.

Lenard, A, T Burns, ML Hladik, KE Keller, S Marcum, WE Thogmartin, and ML Forister. 2025. Pesticide contamination detected across five wildlife refuges in the Sacramento Valley of California. *Science of the Total Environment*, 969: 178991.

Main, AR, ML Hladik, EB Webb, KW Goynes, and D Mengel. 2020. Beyond neonicotinoids – wild pollinators are exposed to a range of pesticides while foraging in agroecosystems. *Science of The Total Environment*, 742: 140436.

McIntyre, PJ, H Ceasar, and BE Young. 2024. Mapping migration habitat for western monarch butterflies reveals need for public-private approach to conservation. *Frontiers in Ecology and Evolution*, 12: 1460363.

Merkley, J. 2022. Monarch Butterfly Conservation Summit June 22-23, 2022: Recommendations Summary Report. Prepared by Kimberly A Horndeski, Community Consulting LLC. Washington D.C.

Moore, T. 2024. State Conservationist, Natural Resources Conservation Service. Multi-Agency Monarch and Pollinator Collaborative virtual meeting on rangeland benefits to monarchs.

Oberhauser, K, R Wiederholt, JE Diffendorfer, D Semmens, L Ries, WE Thogmartin, W.E., L Lopez-Hoffman, and B. Semmens. 2017. A trans-national monarch butterfly population model and implications for regional conservation priorities. *Ecological Entomology*, 42(1): 51-60.

Ollerton, J, R Winfree, and S Tarrant. 2011. How many flowering plants are pollinated by animals? *Oikos*, 120(3): 321-326.

Ponisio, LC, K Wilkin, LK M'Gonigle, K Kulhanek, L Cook, R Thorp, T Griswold, and C Kremen. 2016. Pyrodiversity begets plant-pollinator community diversity. *Global Change Biology*, 22(5): 1794-1808.

Potts, SG, V Imperatriz-Fonseca, HT Ngo, MA Aizen, JC Biesmeijer, TD Breeze, LV Dicks, LA, Garibaldi, R Hill, J Settele, and AJ Vanbergen. 2016. Safeguarding pollinators and their values to human well-being. *Nature*, 540(7632): 220-229.



Safford, HD, AK Paulson, ZL Steel, DJN Young, and RB Wayman. 2022. The 2020 California fire season: A year like no other, a return to the past or a harbinger of the future? *Global Ecology and Biogeography*, 31:2005-2025. 10.1111/geb.13498: 10.1111/geb.13498.

Schultz, CB, LM Brown, E, Pelton, and EE Crone. 2017. Citizen science monitoring demonstrates dramatic declines of monarch butterflies in western North America. *Biological Conservation*, 214: 343-346.

Thompson, HM, and T Pamminger. 2019. Are honeybees suitable surrogates for use in pesticide risk assessment for non-Apis bees?. *Pest Management Science*, 75(10): 2549-2557.

Western Association of Fish and Wildlife Agencies (WAFWA). 2019. Western Monarch Butterfly Conservation Plan 2019 – 2069. Version 1.0.

Xerces Society. 2018. Best Management Practices for Pollinators on Western Rangelands. 126+vii pp. Portland, OR: The Xerces Society for Invertebrate Conservation. (Available online at: <https://xerces.org/best-management-practices-for-pollinators-on-western-rangelands>)

Xerces Society Western Monarch Count. 2025. Western Monarch Count Data, 1997-2024. Available at [WesternMonarchCount.org](https://WesternMonarchCount.org).

Young, JA, Clements, CD. Cheatgrass: Fire and Forage on the Range. University of Nevada Press; 2009





**TABLE A1-1: HABITAT**

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Develop shared definitions of what constitutes monarch breeding and migratory habitat in the West.	Immediate	1 year	None	Shared definitions of breeding, migratory, and overwintering habitat in the west	Number of partners adopting the shared definitions	Experts from the research and restoration practice community; Xerces Society	Near-term
Increase monarch and pollinator habitat via incentive and easement programs administered by Collaborative partners.	2-3 years	3-5 years	Funding	Increase in monarch and pollinator conservation in incentive and easement programs and increased habitat.	Proportion of adopted incentive/easement programs that incorporate pollinator conservation	Resource Conservation Districts	High
Protect existing nectar resources and restore nectar resources to invaded or degraded areas and riparian areas (which have been identified as migratory corridors in the West).	1 year	3-5 years	Identify high priority areas for restoration; Funding	Protected and enhanced migratory habitat	Acres of protected and enhanced habitat in riparian corridors		High
Manage fuel within overwintering sites using outcomes from research.	1 year	3-5 years	Appropriate methods identified by researchers	Reduced fire risk in overwintering sites	Acres treated	Researchers; CalFire; Xerces Society	High
Create early-season milkweed habitat in first-priority zone.	1 year	3-5 years	Plant material availability	Increased early season milkweed habitat on landscape to support monarchs that leave overwintering sites early due to high temperatures	Acres planted	Native plant nurseries; Monarch Plant Materials Working Group; Xerces Society; Monarch Joint Venture (MJV); Pollinator Partnership	High

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Implement practices identified through research or BMPs that protect habitat from pesticides, with a focus on habitat that can function as movement corridors	2-3 years	Ongoing	BMPs identified; Funding	Protection of habitat from pesticide and/or mitigation of impacts	Acres of habitat protected from pesticides; Number of practices implemented	Private landowners including agricultural producers	Medium
Develop advice for managing overwintering sites that contain dead trees and fire hazards in ROWs.	1 year	2-3 years	None	Standard BMPs for management of monarch overwintering sites	Number of BMPs developed	Xerces Society; Arborists; CalFire; Researchers	Medium
Protect overwintering sites that are not on public lands through purchase or easements.	2-3 years	Ongoing	Funding	Purchase of overwintering sites and/or development of easements	Number of potential sites identified; Number of sites purchased or turned into easements	Xerces Society; other NGOs	Medium
Collect native seed and make it available to partners and native plant nurseries (when appropriate).	Immediate	3-5 years	Alignment with CA Native Seed Strategy; Funding; Collection permits; Equipment availability; Identification of storage facilities; Native plant nurseries with capacity	Increased native seed/plant availability	Number of collection events; Pounds of seed collected; Number of species collected; Number of partners distributed to	California Native Plant Society (CNPS); California Native Seed Strategy (CNSS) participants; Native plant nurseries; Farms; Monarch CCAA Rights-of-Way Working Group; Xerces Society; MJV; P2	Medium
Refine habitat goals in collaboration with WAFWA Monarch and Native Insect Pollinator working group to improve and standardize how we measure success.	1 year	1 year	Collaboration with WAFWA Western Monarch and Native Insect Pollinator Working Group	Measurable habitat goals	Number of goals re-defined	Western Association of Fish and Wildlife Agencies (WAFWA)	Medium

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Revise the top 50 list of priority overwintering sites that the Xerces Society developed to incorporate additional sites that support the monarch population and add whether a site has protection to the list.	1 year	1 year		Updated top 50 list of overwintering priority sites	List creation; Number of times list is distributed	Xerces Society; Researchers	Medium
Incorporate monarch/pollinator habitat protection and enhancement into land management plans	2-3 years	Ongoing	Identification of plans being worked on; Spreading awareness/educating plan authors	Land management plans that include monarchs/pollinators	Number of land management plans that incorporate monarch/pollinator habitat protection and enhancement	Xerces Society; NGOs that own and manage lands for conservation (TNC, Land Trusts, etc.)	Medium
Participate in CNPS/BLM CA Seed Strategy to help increase seed resource availability in California.	Immediate	Ongoing	None	Shared knowledge; Development of new plant materials	Number of partners participating in working group; Number of meetings attended	CNPS; CNSS participants	Low
Enhance or create pollinator habitat at rest stops and scenic highway overlooks.	2-3 years	3-5 years	Funding; Staffing for installation and maintenance	Monarch habitat at rest stops and scenic overlooks	Number rest-stops enhanced; Acres enhanced		Low
Caltrans create habitat as identified in pollinator plan funded by the Infrastructure bill for transportation agencies.	2-3 years	3-5 years	Buy-in from Caltrans; Funding; Staffing to apply for funding and implement the plan; Development of a state pollinator plan for Caltrans	Habitat installed	Acres of habitat planted	Xerces Society; MJV	Low

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Adapt restoration plans at breeding/migratory/overwintering sites to incorporate climate resiliency (e.g., objectives to create more shade to protect monarchs from high heat events, include drought tolerant plants, ensure reliable water in proximity to restoration sites, more wind protection at overwintering sites, etc.).	1 year	2-3 years	Funding	Updated restoration plans	Number of plans; Acres enhanced	Researchers	Low
NRCS provide incentives for management of overwintering sites as timber forest lands.	2-3 years	3-5 years	None	Improved management at overwintering sites	Acres enhanced; Number of land managers participating in program	Private landowners	Low



**TABLE A1-2: RESEARCH**

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
In collaboration with other partners, find funding to develop a full annual life cycle demographic model of western monarchs and conduct sensitivity analyses.	1 year	2-3 years	Secure funding	Demographic model	Number of presentations; Number of publications; Number of partners reached	Crone, Shultz, Yang and other research labs	Near-term
Support research on pesticide mixture impacts to monarchs and other pollinators.	2-3 years	3-5 years	Funding; Researchers; List of priority pesticides to focus research on	Data on problematic mixtures; Publications; Presentations	Number of studies funded; Number of publications/ presentations	University of California Cooperative Extension (UCCE); Xerces Society; Researchers	High
Study the costs and benefits of glyphosate, other herbicides, and non-chemical approaches as tools for restoration.	2-3 years	2-3 years	Funding; Researchers	Publication on costs and benefits of herbicides as a restoration tool	Number of publications/ presentations	California Invasive Plant Council (Cal-IPC); Researchers	High
Study toxicity impacts on a wider array of pollinators than honey bees, including butterflies.	2-3 years	3-5 years	Funding; Researchers; List of priority pesticides to focus research on	Toxicity endpoints	Number of studies funded; Number of publications/ presentations	UCCE; Xerces Society	High
Develop a shared pesticide risk to pollinators ranking list	2-3 years	2-3 years	Funding; Researchers	Shared pollinator risk rankings	Number of groups adopting shared ranking system	University of California Statewide Integrated Pest Management Program (UC IPM); Xerces Society	High

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Synthesize existing data and use it to develop a habitat model to identify locations to target for surveys, restoration, and conservation with a focus on connectivity.	1 year	2-3 years	Identify interested researcher(s); Secure funding; Identify data sources	Output with locations to target for surveys, restoration, and other conservation actions.	Model developed; Number of presentations; Number of publications	Researcher(s)	High
Study pesticide residues from drift and run-off in protected areas.	2-3 years	3-5 years	Funding; Researchers	Data on appropriate buffer distances; Publications; Presentations	Number of studies funded; Number of publications/ presentations	UCCE; Xerces Society; Researchers	High
Use pesticide use reporting (PUR) data to identify areas where there could be high monarch and pollinator exposure to pesticides.	2-3 years	1 year	Funding; Researchers	Data on problematic vs prime locations for monarch management; Publications; Presentations	Number of studies funded; Number of publications/ presentations		Medium
Conduct studies to evaluate nectar plant use by monarchs during different parts of their lifecycle.	2-3 years	5 + years	Funding for field studies	Completed studies; white papers; scientific publications; presentations	Number regions where studies are completed; Number of publications; Number of presentations	Non-profits; Researchers	Medium
Identify spring and fall migratory pathways, including using Motus as a tool.	2-3 years	3-5 years	Funding; Assembly of research team; Retrofitted Motus stations	Scientific publication	Publication; Number of citations; Number of times incorporated into best practice documents, policies, or management plans	Researchers	Medium

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Participate in the “super-study” being developed by a variety of partners, led by Xerces Society.	2-3 years	2-3 years	Funding	Findings on factors that influence monarch site selection	Number of sites evaluated; Number of publications; Number of presentations	All partners from the overwintering meeting in San Luis Obispo	Medium
Research pesticide and other contaminant exposure to monarchs in ROWs.	2-3 years	3-5 years	Funding; Identify researchers	Data on pesticide exposure in ROWs; Presentations; Publications	Funding secured; Number of sites studied; Number of publications/ presentations	Researchers	Medium
Combine the DPR PRESCRIBE database with CDFW sensitive species data.	2-3 years	2-3 years	Determine whether platform can house this information or has limitations	A revamped PRESCRIBE database updated with supplemental information	Number of species data incorporated into PRESCRIBE		Medium
Study how to avoid harm to monarchs while reducing fire risk/fuel build up.	1 year	2-3 years	Funding; Partners (researcher/ student/ non-profit) to work on this collaboratively	Study examining fuel reduction; BMP write-up; Meeting where results are shared	Funding for study; Number of sites where treatments are completed; Report/paper produced; BMPs developed; Number of times BMPs used	Researchers; Non-profits; Overwintering site land managers; CalFire	Medium

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Research and better understand first generation monarch habitat use and migratory patterns with a focus on spring and fall time periods.	1 year	2-3 years	Continue to fund Monarch Mystery Challenge; Public and partners input data in winter/spring into Western Monarch Milkweed Mapper/ iNaturalist; Identify interested researcher(s); Develop study design; Secure funding	Data on the first monarch generation	Number of agency staff participating; Number of studies/analyses conducted; Number of publications or other formats to share findings	Schulz and Crone research labs	Medium
Determine which non-eucalyptus trees can be used at monarch overwintering sites.	2-3 years	2-3 years		List of trees that can be used in lieu of eucalyptus	List of alternate tree species	Xerces Society	Medium
Develop a Motus study to evaluate between-site monarch movement during overwintering period.	1 year	2-3 years	Identify interested researcher(s); Develop study design; Secure funding; Scientific Collecting Permit for research; Site access permits (if applicable); Motus towers in suitable locations or materials for temporary towers	Data on monarch overwintering movement	Number of sites studied; Number of paper published; Number of presentations given	Researchers; Xerces Society	Medium
Ground truth habitat suitability models.	2-3 years	3-5 years	Habitat suitability model developed	Data verifying model output	Number of locations surveyed	Researcher(s)	Low

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Synthesize IMMP data and provide results to partners so they can incorporate findings into management on-the-ground.	Immediate	2-3 years	Continued collection/ expansion of IMMP data in the west	Analyses of milkweed, nectar plant and monarch use from different land types and regions; BMPs for management based on findings	Number of publications; Number of presentations; Number of projects adopting findings	MJV	Low
Conduct a study to better understand monarch mortality at overwintering sites.	2-3 years	3-5 years	Learn more about the overwintering site mortality study at Lighthouse Field State Park; Consult researchers to develop appropriate protocol.	Data on overwintering mortality; Publication(s)/ presentation(s)	Number of sites studied; Number of papers published; Number of presentations given	Researchers	Low
Use tools like LiDAR, remote sensing tools, weather stations, etc. to examine microclimatic conditions (temperature, wind, insolation) within overwintering sites to 1) help support habitat models, 2) assist with management decisions, 3) better understand how microclimate influences monarch movement within a grove.	2-3 years	2-3 years	Site selection; Funding for LiDAR flights and data analysis; Identification of researcher partners to analyze data	Analysis of wind and insolation of sites to assist with management decisions; Reports detailing results; Data on wind and how that affects clusters and tree selection at overwintering sites; Data on microclimate in partner-managed overwintering sites; LiDAR data for overwintering sites	Number of sites assessed using these techniques; Reports; Number of papers published; Number of presentations	Creekside Science; Althouse and Meade; Xerces Society; CalPoly San Luis Obispo; Researchers	Low

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Develop standard pesticide risk assessment process for monarchs/butterflies.	3-5 years	5 + years	Toxicity data on monarchs; Information on what environmental matrices are most important; Data on consumption rates	Guidance document that partners can follow when evaluating risks of pesticides	Number of times document is shared with risk assessors	Environmental Protection Agency (EPA)	Low
Synthesize exposure information and predict effects of chemical mixtures that have not yet been tested using existing predictive models.	2-3 years	2-3 years	Funding; Researchers	Publication or white paper summarizing mixture models and their application to pollinator risk	Number of publications/ presentations	EPA	Low
Synthesize adjuvant use/ toxicity data to look for trends in impacts to pollinator populations.	2-3 years	3-5 years	Access to adjuvant data; Studies on a variety of adjuvant impacts to monarchs and other pollinators	Analyses of trends in impacts of pesticides to pollinators; publications; presentations; informational materials	Number of publications; Number of presentations; Number of factsheets	Researchers	Low
Expand research on early season milkweed.	1 year	2-3 years	Funding; Assembly of research team	Information about vital early season resources	Publication; Number of citations; Number of times incorporated into best practice documents, policies, or management plans	Researchers	Low

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Identify pilot areas to improve lighting to be wildlife friendly; Document costs and share information on how to improve efficiencies so light fixture conversion can be scaled up by other partners.	2-3 years	3-5 years	Researchers; Funding	Analysis of areas with light pollution; Publications; Presentations; Installation of wildlife friendly lighting	Number of sites studied; Number of publications/ presentations;	Dark Skies International; University of California, Los Angeles (UCLA) Longcore Lab	Low
Research practices that protect habitat from pesticides, with a focus on habitat that can function as movement corridors.	1 year	Ongoing	Funding	Data on efficacy of mitigation practices; Presentations; Publications; Protection of habitat from pesticide and/ or mitigation of impacts	Number of studies on minimizing or mitigating pesticide exposure; Number of papers, presentations, number of acres of habitat protected from pesticides	Researchers; Landowners	Low
Retrofit existing Motus towers to receive bluetooth frequencies.	1 year	5 + years	Identify priority locations; Secure funding; Staff to retrofit towers	Additional coverage and data collection points	Number of Motus towers retrofitted	American Bird Conservancy; Point Blue Conservation Science; Xerces Society; Motus tower owners	Low
Assess pesticide residues in milkweed leaves, in other passive sampling collectors (e.g., silicone bands) or matrices (e.g., nectar bearing plants, soils) to determine potential exposure of monarchs at restored or otherwise protected sites.	1 year	2-3 years	Funding; Personnel	determination of potential exposure of monarchs at restored or otherwise protected sites from samples collected	Number of samples collected; Number of analyses conducted; Number of publications/ presentations	Researchers	Low

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Synthesize information on seed mix and planting palette success from past projects and use the information to inform future projects.	2-3 years	3-5 years	Funding; Database of monarch/pollinator restoration projects	Success metrics of various planting strategies and species; Publications/presentations	Number of publications; Number of presentations; Number of factsheets	Various groups installing and monitoring habitat	Low
Gather and synthesize information on propagation of key plant materials.	1 year	3-5 years	Standardized metrics of propagation success; funding	Propagation protocols for nectar and milkweed plants	Number of protocols published	California Native Plant Society (CNPS); Monarch Plant Materials Working Group; Native plant nurseries; Botanic gardens	Low
Develop study aimed at understanding the influence of fire severity (e.g., wildfire versus prescribed burns) on butterfly habitat.	2-3 years	3-5 years	Identify funding sources; Identify research partner(s); Identify appropriate methods	Scientific publications	Number of publications/presentations	Researchers; CalFire	Low
Expand USGS habitat suitability model in East to include the West	1 year	2-3 years	Funding	Habitat suitability model for west	Funding acquired; Model developed	Researchers	Low
Initiate a study of important overwintering sites in low desert riparian and urban areas to better understand the relative contribution of those areas to the overall population.	2-3 years	3-5 years	Researcher(s); Develop study design; Funding	Data on low desert riparian and urban overwintering sites; Publication(s)/presentation(s)	Number of sites studied; Number of paper published; Number of presentations given	Researchers; Xerces Society	Low

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Compile existing research on light pollution and invite researchers to help agencies better understand the issue.	1 year	2-3 years	Researchers; Funding	Information (e.g., presentations, 1-pagers, lit reviews) on light pollution and pollinators	Development of resources to share with partners	Dark Skies International; UCLA Longcore Lab	Low
Trial drought-tolerant eucalyptus in monarch overwintering sites.	2-3 years	3-5 years	Funding for trials; Availability of focal eucalyptus species	Study of survival	Number of species trialed; Number of sites evaluated; Report of results	Researchers; Xerces Society	Low
Fly LiDAR over overwintering sites to support other research objectives related to climate (wind, insolation, tree density, etc.).	2-3 years	2-3 years	Site selection; Funding	LiDAR data	Number of sites assessed	Creekside Science; Althouse and Meade	Low
Help with efforts to develop Seed Transfer Zones- areas that delineate where seeds can be safely moved without compromising genetics.	1 year	3-5 years		CA-specific seed transfer zones	Seed zones developed; Number of partners participating in development; Number of outreach materials on new seed zones shared	CNPS; Other partners involved in the California Native Seed Strategy (CNSS)	Low
Create a user-friendly tool that evaluates recent population trends (whole western population and in specific sites) that allows managers to look at a snapshot of population metrics (e.g., growth rate) without waiting for new papers to be published.	1 year	2-3 years	Funding; Staff time	New user-friendly tool	Funding acquired; Tool developed	Xerces Society; WAFWA	Low



**TABLE A1-3: MONITORING**

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Track implementation and success of habitat restoration, enhancement, and preservation projects.	2-3 years	Ongoing	Develop tracker if WAFWA CHAT is being phased out; Initial and long-term funding for creation and maintenance of tool	Tracker development and use	Development of tracker; number of projects input into tracker	All groups that are creating monarch habitat; WAFWA; Xerces Society; Researchers; Non-profits; Land Managers	Near-Term
Ensure that all partner-managed overwintering sites are monitored annually for butterflies and numbers included in the Western Monarch Count.	1 year	Ongoing	Training to conduct overwintering counts; Identify community science volunteers; Provide access to community science volunteers if agency staff are unable to conduct counts themselves	Consistent count data for partner-owned overwintering sites	Number of sites managed by partner agencies monitored annually; Number of trainings; Number of biologists or volunteers conducting counts	Xerces Society	High
Expand the Motus network to key locations to monitor monarch population.	1 year	5 + years	Identify priority locations; Secure funding; Staff to set up and maintain Motus towers; Tags purchased and placed on monarchs to generate data	Additional coverage and data collection points	Number of Motus towers installed	Researchers; On-the-ground managers; Funding agencies	High

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Develop shared methodology to assess success of management actions in overwintering sites.	2-3 years	2-3 years	Develop a datasheet of key attributes to be tracked; Access to a shared database	Protocol that can be used by all partners; Shared data management portal	Number of sites monitored annually and reported	Xerces Society; Overwintering site land managers	Medium
Prioritize surveying milkweed and nectar resources on rangelands to better understand their geographic and temporal distribution. Use this information to identify priority zones for management actions.	2-3 years	2-3 years	Access to land (private and public); Staffing for monitoring; Development of protocols; Training for staff to conduct monitoring; Shared database for recording and analyzing data	Milkweed on rangelands mapped; Priority zones for management actions identified	Acres of rangeland surveyed; Creation of priority zones	University of California Cooperative Extension (UCCE); Livestock associations (Cattlemen's, Wool Growers, etc.); Private landowners; MJV; Xerces Society	Medium
Train agency staff to participate in annual overwintering counts.	1 year	Ongoing	Coordinate with western monarch count regional leads to schedule trainings	Reliable counts at partner-managed overwintering sites; Staff trained in counting monarchs	Number of agency staff trained	Xerces Society	Medium
Train staff in how to assess overwintering habitat.	2-3 years	Ongoing	Training depends on agency and how/if they prioritize this training; Funding for consultants/ non-profits to conduct the trainings	Increased capacity to assess overwintering habitat in-house	Number of agency staff trained	Xerces Society; Creekside Science; Althouse and Meade	Medium

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Public agencies that manage overwintering sites should conduct regular habitat assessments.	1 year	Ongoing	Training for agency biologists on what data to collect; Data collection forms; Centralized location to store data	Annual data from overwintering sites	Number of sites monitored annually	Xerces Society	Medium
Develop electronic, shareable apps and forms (e.g., Survey123) to assist with habitat assessments that builds off the western monarch count overwintering habitat assessment forms.	1 year	2-3 years	Funding to develop forms (i.e. Survey 123); Personnel to develop forms	Expanded habitat assessment forms	Tool developed; Number of partners using the tool	Xerces Society	Medium
Continue adding data to Western Monarch Milkweed Mapper and iNaturalist so long as it does not jeopardize the privacy of landowners should monarchs be federal or state listed.	1 year	Ongoing		Expanded data on monarch and milkweeds on community science platforms	Amount of additional data added; Number of partners adding data		Medium
Include effects from fire, drought, and other impacts from climate change in monitoring protocols.	1 year	1 year	Agency input into monitoring protocols	Monitoring protocol changes to include effects from fire, drought, and other impacts from warming climates	Revised monitoring protocols	Xerces Society; MJV	Medium

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Participate in the long-term California Bumble Bee Atlas data collection sites; train agency biologists and promote the project to the public through outreach/ interpretive programs.	1 year	Ongoing	Funding for CA Bumble Bee Atlas; Training for agency biologists	Increased data on bumble bee abundance and distribution	Number of participants; Number of surveys		Medium
Use information from the Powell Center-funded Butterfly Trends Project to develop a long-term monitoring plan and survey protocol for priority butterfly species (Edwards et al. 2025).	2-3 years	2-3 years	Funding; Research partner(s)	Long-term monitoring framework and survey protocol for butterflies; Additional data on butterfly trends	Funding acquired; Protocol and framework developed	Pollinator researchers from the Powell Center	Medium
Adopt IMMP as a standardized monitoring strategy on partner lands including monarch-focused restoration sites and implement the monitoring protocol.	1 year	2-3 years	Work with USGS to adjust IMMP as needed to better reflect conditions in the west; training for staff in protocol	Standardized monitoring approach utilized by agencies that can provide data that can be analyzed collectively	Number of agencies adopting IMMP as a monitoring standard; Number of IMMP surveys conducted annually	MJV	Low
Couple monitoring of pollinator populations with climate and other threats (e.g., artificial light at night, pesticide residues) to help determine potential impacts and engage in potential mitigations or other management actions.	2-3 years	Ongoing	Identify or develop protocols that can be added to existing threat monitoring; Identify existing threat monitoring efforts	Monitoring data that can relate threats to population status	Number of monitoring programs pollinators are incorporated into; Number of threats captured through monitoring; Number of sites monitored; Number of pollinator species incorporated into monitoring	Researchers; Land managers	Low

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Enhance partner agency participation in the national native bee monitoring network development and roll out on partner properties once the protocol has been identified.	2-3 years	Ongoing	Native bee monitoring has completed protocol development; Training for agency biologists on protocol	Increased data on native bee abundance and distribution	Number of agencies participating; Number of surveys conducted	Native Bee Monitoring Network; University of California, Riverside Woodard Lab	Low
Expand tracking tools used by California State Parks at Pismo for use by all overwintering site managers.	1 year	2-3 years	Survey123 or other format for tracking data; Training(s) on how to collect data	More nuanced data on monarch habitat use	Number of partners using the tool	Xerces Society	Low
Expand North America Butterfly Association (NABA) sites in CA and ensure existing sites are adequately surveyed.	1 year	2-3 years	Training on how to conduct NABA protocol	Selection of additional sites to monitor; Expanded monitoring of butterflies in CA	Number of additional sites added; Number of additional surveys conducted	NABA; Researchers; Organizations interested in conducting surveys; Community scientists	Low
Track implementation and success of habitat restoration, enhancement, and preservation projects.	2-3 years	Ongoing	Develop tracker if WAFWA CHAT is being phased out; Initial and long-term funding for creation and maintenance of tool	Tracker development and use	Development of tracker; number of projects input into tracker	All groups that are creating monarch habitat; WAFWA; Xerces Society; Researchers; Non-profits; Land Managers	Near-Term



**TABLE A1-4: OUTREACH AND EDUCATION**

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Compile existing trainings, educational tools, and synthesized BMPS into a centralized location (e.g., multi-agency collaborative website).	1 year	Ongoing		Centralized list of training materials and educational tools	Number of trainings added to centralized list		Near-term
Engage Native American Tribes in outreach.	Ongoing	Ongoing	Partner agencies have tribal policies and liaisons in place	Increasing collaboration with tribes	Number of tribes engaged; Number of meetings with tribes	Tribes (both federally-recognized and not)	High
Develop core messages on key topics that partners can be shared with staff, the public, and local businesses such as plant nurseries. Specific topics could include appropriate species to plant in monarch habitat and messaging specific to agriculture and rangelands.	Immediate	2-3 years	Funding	Coordinated messages on monarch/pollinator conservation efforts; Informational Materials (webpages and 1-pagers)	Number of materials and resources created; Number of time resources are accessed, used or distributed (number of pamphlets handed out or downloaded, number of website visits); Number of staff and members of the public that the core messages are shared with	Xerces Society; Pollinator Partnership; Non-profits; California Pollinator Coalition; MJV; P2	High

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Incorporate educational material about protecting pollinators from pesticides into pesticide applicator education classes and other forums like pesticide application trainings held by partner agencies; includes development of training materials concerning protections for newly listed species	Immediate	2-3 years	N/A	Development and approval of material, including resources geared specifically to wildlife pesticides and applications; Material added to CDPR classes; informational resources (printed material) distributed to applicators	Number of materials developed; Number of courses/forums incorporating pollinator protections content; number of pesticide applicators trained; number of pesticide applicators passing quizzes; number of staff attending trainings		High
Encourage the public to visit monarch overwintering sites to inspire conservation ethic.	Immediate	Ongoing	Identify appropriate media outlets within and outside partner organizations; Engage relevant Communications staff	Increased public awareness and understanding of overwintering site management and conservation value	Number of outreach events and types		Medium
Focus social media campaigns on annual "Western Monarch Day" and "Pollinator Week."	1 year	Ongoing	Work with agency communications teams	Social media posts around western monarch day	Number of posts; Number of agencies participating	Xerces Society; MJV	Medium

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Encourage the public to visit monarch overwintering sites to inspire connectivity with local populations and advance local knowledge and stewardship of the habitat.	1 year	Ongoing		Increased public awareness and understanding of overwintering site management and conservation value	Number of outreach types targeted at public; Increased number of visits by public (at sites where this is measured)		Medium
Develop and provide educational pamphlets at public wildlife areas and reserves about monarch conservation.	Immediate	1 year	Funding	Coordinated messages on monarch/pollinator conservation efforts; Informational Materials (webpages and 1-pagers)	Number of locations offering pamphlets	Xerces Society; Pollinator Partnership; Non-profits; CA Pollinator Coalition; MJV; P2	Medium
Increase or update interpretive signage at overwintering sites open to the public, including by using the Western Monarch Trail sign templates, where appropriate, and providing signage at rest stops and scenic highway overlooks.	1 year	3-5 years	Funding	Development and installation of interpretive signs that include information on monarch conservation	Number signs developed; Number installed on partner properties	Western Monarch Trail; Xerces Society; MJV	Medium
Develop and publish information about monarch conservation activities on partner websites, using pre-existing resources where possible; Distribute regionally specific planting guides for home gardens.	1 year	Ongoing	Funding and labor to develop and create web material	Monarch content on partner websites	Number of partner websites that include monarch content		Medium

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Provide outreach resources about opportunities to engage in community science projects (e.g., Western Monarch Milkweed Mapper, Western Monarch Count, Southwest Monarch Tagging Project, etc.).	1 year	Ongoing		Public educated about pollinator-focused community science projects	Number of people reached; Number of educational event conducted that include information on community science opportunities	Xerces Society; MJV; Other groups with community science projects (e.g., NABA; P2)	Medium
Educate the public on the impacts of pesticides used around the home and local neighborhoods on local pollinators.	Immediate	Ongoing	Handouts and other materials about pesticide impacts to monarchs from residential exposure.	Informational resources; Public education	Number of outreach materials developed; Number of people reached	Local monarch and pollinator-focused groups; Overwintering site docents	Medium
Train interpretive staff on communicating with the public about monarchs and other pollinators.	1 year	2-3 years	Development and/or consolidation of training messages and materials (power points, laminated slides for outdoor trainings, websites, story maps)	Public educated about monarch conservation when visiting partner properties that support monarchs	Number agencies including monarchs in interpretation; Number of staff trained	Xerces Society; MJV; P2: East Bay Pollinator Posse	Medium
Host a field trip to native plant nurseries for Partners and agencies interested in growing own plant materials or increasing their awareness of plant materials availability and propagation.	1 year	1 year	N/A	Partners educated on how to develop native plant nursery for their agency	Number of trips; Number of participants	Native plant nurseries and farms	Medium

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Encourage elected officials to visit monarch habitat.	1 year	Ongoing		Increased public awareness and understanding of overwintering site management and conservation value	Number of public officials visiting monarch overwintering sites	Overwintering site managers; Xerces Society; Researchers	Medium
Work with CA Naturalist program to add pollinator content.	1 year	2-3 years	Funding	Educational modules/materials for pollinators; UC Naturalists trained on pollinator conservation	Number of UC Naturalist courses adopting pollinator content; Number of naturalists trained	UC Naturalist Program; UC Agriculture and Natural Resources	Medium
Work to update perception of Eucalyptus as an undesirable non-native species given its importance to monarch overwintering in certain settings and train partner agency staff in the use of the species for monarch and wildlife habitat.	1 year	3-5 years		Factsheets and other materials on the role of eucalyptus in supporting overwintering	Number of handouts or other materials produced; Number of people reached		Medium
Broadly distribute new overwintering site map with the 3 core zones (core, shelter, and support) to management agencies and the public.	Immediate	5 + years		Better understanding of key conservation actions in each zone	Number of partners referencing or using to the zone map to plan/prioritize work	Xerces Society	Medium
Share relevant resources developed by Collaborative or partner agencies with County Agricultural Commissioners.	1 year	Ongoing		Agricultural commissioner's have access to information developed by partners and can share with constituents	Number of resources shared; Number of Ag. Commissioners researchers	County agricultural commissioners	Medium

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Develop templates for grazing leases that incorporate pollinator-friendly practices.	1 year	1 year	Identify existing leases or templates that can be used as a basis; Identify conditions to incorporate that are beneficial for pollinators; Education of ranchers	Pollinator-beneficial grazing lease templates	Number of groups templates are shared with; Number of times conditions from the templates are incorporated into new or existing lease agreements	UCCE; Livestock associations (Cattlemen's, Wool Growers, etc.); Private landowners; MJV; Xerces Society; Audubon Society	Medium
Develop and deliver trainings for ranchers on safety of milkweed for cattle, for incentive programs like EQIP and CSP that can support monarch conservation, and on nectar plants that support pollinators.	1 year	3-5 years	Identify people who can conduct trainings; Funding	Training materials (e.g., PowerPoint, 1-pagers, shareable resources, etc.); Workshops to share information; Education of ranchers	Number of trainings; Number of training materials developed; Number of participants (groups/ individuals) in trainings; number of landowners that enroll in incentive programs	University of California Cooperative Extension (UCCE); Livestock associations (Cattlemen's, Wool Growers, etc.); Private landowners; RCDs; Xerces Society	Medium
Work with communication experts to determine how to message science-based site management to help overcome local stumbling blocks to effective management	2-3 years	2-3 years	Funding	Core messages that can be used	Messages for various situations	Consultants	Medium
Share outcomes of Multi-agency Collaborative assessments with partners and the public.	Immediate	5 + years		Public and partners informed about Collaborative	Number of individuals and partners shared with	Members of public; Tribes; Other stakeholders	Medium

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Develop maps or other shared resources to help identify, then preserve/restore along corridors.	1 year	2-3 years	Research to identify corridors	Maps and geospatial data	Number of times map and products used	Researchers	Medium
Promote monarch and pollinator conservation in the incentive and easement programs administered by Multi-Agency collaborative partners.	1 year	2-3 years	Funding	Increase in monarch and pollinator conservation in incentive and easement programs and increased habitat.	Proportion of adopted incentive/easement programs that incorporate pollinator conservation	Agricultural producers; Private landowners	Medium
Provide public and agency outreach emphasizing Educate the public and agencies that monarch overwintering sites are protected by the California Coastal Commission as Environmentally Sensitive Habitat Areas (ESHA).	1 year	3-5 years	Identify people who can conduct trainings; Funding; List of overwintering property owners	Training materials (e.g., PowerPoint, 1-pagers, shareable resources, etc.)	Number of trainings; Number of training materials developed; Number of participants (groups/individuals) in trainings	Private landowners; RCDs; Xerces Society; Overwintering site land managers	Medium
Once the DPR PRESCRIBE database is completed (seeing the applied research section) conduct training and publicize the updated sensitive species data.	2-3 years	2-3 years	Incorporation of sensitive species data in PRESCRIBE database	Practitioners educated about newly available information	Number of trainings; Number of other outreach products		Medium



**TABLE A1-5: FUNDING**

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Develop forward contracts with native plant nurseries to enable a more consistent supply of seed mixes/plants for monarch conservation projects	2-3 years	3-5 years	Ability of state agencies to engage in forward contracting: Approval from legal staff	New contracting mechanism	Number of contracts developed		Near-term
Explore opportunities to continue and expand the ability of the WCB to fund monarch and pollinator conservation in California.	1 year	Ongoing	Funding availability via legislative allocation	Funding awarded to pollinator-focused restoration projects	Amount of funding awarded; Number of projects funded; Number of acres of restored		32
Develop a list of funding mechanisms that can support - long-term, multi-species monitoring - wildlife-friendly light conversions - research.	1 year	1 year		List of potential funding sources	List of potential funding sources	National Fish and Wildlife Foundation	28
Work to find funding to increase capacity for pollinator positions within partner agencies.	Ongoing	Ongoing	State/Federal funding availability	Increased capacity to work on pollinator habitat restoration, research, coordination, etc.; Funding allocated to pollinator grant programs and directly to partner agencies	Number of new pollinator focused positions created or sustained; Amount of funding allocated		26

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Develop a funding working group to explore how to leverage existing opportunities and support multi-phase projects.	1 year	Ongoing	Funding agencies meeting/ collaborating on a regular basis	Increased collaboration between funding agencies; Development of multi-agency funding priorities document; Leverage funding from multiple agencies to support larger/ longer projects	Number of multi-agency meetings; Number of multi-agency funded projects	National Fish and Wildlife Foundation	26
Explore alternative sources of funding such as a state license plate or pollinator stamps to generate long-term, sustainable funding.	1 year	2-3 years		Development of (or plans to develop) new funding mechanisms	Number of new funding sources developed; Amount of funding generated		25
Explore opportunities to expand monarch and pollinator conservation in new or existing public/ private partnerships and programs (e.g., incentive programs)	2-3 years	Ongoing	Identification of relevant partnerships and programs	Include monarch conservation actions in new or existing public/ private partnerships (e.g., habitat incentive programs, easements)	Number of programs that incorporate monarch conservation actions; Number of monarch conservation actions taken by program participants; Number of acres impacted		27

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Work with agency biologists and researchers to develop a proposal for submission to the climate adaptation center. Possible areas of study include: Phenological mismatch, Warming climates and how that impacts spring and fall migration, Impacts of drought on monarch populations, especially floral resources.	Immediate	3-5 years	N/A	Research direction identified and funding secured	Number of successful proposals	Researchers	23
Increase funding availability for monarch and pollinator conservation on rangelands.	1 year	2-3 years	Work with existing partners (e.g., WCB, USFWS Partners program) to expand opportunities	Ranchlands identified as priority areas in funding request for proposals	Number of RFPs that prioritize monarch conservation on rangelands; Number of range operations applying for funding; Number of projects implemented (acreage)	University of California Cooperative Extension; California Cattlemen's Association	22
Grow the NRCS RCPP and CA wildlife fund pool.	2-3 years	Ongoing	Funding availability; Identification of priority actions	Continued funding opportunity for agricultural operators	Number of operations enrolled in EQIP and RCPP; Number of acres of habitat created		19



**TABLE A1-6: COLLABORATION**

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Institute annual project check-ins to identify and share both successes and lessons learned.	1 year	Ongoing	This spreadsheet and the final report	Annual reports on group's progress	Number of annual check-ins; evidence that check-ins facilitate group making progress toward our priority goals		30
Participate in pollinator-focused working groups such as the CNPS/BLM CA Seed Strategy to help increase seed resource availability in CA.	1 year	Ongoing		Shared knowledge and development of new plant materials; Shared information; relationships established	Number of meetings attended; Number of staff attending meetings	California Native Plant Society (CNPS); Seed producers; Association of Official Seed Certifying Agencies (AOSCA)	28
Participate in 30x30 working group to help integrate pollinator conservation as a key focal area.	1 year	1 year		Pollinators are represented in 30x30 initiative	Number of partners participating in 30x30; Number of meeting attended	California Natural Resources Agency	25
Hold periodic meetings in overwintering sites to foster coordination and inspire champions of monarch conservation.	1 year	Ongoing	Facilitator/ coordinator; Funding for staff to travel to overwintering sites; Availability of local partners to provide information on overwintering site management	Enhanced understanding of specific sites and the factors they face as well as how the lessons can be applied to management of other sites; Increased awareness and understanding of OW site management and conservation value	Number of meetings; Number of participants in the annual meeting	Overwintering site managers; Xerces Society; Researchers	25

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Participate in the Monarch Overwintering Managers meetings co-facilitated by Xerces and USFWS.	1 year	Ongoing		Knowledge about overwintering management practices	Number of meetings attended; Number of staff attending meetings	Overwintering site managers; Various non-profits	24
Enhance partnerships with organizations outlined in the WAFWA plan	Immediate	Ongoing		Identification of shared goals and establishment of formal or informal partnerships with organizations; Identification of additional partners to work with --> expanded partnerships	Number of partnerships developed; Number of partners involved; Number of meetings with new partners	Organizations outlined in WAFWA plan; University of California Cooperative Extension; Livestock associations (Cattlemen's, Wool Growers, etc.); Private landowners	24
Participate in the Monarch Plant Materials working group co-facilitated by CDFW and Xerces as it works to expand the foci from early-season milkweeds to species such as nectar plants that provide much-needed resources during the spring and fall migration, and host plants that support other at-risk pollinator species.	1 year	Ongoing		Protocols in collection, seed processing, production, outplanting of novel species; Availability of novel species for habitat enhancement and restoration projects	Number of meetings attended; Number of staff attending meetings	Xerces Society; Heritage Growers; Other restoration practitioners; Researchers	23
Participate in other partnerships (e.g., sentinel landscapes with DoD, San Joaquin Valley Monarch Collaborative).	1 year	Ongoing		Work together on focal areas	Number of meetings; Number of participants in the annual meeting	Sentinel landscape partners	22

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Partner with relevant stakeholders including agricultural producers to develop Voluntary Local Programs or Safe Harbor Agreements (CDFW), Conservation Benefit Agreements (USFWS), or Conference Reports (NRCS) that provide take coverage for listed or candidate pollinator species.	Immediate	3-5 years		Inclusion of pollinator conservation measures and mitigations for impacts to listed or candidate species in Voluntary Local Programs and Conference Reports	Number of programs that encourage conservation/ impact mitigation for listed or candidate pollinator species; Amount of habitat conserved/created through these programs; Number of landowners mitigating impacts to listed/candidate pollinators	Relevant stakeholders	26
Coordinate with overwintering site owners with a focus on landowners adjacent to agency-owned properties.	1 year	3-5 years		Increased connection between overwintering site managers	Number of overwintering owners reached	Private landowners; Resource Conservation Districts; Xerces Society; Overwintering site land managers	22
Participate in pesticide-related working groups (e.g., DPR Sustainable Pest Management).	1 year	Ongoing		Shared information; Relationships established	Number of meetings attended; Number of staff attending meetings	CNPS; Seed producers; AOSCA	21
Include light pollution as an action item in the State Wildlife Action Plan	2-3 years	5 + years	Next major update of the SWAP	Sections of SWAP that address light pollution	Final text incorporated into SWAP	Dark Skies International; Researchers	20

Action	Time to initiate	Time to complete	Dependencies	Deliverables	Success metrics	Potential partners	Priority level
Participate in CDPR rulemaking processes (e.g., risk assessments)	1 year	Ongoing		Comment letters on applicable rulemakings	Number of rulemakings commented on; Number of agencies submitting comments		9
CCC continue to work to include monarchs in Local Coastal Plan updates	1 year	Ongoing	Cities updating their local coastal plans	Monarchs incorporated into local coastal plans; Increased monarch habitat protection in coastal areas	Number of local coastal plans that include protections for monarchs	Local governments	20