

# **National Fish and Wildlife Foundation**

## **Monarch Butterfly Business Plan**

**August 2016 – August 2026**

**(Revised March 2022)**

## **Purpose of a Business Plan**

The purpose of a NFWF business plan is to provide a concise blueprint of the anticipated strategies and resources required to achieve the desired conservation outcomes. The strategies discussed in this plan do not represent solely the Foundation's view of the actions necessary to achieve the identified conservation goals, but also reflect the majority view of federal, academic, and organizational experts consulted during plan development. This plan is not meant to duplicate ongoing efforts but rather to guide investments to areas where gaps might exist to support the efforts of the larger conservation community.

## **Acknowledgments**

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## **About NFWF**

The National Fish and Wildlife Foundation protects and restores our nation's wildlife and habitats. Chartered by Congress in 1984, NFWF directs public conservation dollars to the most pressing environmental needs and matches those investments with private contributions. NFWF works with government, nonprofit and corporate partners to find solutions to the most complex conservation challenges. Over the last three decades, NFWF has funded more than 5,000 organizations and committed more than \$6.8 billion to conservation projects. Learn more at [www.nfwf.org](http://www.nfwf.org).

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## Conservation Need

People throughout North America cherish monarch butterflies.<sup>1</sup> They value monarchs for their beauty and are fascinated by their life cycle, whether they are watching monarch caterpillars change into adult butterflies or contemplating the monarch's multigenerational, cross-continental migration. Unfortunately, monarch butterfly populations have declined significantly since the 1990s and the spectacle of monarch migration is at risk.

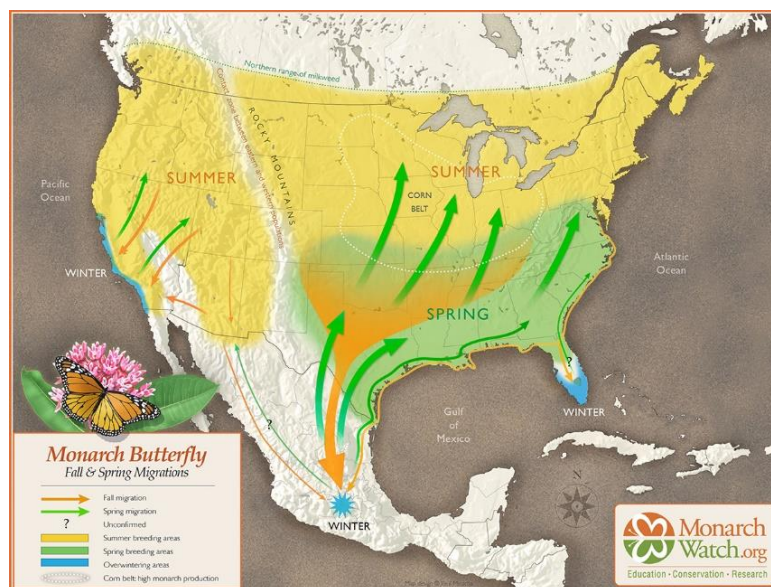
Monarch butterflies in North America primarily consist of two migratory populations, one east of the Rocky Mountains and one to the west (Figure 1). Although the two populations are unlikely to be distinct genetically, we treat them as separate for conservation purposes because trends in their numbers appear to be independent of one another and driven by different factors. Both migratory populations overwinter in relatively small areas, with eastern monarchs inhabiting high elevation fir forests in Central Mexico and western monarchs in clusters along California's coastal zone.<sup>2</sup> The breeding range for migratory monarch butterflies, however, expands over multiple generations to cover most of the conterminous United States and southern Canada. This business plan focuses on both the eastern and western migratory populations.

The eastern monarch population contains >95% of the continent's monarch butterflies. Over the past decade, the eastern population has declined by approximately 80% (Semmens et al. 2016). Population modelers have shown that in the absence of conservation efforts, eastern monarch numbers could decrease within the next 20 years to the point where they would be unable to rebound, so called "quasi-extinction" (Semmens et al. 2016).

In 2020, the western monarch population had declined by more than 99.9% from population estimates of 4.5 million in the 1980s. Volunteers counted fewer than 2,000 overwintering monarchs in 2020, which is well below the quasi-extinction threshold of 30,000 individuals. Surveys detected an encouraging rebound in late 2021, with preliminary efforts observing more than 50,000 butterflies on overwintering sites, but even with this increase, the population remains dangerously small and well below the size needed to be secure (Xerces 2021).

Conserving migratory species requires addressing the threats faced throughout the range and over the course of the journey, an approach often called "full life-cycle" conservation.<sup>3</sup> Monarch butterflies are no exception. Habitat is necessary on the wintering grounds, across the breeding range, and to fuel migration in spring and fall.<sup>4</sup>

Figure 1. Monarch migrations



Overwintering sites for monarch butterflies continue to be impacted by deforestation in Mexico and poor management, development, and drought in California.<sup>5</sup> Catastrophic weather events such as winter storms periodically kill large numbers of overwintering monarchs, and severe drought and extreme temperatures are considered important threats to monarch adults and larvae.<sup>6</sup>

On the breeding grounds and migratory flyways, habitat loss has resulted from the disappearance of milkweed and other nectar resources. Monarch butterfly larvae require milkweed to develop, and its loss from the landscape has been implicated in the reduction of monarch numbers. Milkweed can serve as a source of nectar for adult butterflies, but monarchs also feed on a number of other flowering species. In addition to milkweed, ideal habitats for monarch butterflies contain a diversity of flowering plants in bloom at any time monarchs are likely to be present, thus facilitating both breeding and migration. Milkweed (along with other nectar sources) has declined in the past two decades due to urban/suburban expansion, agricultural expansion into areas that once held milkweed, and adoption of herbicide-tolerant crops that have made it easier for farmers to eliminate weeds from their fields.<sup>7</sup> On the breeding grounds, there are many other potential threats to monarch butterflies (e.g., insecticides, diseases, predators), but their relative importance is difficult to assess.

## Background

In 2015, NFWF established the Monarch Butterfly and Pollinators Conservation Fund (Fund). Through seven grant cycles to date, the Fund has awarded approximately \$16.8 million to 109 projects that are necessary to conserve and recover the monarch butterfly and other at-risk native insect pollinators. Grantees have matched this investment with an additional \$27.8 million, for a total on-the-ground impact of more than \$44.6 million. As of 2021, this investment had provided support for:

- Restoration/enhancement of 336,000 acres
- Propagation of 931,100 native milkweed seedlings
- Collection of 2,500 pounds of native milkweed seeds
- Coordination of 1,570 workshops and meetings

NFWF's investments focus on two approaches: implementing habitat improvement and providing technical assistance to private landowners. Developing native plant materials is often interwoven into projects with efforts to collect milkweed seed and propagate milkweed seedlings. Past projects have also provided support for capacity building and outreach efforts, including the development of the Mid-America Monarch Conservation Strategy and the Western Monarch Conservation Plan (WAFWA 2019).

The investments NFWF has made in support of the 2016 Monarch Business Plan produced monarch habitat and built capacity that has catalyzed butterfly conservation. However, NFWF has been eager to understand how such investments translate into increased numbers of monarch butterflies. From 2019 through 2022, NFWF contracted the Monarch Joint Venture to monitor outcomes generated by Fund investments. This effort has resulted in a robust dataset about the presence of milkweed, nectar resources, and monarch eggs, larvae, and adults on sites improved by the Fund.

NFWF is updating its Monarch Butterfly Business Plan to reflect the latest advances in pollinator conservation, particularly in light of recent funding trends and the availability of new data and information to focus efforts and measure conservation impact. Importantly, this revised business plan uses these developments to set new partnership-based monarch conservation goals.

## Current Conservation Context

Efforts to conserve monarch butterflies occur throughout North America in each phase of the annual cycle: winter, breeding season, and spring and fall migration. Some of this work has been conducted for decades, with government agencies, non-profits, and committed individuals taking part. However, much of this work has been initiated in the past decade, due in part to the decline in monarch population numbers and a petition to list the species under the U.S. Endangered Species Act (ESA).<sup>8</sup> It is also due to the heightened attention that pollinators have received and the recognition that the conservation of monarch butterflies will aid other species, as made apparent in the National Strategy to Promote the Health of Honey Bees and Other Pollinators (2015).

In 2008, the Commission for Environmental Cooperation (CEC)<sup>9</sup> published a landmark document, the North American Monarch Conservation Plan (NAMCP). The plan summarized information pertaining to the conservation of monarch butterflies and established priorities for the species. The plan was innovative in its treatment of the actions needed within each of the three countries, and it sparked interest in monarch butterflies as a unifying conservation concern for North America. The Trilateral Committee<sup>10</sup> regularly references the plan and the Monarch Joint Venture (MJV), which was formed in 2008 and serves as the umbrella organization for much of the work in the United States, adopted the plan as its guiding framework. The MJV has 110 member organizations, including federal agencies and non-profits.<sup>11</sup> The MJV also funds on-the-ground conservation and research that is aligned with the NAMCP (from 2009–2018 totaling \$1.2 million in conservation projects) (W. Caldwell, personal communication, December 20, 2021).

In 2017, Wayne Thogmartin and colleagues published “Restoring Monarch Butterfly Habitat in the Midwestern US: ‘All hands on deck.’” This paper helped frame community-wide conservation goals for eastern monarchs, such as the goal of establishing 1.3 billion new milkweed stems with substantive contribution coming from agricultural areas. This paper also influenced state-level goals and the regional Mid-America Monarch Conservation Strategy (MAFWA 2018).

In December 2020, the U.S. Fish and Wildlife Service (USFWS) determined that listing the monarch butterfly under the ESA was warranted but precluded by higher priorities. The Service may propose listing in 2024, if it determines that listing is still warranted at that time. Listing implications have prompted some public–private conservation efforts. For example, the Rights-of-Way as Habitat Working Group collaborated with more than 40 organizations to develop the “Nationwide Candidate Conservation Agreement for Monarch Butterfly on Energy or Transportation Lands” (2020).

In Mexico, most efforts have focused on establishing (in several stages) the Monarch Butterfly Biosphere Reserve (MBBR) and its management. Land ownership in much of Mexico is communally based, making the designation of a protected area of little consequence without effective community engagement and concomitant local buy-in. This engagement is led by multiple federal agencies and NGOs. In 2000, a fund was created to compensate landowners for lost logging revenue in exchange for habitat protection. The USFWS and U.S. Forest Service have both contributed to conservation in and around the MBBR over the past decade (Shahani et al. 2015). As a result of these efforts, logging rates have decreased markedly, though not all communities have participated in conservation and logging still occurs.<sup>12</sup>

Finally, no description of the conservation landscape for monarch butterflies would be complete without mentioning the untold enthusiasm and dedication of thousands of volunteers across the three countries

and the massive efforts at restoration within urban/suburban areas. Community science monitoring has become a sophisticated endeavor with data being collected via multiple digital platforms. Individuals, communities, schools, nature centers, and corporations have all been planting native flower gardens to attract butterflies and support the monarch migration.<sup>13</sup> NFWF seeks to complement this work by expanding both outreach and habitat improvements in areas that have not received enough attention from funders, particularly on rural lands.

This business plan sets forth an ambitious 10-year budget, implemented through NFWF's Monarch Butterfly and Pollinators Conservation Fund, that will result in major contributions to the conservation of monarch butterflies. The Fund is recognized as one of the key sources of support for monarch work, and it is a partnership that currently includes: Bayer Crop Science; Scotts Miracle-Gro Foundation; Shell Oil Company; the U.S. Department of the Interior's U.S. Fish and Wildlife Service; and the U.S. Department of Agriculture's Natural Resources Conservation Service and U.S. Forest Service. The strategic focus of the business plan will make a meaningful contribution by focusing habitat efforts where they are most needed. Finally, the business plan will send an important signal to practitioners that sustained funding for monarch butterfly conservation is likely to remain through at least 2026.

# Conservation Outcomes

The vision of the Monarch Butterfly Business Plan is **to conserve North American monarch butterfly populations and their migrations by improving the quality, quantity, and connectivity of pollinator habitat**. Ultimately, this program seeks to increase the population of migratory monarch butterflies through investing in habitat improvements that increase native milkweed and nectar resources. By supporting restorations and enhancements that follow best management practices, NFWF will be changing habitats that currently lack adequate milkweed and other nectar plant species into functioning landscapes for monarch butterflies. The USFWS has developed Monarch Conservation Units to identify primary breeding ranges and migratory corridors throughout their eastern and western migratory extent. This business plan will target habitat creation and improvement of breeding habitat in the North Core and South Core Monarch Conservation Units for the eastern population, and the West Core Monarch Conservation Unit for the western population (Figure 2).

## Breeding and Nectaring Habitat

Milkweed species (*Asclepias spp.*) are the sole host plants for monarch butterfly reproduction. Monarch larvae feed exclusively on milkweed leaves while milkweed blooms provide nectar resources for adult butterflies. Reductions in breeding habitat availability has been cited as a principal driver of severe population declines (Pleasants 2017). Enhancing breeding and nectaring habitat availability and quality can enhance population resilience to severe disturbances and stressors, such as major storm events, drought, or heat waves. Planting a diverse suite of native milkweed and nectar plant species is also key in fostering healthy monarch populations and conserving migratory behavior. While monarchs can utilize non-native plant species, overreliance on these plants can negatively impact survival and fitness by leaving monarchs more susceptible to negative impacts, such as increased predation and higher parasite loads. Other impacts can include the loss of migratory behavior because the year-round availability of non-native milkweed can cause monarchs to breed continuously rather than make the journey to their overwintering grounds. Thoughtful approaches to the spatial orientation, species diversity, and bloom times of plants used for monarch habitat restoration are needed. NFWF will invest in increasing the availability of breeding habitat throughout the central flyway in both the North and South Core of the eastern population breeding range, and the West Core of the western population.

## Eastern Migratory Population

### North Core

Due to the multi-generational life history of monarchs, suitable breeding habitat is critical throughout the entirety of their northerly migration. Ample native nectar resources are equally vital in sustaining monarchs throughout the summer breeding season and during the almost 2,000-mile fall migration back to overwintering grounds in central Mexico. The Mid-America Monarch Conservation Strategy (MAFWA 2018) established a habitat goal to support an overwintering occupancy of 6 hectares in Mexico that will require an additional 1.3 billion milkweed stems in the North Core conservation unit by 2038 (Thogmartin et al. 2017). The 6-hectare occupancy goal was set forth by the Pollinator Health Task Force in 2015 to reduce probability of extinction for the eastern population (Semmens et al. 2016, Thogmartin

et al. 2017). **Through habitat restoration and enhancement, NFWF plans to contribute 344,000,000 milkweed stems (26%) towards this community goal by 2026. We anticipate these milkweed stems will support the production of 2.3 million fall migratory adult monarchs** and we intend to monitor monarch use and survival on NFWF-funded project sites. It is currently unknown how many of the fall migrants produced will successfully complete their journey to Mexico, but increasing the abundance of the breeding population is expected to ultimately improve population size in the overwintering grounds.

### **South Core**

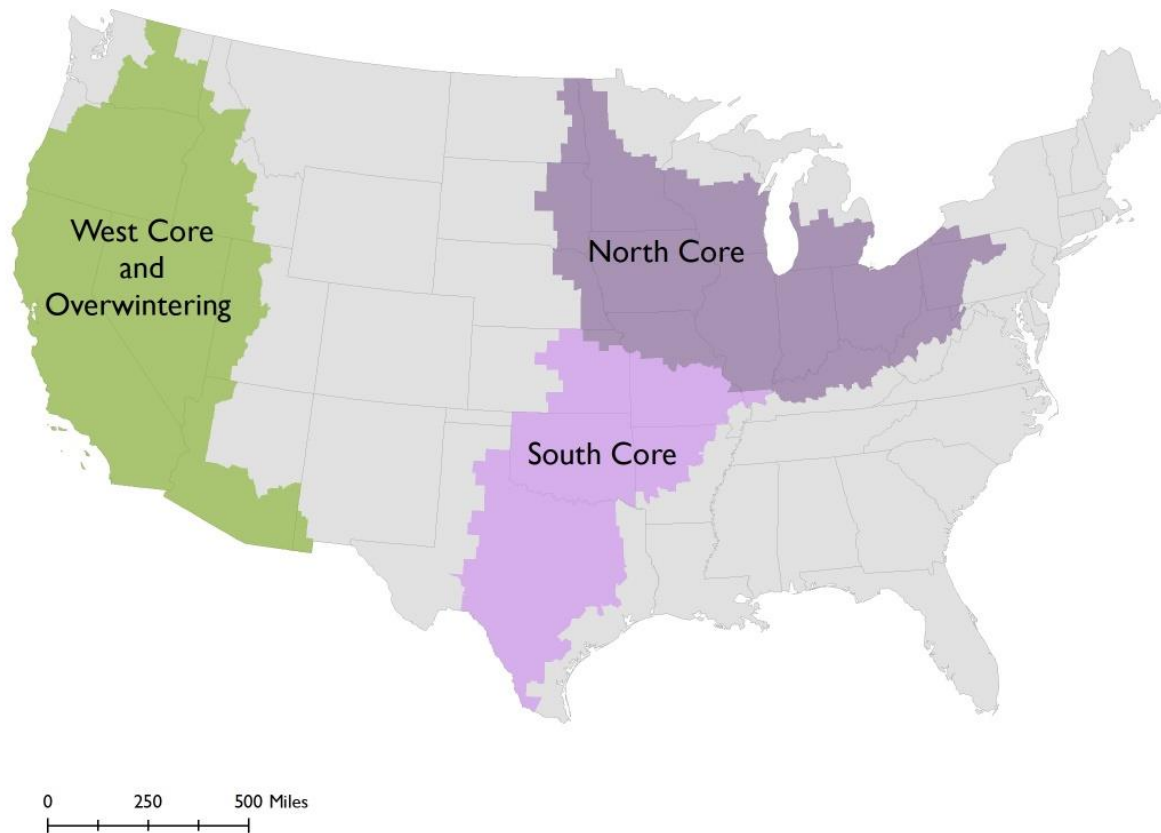
In the spring, the overwintering generation starts its migration from Mexico northward into portions of the southern United States to lay eggs that will produce the first generation of the year's eastern population. The subsequent generations depend on high recruitment from this first generation, so ample breeding habitat is critical, especially in years when unfavorable spring weather reduces breeding success. Unlike the North Core, there are no quantitative, community-driven goals for the South Core conservation unit. Nonetheless, **through our South Core habitat investments, NFWF plans to establish an additional 58 million milkweed stems.**

### **Western Migratory Population**

#### **West Core**

The western population faces similar conservation challenges as the eastern population, but the drier and hotter climate presents a suite of more frequent and extreme climatic effects such as drought and wildfire that can affect available breeding and overwintering habitat. The paucity of data on the western population highlights the uncertainties regarding key drivers of the observed population decline; however, extensive habitat conversion, destruction, and fragmentation are thought to play a significant role (Espeset et al. 2016, Pelton et al. 2019). Impacts of non-native milkweed have also been implicated in the loss of migratory behavior and may play a role in reducing population abundance (Satterfield et al. 2016). **NFWF plans to invest in habitat improvement projects to increase breeding habitat availability across 55,000 acres spanning seven states throughout the West Core.** It is critical that projects including milkweed are located at least 5 miles from the coastal overwintering grounds to promote migratory behavior. The success of western restoration and enhancement projects can be uncertain, particularly in water-limited regions; consequently, measures of expected milkweed density and nectar abundance are not well understood. However, NFWF efforts to expand monitoring into the West Core region are expected to provide more insight on milkweed and nectar resources for monarchs in the near term.





**Figure 2. Focal Geographies.** These three focal geographies are Monarch Conservation Units defined by the U.S. Fish and Wildlife Service and represent priority, but not exclusive, areas for NFWF investments in monarch conservation.

# Implementation Plan

There is broad agreement among monarch experts, conservation organizations, and government agencies about the types of interventions that benefit monarch butterflies. These interventions have not changed substantially since they were put forward in 2008 by the Commission for Environmental Cooperation (CEC). Each year the Monarch Joint Venture builds on the CEC effort by reviewing and updating priorities for monarch butterfly conservation in the United States. The results chain (Figure 3) does not add new priorities; rather it depicts the relationships and sequence of strategies-to-outcomes by which we intend to reach our goals. For the monarch butterfly population to rebound there needs to be a net gain in the quality, quantity, and connectivity of breeding and flyway habitat. To help achieve this, NFWF will restore and improve the management of existing habitat to support more butterflies.

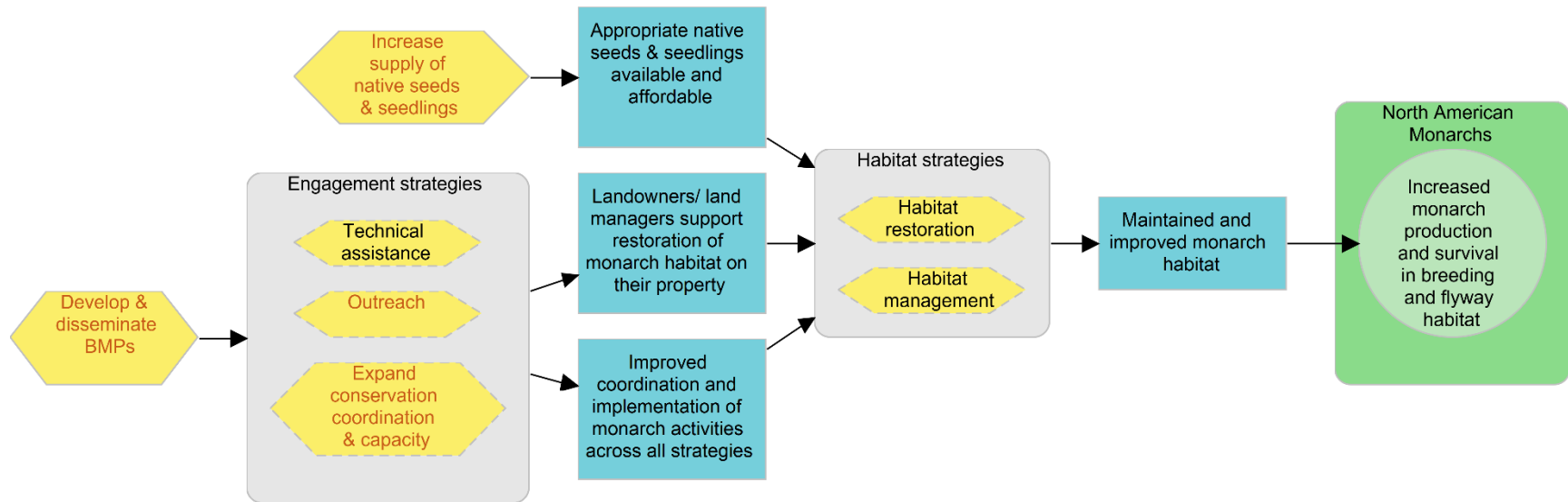
## **Strategy 1: Increase the quality, quantity, and connectivity of habitat<sup>14</sup>**

Habitat restoration and management in the eastern and western flyways is critical to creating the necessary network of habitat for monarch butterflies. Monarch butterflies are highly mobile and fly from one habitat patch to another across long distances. The acreage of habitat on a landscape and quality of plants growing within it are important to fuel butterflies during the breeding season and migration.

The strategies in this plan include but are not limited to the following lands:

- **Habitat within agricultural landscapes, including private working lands:** Agricultural lands are of particular interest because they occupy most of the central U.S. The marginal portions of the agricultural landscape alone, such as hedgerows, buffer strips, and drainage ditch edges, have huge potential because of their regularity of occurrence in both rangelands and croplands.<sup>15</sup>
- **Rights-of-way habitat:** Other non-residential lands that could benefit monarchs include habitats managed and retained for the movement of people, goods, and services (e.g., transmission/pipeline corridors, roadsides, and railroad rights-of-way). These lands can contribute significantly to the conservation of monarch butterflies because of their potential for north–south linkages.<sup>16</sup>
- **Lands managed by federal, state, and local governments and tribes:** A variety of lands managed by federal, state, and local governments and tribes will serve as key components for well-connected pollinator habitats.<sup>17</sup>

Within these lands, the plan’s strategies will be implemented to establish the high-quality, interconnected habitat necessary to support monarch breeding and migration.



**Figure 3. Results chain.** The results chain depicts the relationship of various strategies (yellow hexagons) within the business plan to each other, to the intermediate results (blue boxes), and ultimately to improvements in monarch butterfly production and survival (green oval). Although they have a role in monarch conservation, strategies in brown text are not anticipated to receive further NFWF investment in this updated plan.

### *1.1 Habitat Restoration<sup>18</sup>*

Habitat restoration is necessary throughout much of the monarch butterfly range to increase the amount of high-quality, connected monarch habitat. Habitat restoration involves the manipulation of an area with the goal of returning integrity to a site where native habitat has been lost or degraded. Examples may include, but are not limited to, planting native plant communities that likely existed previously on the site. For example, conservation plans developed with technical assistance would reference appropriate Natural Resources Conservation Service (NRCS) practice standards designed to establish wildlife habitat. Habitat restoration will also require long-term maintenance and conservation (e.g., easements) of the restored sites.

### *1.2 Habitat Management<sup>19</sup>*

For the purposes of this plan, habitat management/improvement refers to activities that involve the manipulation of an area to change (heighten, intensify, or improve) specific ecological function(s) or the vegetative successional stage of the project site to provide additional benefits to monarchs. Habitat under improved management includes implementation or modification of land management practices such as mowing, haying, grazing, prescribed burning, invasive plant species control, forest health management activities, and inter-seeding existing habitat with milkweeds and forbs. For example, conservation plans developed with technical assistance would reference appropriate NRCS practice standards designed to enhance wildlife habitat. In many cases, habitat management for monarch butterflies is more cost-effective than restoration in achieving quality habitat in crucial areas.

## **Strategy 2: Technical Assistance**

### *2.1 Technical Assistance<sup>20</sup>*

NFWF will invest in the distribution of existing best management practices (BMPs), particularly to practitioners engaged in large-scale land management and restoration in rural areas. Dissemination of these BMPs will require engagement with landowners, such as through traditional media and training workshops, demonstration sites, peer-to-peer communication, social media, or web forums. NFWF will support technical assistance providers who aid producers and other private landowners in the creation of management plans and applications to Farm Bill programs. Likewise, the dissemination of BMPs pertaining to non-working agricultural lands, such as those enrolled in USDA's Conservation Reserve Program, will be a priority.

In addition to agricultural producers, NFWF will support technical assistance to the managers of habitat on rights-of-way. This sector has significant potential given the large, distributed footprint across the landscape. Progress on this front is gaining traction regarding state and federal departments of transportation, railroads, and within the energy sector (e.g., transmission corridors and pipelines). However, there is a need for technical assistance to be more readily available for managers and practitioners.

Working collaboratively with Tribes, NFWF will continue to support monarch habitat work on tribal lands or areas primarily for conservation purposes. Often these are strategic in terms of their location and potential for sustaining habitat gains.

## Risk Assessment

Risk is an uncertain event or condition which, if it occurs, could negatively affect a plan’s outcomes. NFWF assessed seven risk categories to determine the extent to which they could impede progress towards business plan strategies and goals over the duration of this plan. Below, we identify primary risks to success and describe strategies that NFWF will implement to minimize or avoid those risks, where applicable (Table 1).

NFWF also considers how these risks might affect the long-term sustainability of the outcomes achieved (i.e., up to 10 years after closure of the business plan). In particular, funding for continued maintenance (e.g., removal of invasive plants) and monitoring can be challenging to raise. In addition, environmental risks may become more intense and have greater impacts on the sustainability of restoration projects.

To support long-term sustainability, NFWF engages in the following best practices:

- **RFP:** The Request for Proposals for the business plan includes language notifying applicants that projects may be subject to post-implementation monitoring by NFWF contractors.
- **Technical Assistance to Landowners to Build Sustained Support:** NFWF funds technical assistance to help private landowners engage in monarch conservation activities.
- **Long-term Maintenance:** NFWF-funded technical assistance helps enroll private landowners in Farm Bill conservation programs that include long-term maintenance requirements. Proposal reviewers consider the use of long-term contracts when rating projects.

**Table 1: Monarch Business Plan Risk Assessment.**

RISK CATEGORY	RATING	RISK DESCRIPTION	MITIGATING STRATEGIES
<b>Economic Risks</b>	Low	Landscape-scale monarch goals require participation of ag sector, but high commodity prices incentivize planting crops over monarch habitat and using pesticides. Development and urban sprawl contribute to habitat loss.	Technical assistance funding is being used to encourage ag projects that support pollinator habitat.
<b>Environmental Risks</b>	High	Weather greatly affects annual variation in monarch numbers and nectar resources. Climate change impacts the health and resilience of monarchs and the plants they rely on, including drought-intolerant trees at overwintering sites in California. Habitat degradation from the spread of invasive species reduces nectar resources for monarchs.	Monarch goals in the business plan take recent environmental trends into consideration. Funding for long-term monitoring can help assess whether restored monarch habitat is becoming degraded over time.
<b>Financial Risks</b>	Low	66% of the budget has been secured at this time. Grantee match is challenging for projects on federal lands (funded by federal dollars) and for large award amounts.	Business plan goals are based on anticipated levels of funds. NFWF can discuss providing some flexibility to grantees on match.

RISK CATEGORY	RATING	RISK DESCRIPTION	MITIGATING STRATEGIES
<b>Institutional Risks</b>	Low	Milkweed and other native plants can be hard to establish. Although technical assistance is available, NCRS staff can be unfamiliar with pollinator programs and how to qualify people for them.	NFWF will direct grant funds to organizations that provide technical assistance for private landowners.
<b>Regulatory Risks</b>	Low	In Dec 2020, the USFWS stated that listing monarchs under the ESA is warranted but precluded by higher priority listing actions. The potential for future listing could encourage greater participation by corporate ag partners that have been more hesitant to engage in the past.	NFWF funds technical assistance to encourage participation. There are many restoration opportunities across the landscape, so projects can focus on more interested landowners.
<b>Scientific Risks</b>	Moderate	Monarch threats and needed conservation actions are well known. However, estimating monarchs benefitting from restored habitat is challenging due to several confounding variables.	With NFWF support, the Monarch JV has developed a monitoring protocol that can be used to relate habitat and monarch outcomes at the landscape scale.
<b>Social Risks</b>	Low	Monarchs generally enjoy enthusiastic support from the public although some farmers see milkweed as something to eradicate.	There are many restoration opportunities across the landscape, so projects can focus on more interested landowners.

# Monitoring & Evaluating Performance

Performance of the Monarch Butterfly Business Plan will be assessed at both project and program scales. At the project scale, individual grants will be required to track relevant metrics from Table 2 for demonstrating progress on project activities and outcomes and to report out on them in their interim and final programmatic reports. At the program scale, broader habitat and species outcomes will be monitored through targeted grants, existing external data sources, and/or aggregated data from relevant grant projects, as appropriate. In 2018, NFWF conducted an internal assessment to evaluate early-stage program outcomes and support the continued success of the business plan’s implementation. NFWF may conduct another assessment in the future.

**Table 2. Metrics for measuring progress towards monarch conservation goals.**

Category	Outcomes	Metrics	Baseline (2016)	Goal (2026)	Data source(s)
North Core	Support the production of 2.3 million adult fall migrants annually through breeding habitat improvements	Estimated # of fall migratory adults produced	0	2,300,000	Grantees and monitoring contracts
	Add an additional 344 million milkweed stems to the North Core	# of milkweed stems	0	344,000,000	Grantees and monitoring contracts
# of acres of monarch habitat in North Core		0	330,000	Grantees	
South Core	Add an additional 58 million milkweed stems to the South Core	# of milkweed stems	0	58,000,000	Grantees and monitoring contracts
		# of acres of monarch habitat in South Core	0	160,000	Grantees
West Core	Establish or enhance 55,000 acres of breeding habitat	# of acres of monarch habitat in West Core	0	55,000	Grantees
All units	Increase native seed supply	Lbs of seed collected	0	4,100	Grantees
		# of milkweed seedlings propagated	0	1,650,000	Grantees

## Budget

This update comes five years into NFWF's Monarch Business Plan. The following budget shows the estimated costs to implement the business plan activities set forth in this updated document, including activities funded to date. NFWF will need to raise funds to meet these costs; therefore, this budget reflects NFWF's anticipated engagement over the business plan period of performance and it is *not* an annual or even cumulative commitment by NFWF to invest. This budget assumes that current activities funded by others will, at a minimum, continue.

BUDGET CATEGORY	YEARS 1-5	YEARS 6-10	TOTAL
<b>Strategy 1. Increase the Quality, Quantity, and Connectivity of Habitat</b>			
1.1 Habitat Management & Enhancement	\$4.4M	\$3.7M	\$8.1M
1.2 Habitat Restoration	\$7.5M	\$1.8M	\$9.3M
<b>Strategy 2. Technical Assistance, Outreach and Organizational Coordination</b>	\$5.5M	\$3.0M	\$8.5M
<b>Monitoring Conservation Outcomes</b>	\$0.4M	\$0.8M	\$1.2M
<b>TOTAL BUDGET</b>	<b>\$17.8M</b>	<b>\$9.3M</b>	<b>\$27.1M</b>



## Appendix A. Carbon Co-Benefits



Although NFWF business plans are aimed at achieving habitat and species goals, NFWF is committed to understanding the broader impacts of these investments in conservation. Specifically, NFWF has begun measuring other environmental and social co-benefits from business plan investments, including carbon benefits.

NFWF estimates the activities funded through the life of this business plan will yield a 30-year carbon benefit, either sequestered (i.e., removed from the atmosphere) or through avoided emissions, of 10.5 million metric tons CO<sub>2</sub> equivalent. NFWF produced this estimate using open-source datasets, various scientific reports, and IPCC guidelines. NFWF estimates the carbon benefit not to claim any formal carbon credits, but rather to demonstrate the co-benefits that accrue from our business plan's conservation investments for fish, wildlife, and habitats.

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## Endnotes

<sup>1</sup> For a valuation of citizens' willingness to pay for monarch conservation, see Diffendorfer *et al.* (2014), whose survey results indicate that U.S. households would support a \$4.78–\$6.64 billion one-time payment. Monarchs are very accessible, recognizable, and meaningful to people. See Gustafsson *et al.* (2015) for a discussion of the iconic status of monarch butterflies over time.

<sup>2</sup> This paragraph describes the distribution of migratory monarch butterflies in continental North America in broad terms. At a fine scale there are numerous exceptions. A small portion of western monarch butterflies winter outside California's coastal zone in northern Baja. There are tiny colonies in central and eastern California, Arizona, and Sonora. Likewise, although the vast majority of eastern monarch butterflies can be found wintering within the Monarch Butterfly Biosphere Reserve (MBBR), there are small colonies in the southern U.S. along the Gulf coast and the number of migrating monarchs that winter in south Florida (relative to a year-round population) and in the Caribbean is poorly understood.

In the past, the continental divide was thought to mark the boundary between the eastern and western populations, but this is not the case. The division between the populations appears to be much more fluid (Pyle 2015). Genetic analyses that have looked at portions of DNA (i.e., microsatellite markers) have not detected a difference between populations (Lyons *et al.* 2012; Zhan *et al.* 2014; Pierce *et al.* 2015). This implies some degree of interchange between east and west, which has also been strongly inferred from observational data. For example, Arizona lies west of the continental divide and there appears to be no geographical boundary determining where a tagged individual might turn up. Multiple specimens have been recovered from either California or Mexico that were tagged in Canelo, AZ (Morris *et al.* 2015). There are also a number of records of butterflies from the west that appear to be headed to Mexico or were actually seen crossing the border (Morris *et al.* 2015; Pyle 2015). It is unclear how regular this interchange between the two populations is.

For support of the statement that monarch butterfly population trends for the east and west appear to be driven by different factors, see: Frey & Schaffner (2004), Stevens & Frey (2010), Espeset *et al.* (2016).

<sup>3</sup> For most species the full life-cycle of migration equates to the individual migrant—i.e., the full life of an individual or that individual's life over the course of a year. However, because the monarch butterfly migration is multigenerational, with most individuals living only for a few weeks, the full life-cycle can be considered the predictable movement of monarchs across the continent each year despite the fact that this movement entails a series of butterfly generations. In this plan, the "full life-cycle" refers to this annual, multigenerational movement.

<sup>4</sup> For more on this topic, see: Oberhauser *et al.* (2016).

<sup>5</sup> Deforestation in Mexico has long been recognized as a threat to monarch butterflies (Brower *et al.* 2002; CEC 2008; Brower *et al.* 2012). There has been a great deal of effort to address this issue, yet some communities are still not part of the MBBR and elsewhere within the reserve illegal logging remains a serious concern (Navarrete *et al.* 2011; Vidal *et al.* 2013; Brower *et al.* 2016).

<sup>6</sup> For winter storms, see: Brower *et al.* (2004), Stevenson (2016), Taylor (2016). For drought, see: Brower *et al.* (2015). And for the effects of extreme temperatures, see: Batalden *et al.* (2007), Nail *et al.* (2015).

<sup>7</sup> CEC 2008; Pleasants and Oberhauser 2013; Flockhart *et al.* 2013; Stenoien *et al.* 2016; Pleasants 2015, 2017

<sup>8</sup> The petition was brought by the Center for Biological Diversity, Center for Food Safety, Xerces Society for Invertebrate Conservation, and Dr. Lincoln Brower on August 26, 2014.

<sup>9</sup> The CEC is an intergovernmental organization that was established by an agreement between Canada, Mexico, and the United States to "conserve, protect and enhance the North American environment in support of sustainable development for the benefit of present and future generations" (see: <http://www.cec.org/about/>).

<sup>10</sup> The Trilateral Committee for Wildlife and Ecosystem Conservation and Management facilitates cooperation between the wildlife conservation agencies of Canada, Mexico, and the United States. It was established in 1995 with the signing of a memorandum of understanding among the three countries.

<sup>11</sup> While drafting this business plan, the number of MJV member organizations increased steadily. This number was updated 11/12/2021. For a current list of MJV partners, go to: <http://monarchjointventure.org/about-us/partners>

<sup>12</sup> Discussed above ( ). Relevant references: Navarrete *et al.* (2011), Vidal *et al.* (2013), Brower *et al.* (2016).

<sup>13</sup> Oberhauser *et al.* (2015) provide an excellent overview of this topic. In their account they state: “no other single species has garnered such a wide following of personally involved educators, conservation advocates, and citizen scientist contributors.” (p. 13). See also Ries and Oberhauser (2015).

<sup>14</sup> This strategy falls within the MJV’s Goal 1 of “monarch habitat conservation, maintenance and enhancement” (see pp. 5–10 Caldwell *et al.* 2017).

<sup>15</sup> Habitat conservation on agricultural lands for monarch butterflies is Goal 1: Strategy 2: H-10 of the 2017 MJV plan. See p. 9 of Caldwell *et al.* (2017) for references and resources.

<sup>16</sup> Habitat conservation on rights-of-way for monarch butterflies is Goal 1: Strategy 2: H-8 of the 2017 MJV plan. See p. 8 of Caldwell *et al.* (2017) for references and resources.

<sup>17</sup> Habitat conservation on federal, state, and tribal lands for monarch butterflies is similar to Goal 1: Strategy 2 in the widest sense of the 2017 MJV plan, see pp. 7–10 of Caldwell *et al.* (2017). However, in this plan we are more interested in managing and enhancing as well as restoring habitat on these lands rather than promoting these habitat improvements, which appears to be the focus of the MJV plan.

<sup>18</sup> Habitat restoration is covered broadly by Goal 1: Strategy 2 of the 2017 MJV plan. See pp. 7–10 of Caldwell *et al.* (2017) for references and resources.

<sup>19</sup> Habitat management and enhancement are covered broadly by Goal 1: Strategy 2 of the 2017 MJV plan. See pp. 7–10 of Caldwell *et al.* (2017) for references and resources.

<sup>20</sup> Within this section of the plan we will be focused on the same areas as mentioned above under: habitat within agricultural lands, rights-of-way habitat, and federal, state, and tribal lands.