
SPRINGS

THE RACHEL CARSON CENTER REVIEW

Issue #2 | 2022

December




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MONARCHS OF THE GREAT PLAINS: PLANT POWER AND COLONIAL LEGACIES IN NORTH AMERICA

Sara M. Gregg

Springs
The Rachel Carson Center Review

2 • 2022

 This article is peer reviewed

Sara M. Gregg

Resplendent in shades of orange and black as they float along the breeze, migratory Monarch butterflies have ridden the gusts of transformation over the last centuries on the Great Plains. Known as “milkweed butterfly” because of its close relationship with its host plant, milkweed (*Asclepias* spp.),¹ the Monarch is perhaps North America’s most charismatic insect, and its delicate appearance belies a resilience and endurance that defies expectations. Indeed, the erratic demographic history of the migratory Monarch butterfly (*Danaus plexippus plexippus*) adds an unexpected insight to the legacy of European settlement of North America.



Milkweed (*Asclepias* spp.). © Sara M. Gregg. All rights reserved.

Twenty-first-century concerns about the survival of these butterflies take on a subtle irony in light of the boom in Monarch numbers during the early decades of Euro-American settlement on the Great Plains. Milkweed expanded steadily, propagated by seeds moving eastward upon prairie zephyrs, feeding ever-larger numbers of Monarch caterpillars. The herbaceous plants and their insect partners proliferated alongside US and Canadian settler-colonists and their industrial machines during the second half of the nineteenth century and into the twentieth century.

During the early decades of Euro-American settlement on the Great Plains, milkweed expanded steadily, feeding ever-larger numbers of Monarch caterpillars.

During the summer months, Monarchs feast on nectar plants, steadily accumulating the fat reserves that allow migrating adults to fly for a dozen hours straight, crossing up to a thousand kilometers without feeding.² In spite of their fragile appearance, these butterflies routinely travel up to four thousand kilometers from the northern Great Plains into the mountains of Michoacán, where in 1976 Indigenous citizen-scientists helped locate the butterflies' long-sought Mexican overwintering grounds.³ In the spring these adults head north from the coniferous forests of the Sierra Madre de Oriente. From there they shift to the west, toward the Trans-Mexican Volcanic Belt, where they spend the winter.⁴



Monarch butterfly (*Danaus plexippus plexippus*). © Sara M. Gregg. All rights reserved.

These charismatic butterflies have long attracted the attention of scientists, who chronicled Monarchs' feeding patterns and startling feats of strength, hypothesizing about butterfly migration as early as the 1850s.⁵ *The American Naturalist* published a description of the migration in 1877, with a correspondent noting a "continuous line of passing butterflies flying in a direct course towards the south, and at the height of thirty or forty feet above our heads."⁶ Other observers remark that during the fall they ride the prevailing winds, flying south in large numbers and launching upon "the first favorable wind to start upon their journey." They sailed along rapidly on southerly breezes, but "as soon as the wind changed its course all butterflies descended," so that it appeared to be "rain[ing] butterflies."⁷ Weather systems played a significant role in determining the timing of the migration—as prevailing winds and storm systems hold significant power to force a pause in their north-south movement.

In 1889, a report from Minnesota made note of the weathered adults who arrived in early spring, observing that "specimens looked bleached and had but few scales upon their wings . . . indicating a long flight." For the Monarch, survival is the upmost priority at this vulnerable moment, and these

butterflies “flew about rapidly, evidently in search of food, which at this time was scarce,” moving on as the flowers of wild cherries and plums ceased to blossom in one location and came into bloom further north.⁸

Yet milkweed thrives on disturbance, and it flourished as the steady westward movement of aspiring settler-colonists opened new ground for its airborne seeds to take root.

We now know that while the Monarch feeds on a wide range of flowers, its success is entangled with the fate of milkweed, a resilient, promiscuous perennial characterized by milky sap and elongate leaves.⁹ The butterflies’ intimate relationship with the milkweeds native to the Great Plains has long been clear to curious observers. Historical populations were in fact limited by access to milkweed, since the larval stage relies exclusively on this plant, which prior to the advent of settler-colonial agriculture comprised only a small share of prairie biomass. Yet milkweed thrives on disturbance, and it flourished as the steady westward movement of aspiring settler-colonists opened new ground for its airborne seeds to take root.



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In the summer, the various species of milkweed are capped by floppy tufts of flowers blooming in earthy tones of white, green, orange, and pink. As the long days of summer cool into autumn, the plant’s seed pods burst open, releasing tufted clumps of long white floss, each containing hundreds of seeds, that are carried to new terrain with each burst of wind.¹⁰ Wherever dislodged soil offers space for its airborne seeds to set root, milkweed seizes upon these openings to bypass the deep roots of the grasses and forbs that spread through rhizomes and subterranean networks.¹¹ While Indigenous farmers had cultivated intercropped gardens of plants with hoes, settler-colonists used imported agricultural methods and seeds and increased the area of land under cultivation. Each cut of the steel-tipped plow severed the root networks of acres of long-dominant prairie grasses, and into the edges of ever-expanding fields and farms crept this most opportunistic of the native prairie plants.¹²

Joel Asaph Allen described the quick pace of land-cover change in *The American Naturalist* in 1870: “No sooner is the sod inverted than scores of species of the original and most characteristic plants almost wholly disappear; in a few years the luxuriant wild grasses, overtopped with showy flowers . . . have become supplanted by the cultivated grasses and the cereals.”¹³

By replacing endemic diversity with imported row crops for sale to globalizing markets, the settler

farmers inadvertently opened new ground for the airborne milkweed seeds. These plants assumed an increasingly large role in the grassland mix along field edges, cuts for new wagon roads, and heavily grazed pastures.¹⁴

The multiplying milkweed nourished booming populations of Monarch caterpillars, which feed exclusively on the plant.¹⁵ During the spring and summer each female lays hundreds of eggs, solely on milkweed, and successful larvae mature into breeding adults in less than a month. Placing each egg on its own leaf, the breeding female ensures a jumping-off point for the caterpillar's ravenous consumption.¹⁶ Monarchs spawn several generations in rapid succession. Reproductive speed and choice of food plant are crucial to the butterfly's success, and the Monarch has been savvy in its choice of host plant. Milkweed is endowed with a powerful chemical defense, cardiac glycoside, a toxin that the Monarch ingests in its larval stage. This toxin courses through the plant and is absorbed into the tissues of the insect, making both caterpillars and adult butterflies distasteful and "virtually inedible" to predators.¹⁷



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Milkweed's expansive spread was cut short after World War II, as habitat loss and deforestation in the Monarchs' Mexican overwintering grounds, combined with postwar human inventions, wreaked havoc on the butterflies' once-soaring population.¹⁸ In the postwar era, cheap petrochemical inputs and farm consolidation once again transformed the landscapes of the Great Plains, and biodiversity declined under pressure from changing farm practices.¹⁹ This process has been magnified since the 1990s, as further technological innovations added novel weapons to the arsenal: genetically modified seeds that incentivize the use of herbicides and pesticides on plants bred to resist these chemical poisons, such as Monsanto's Roundup Ready crops. These practices represent a new generation of settler technologies that threaten the survival of a wide range of plants, as well as their insect and animal partners.²⁰

Monarchs are resilient, prolific breeders, and scientists still hold out hope that these latest threats to their survival represent setbacks, rather than the end of their dance on North American grasslands.

New genotypes and chemical formulations are only a part of the twenty-first-century challenge for the Monarch butterflies. Their success remains constrained by the risks inhering on the Great Plains, whose unreliable precipitation and extreme temperatures are now exacerbated by the erratic

weather caused by human-induced climate change. In fall 2012, a minute, drought-depleted contingent had arrived in Mexico only to face a devastatingly cold winter and a late, wet spring, and in 2013, the annual swarms of winged migrants from Mexico did not arrive on the Great Plains. An unusual confluence of events magnified the already monumental challenges of a thousand-mile migration up the continent, and fears intensified that the population was in imminent peril.²¹ But Monarchs are resilient, prolific breeders, and scientists still hold out hope that these latest threats to their survival represent setbacks, rather than the end of their dance on North American grasslands. The news in winter 2019 broadcast a hopeful 144 percent increase in overwintering acreage in Mexico, evidence of a promising breeding season, and a successful migration after a half-dozen years of desperate numbers.²²

This story of the migratory Monarch butterfly is emblematic of larger patterns on the Great Plains, and over the last two decades the uncertainty surrounding their survival has garnered significant public attention. Gardeners, conservation groups, and transportation officials are called upon to “Bring Back the Monarchs” by planting milkweed and other native plants in yards and along state and county highways.²³ Efforts at conservation are coordinated by nonprofit organizations and educators including Monarch Watch and Monarch Joint Venture, which cultivate networks committed to distributing seed, tagging migrant butterflies, highlighting the dangers of habitat loss and chemical overuse, and educating the public about native plants. The ecologists and entomologists who guide these organizations labor in concert with citizen-scientists, who share their passion for Monarchs and milkweed, bolstering the butterfly’s chance of survival.



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These groups seek to push policymakers into action: The Mexican government created the Monarch Butterfly Biosphere Reserve in 2008, protecting 56,259 hectares of overwintering grounds in the mountains of the state of Michoacán after sustained habitat destruction due to logging.²⁴ In 2014 the Xerces Society and other conservation groups petitioned the US Fish and Wildlife Service to list the Monarch butterfly as a threatened species under the 1973 Endangered Species Act, and the

Fish and Wildlife Service assigned “warranted-but-precluded” status to the Monarch in 2020. This acknowledged that the butterfly is deserving of protection, but due to other species taking priority, did not yet commit federal resources to preserve its habitat.²⁵

For the foreseeable future, Monarch Watch’s Chip Taylor recognizes, “habitat restoration will have to be funded by the private sector.”²⁶ Meanwhile, illegal logging continues to threaten the protection of some of the largest overwintering colonies in Michoacán, and in 2021 the International Union for the Conservation of Nature (IUCN) added the migratory Monarch to its “Red List,” noting, “The decision comes after decades of falling populations driven by losses in the plants they need as caterpillars and in the forests where adults spend the winter, combined with climate change.”²⁷ The situation has grown increasingly dire, but preserving habitat in Mexico and sowing new nectar plants in the United States and Canada may offer hope for the future.



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A central irony of the efforts to restore the insect’s habitat is that returning to the historic composition of prairie would likely not sustain the population of Monarchs who feed on milkweed from the Rocky Mountains to the Atlantic coast. Prairie restoration provides a path forward for the economy and ecology of the Great Plains, a means of reopening habitat and migratory corridors for grazing animals, and protections for endangered and threatened species, sustaining butterflies alongside other non-charismatic pollinators.²⁸ Replanting milkweed among other native grasses and forbs on damaged land would help return the Great Plains to a landscape that addresses the needs of other-than-human species alongside the diverse human communities in North America.²⁹

A systematic effort to convert agribusinesses to restored prairies would radically shift the distribution of species. One might expect that in recreated prairies, milkweed would comprise a larger proportion of biomass than in historical prairies, as all cultivated species would get an equal start. For the Monarch butterfly, the replacement of critical habitat may well ensure that these

iconic insects could secure the vital sustenance needed to fuel their travel from Mexico to the Northern Plains.³⁰

The relationship between the fragile Monarch butterfly and the humble milkweed provides an apt illustration of the unexpected consequences of human modifications of the North American grasslands.

There is much to learn from the larger patterns in this natural history. Land-cover changes associated with settler-colonial expansion in North America drove the reproductive success of milkweed and, in turn, the Monarch butterfly. While the interwoven life cycles of milkweed and Monarch momentarily flourished, the boom was followed by sharp declines as colonial legacies further transformed the ecosystems of the Plains. The relationship between the fragile Monarch butterfly and the humble milkweed provides an apt illustration of the unexpected consequences of human modifications of the North American grasslands.

The symbiotic coexistence of milkweed and Monarch butterflies yields insights into success and failure that could be mobilized as humans navigate climate crisis, especially as we confront the uncertain future of the prairie biome, and serves as a reminder that colonization relies on disruption. This partnership also gives momentum to what has not yet been lost: mutualism and the possibility of regeneration. Monarchs' fortunes are often shaped by circumstances thousands of miles away. These ebbs and flows will continue as climate cycles and human-induced landscape change shape the reproductive patterns of both plants and insects.

Notes

¹ *Asclepias* comes from the name of the Greek god of medicine, Asklepios. Indigenous and Western societies have derived a wide range of medicinal uses for the milkweed plant. See Kelly Kindscher, *Medicinal Wild Plants of the Prairie: An Ethnobotanical Guide* (Lawrence: University Press of Kansas, 1992), 54ff.

² Andrei Sourakov, "Monarch Butterfly," Featured Creatures, University of Florida Entomology and Nematology Department, last modified 2021, <https://entnemdept.ufl.edu/creatures/bfly/monarch.htm>.

³ Fred A. Urquhart, "Found at Last: The Monarch's Winter Home," *National Geographic*, August 1976, 160-173.

⁴ Sourakov, "Monarch Butterfly."

⁵ Renowned lepidopterist Lincoln Brower dated the first reference to Monarch migration to 1857, placing it in the Mississippi Valley and referencing a description by d'Urban of the butterflies appearing in the Mississippi Valley in "such vast numbers as to darken the air by the clouds of them." William S. M. D'Urban, "Description of Four Species of Canadian Butterflies," *The Canadian Naturalist and Geologist, and Proceedings of the Natural History Society of Montreal* 2 (1 November 1857): 349; cited in Lincoln P. Brower, "Understanding and Misunderstanding the Migration of the Monarch Butterfly (Nymphalidae) in North America: 1857-1995," *Journal of the Lepidopterists' Society* 49, no. 4 (1995): 304-385, p. 306.

⁶ Wm. Edwards, "A Flight of Butterflies," *The American Naturalist* 11, no. 4 (April 1877): 244.

⁷ Otto Lügger, "On the Migrations of the Milkweed Butterfly," *Proceedings of the Entomological Society of Washington* 1 (1890): 256-58, p. 257.

⁸ Lügger, "Migrations of the Milkweed Butterfly," 256; "The Milkweed Butterfly," *Kansas Farmer*, 3 May 1893, 10.

⁹ Recent scholarship stresses an unequal relationship between these two organisms, with at least one evolutionary biologist characterizing the relationship as a battle between plant and insect. Anurag Agrawal, *Monarchs and Milkweed: A Migrating Butterfly, a Poisonous Plant, and Their Remarkable Story of Coevolution* (Princeton: Princeton University Press, 2017), 21.

¹⁰ Kindscher, *Medicinal Wild Plants of the Prairie*, 54.

- ¹¹ While fire, flooding, grazing, and human-induced landscape change had a material impact on grasslands for millennia, the changes induced by agricultural machines uprooted millions of acres of prairie grasses—changing land cover at an unprecedented scale. Candace Savage, *Prairie: A Natural History* (2004; repr. Berkeley, CA: Greystone Books, 2011), 5.
- ¹² There are 72 catalogued species in North America, with 41 native to the “West.” “Milkweed Biology,” Western Monarch Milkweed Mapper, accessed 28 September 2022, <https://www.monarchmilkweedmapper.org/milkweed-biology/>.
- ¹³ Joel A. Allen, “The Flora of the Prairies,” *The American Naturalist* 4, no. 10 (December 1870): 577–585, p. 578; “Joel Asaph Allen,” in *National Cyclopædia of American Biography* (New York: James T. White & Company, 1893), 3:100.
- ¹⁴ John Thieret, *National Audubon Society Field Guide to North American Wildflowers, Eastern Region*, revised edition (New York: Alfred A. Knopf, 2001), 360. Original authors: William Niering and, Nancy Olmstead.
- ¹⁵ Scientists have attempted to gauge relative Monarch/milkweed populations by studying museum and herbarium collections, and these data have documented an increase that correlates with the increase in agriculture (as well as the movement of naturalists into the Great Plains). While the data on butterflies have been critiqued in other letters to *PNAS*, the consensus is that Boyle et al.’s analysis of milkweed trends is convincing. John H. Boyle, Harmony J. Dagleish, and Joshua R. Puzey, “Monarch Butterfly and Milkweed Declines Substantially Predate the Use of Genetically Modified Crops,” *Proceedings of the National Academy of Science (PNAS)* 116, no. 8 (5 February 2019): 3006–3011, pp. 3006–07.
- ¹⁶ Julia E. Rogers, “The Migration of the Monarch Butterfly,” *Country Life in America*, 1 August 1911, 48.
- ¹⁷ Amy McDermott, “To Fight Off Predators, Insects Evolved a Taste for Toxic Plants,” *Proceedings of the National Academy of Science of the United States of America*, 27 May 2022, <https://www.pnas.org/post/journal-club/fight-off-predators-insects-evolved-taste-toxic-plants>; Stephen Jones and Ruth Cushman, *The North American Prairie: A Guide to the Plants, Wildlife, and Natural History of the Prairie, Including Where to Hike and Camp* (Boston, MA: Houghton Mifflin Company, 2004), 169–70; Paul Opler and Amy Bartlett Wright (ill.), *A Field Guide to Western Butterflies*, 2nd ed. (Boston, MA: Houghton Mifflin Company, 1999), 369–70.
- ¹⁸ Anurag Agrawal, “Advances in Understanding the Long-Term Population Decline of Monarch Butterflies,” *Proceedings of the National Academy of Science* 116, no. 17 (23 April 2019): 8093–95; Boyle et al., “Monarch Butterfly and Milkweed Declines,” 3006–11.
- ¹⁹ Brower, “Understanding and Misunderstanding the Migration of the Monarch Butterfly,” 304–85.
- ²⁰ “The native population . . . has shrunk by between 22% and 72% over the past decade.” IUCN Press Release, “Migratory Monarch Butterfly Now Endangered—IUCN Red List,” 21 July 2021, <https://www.iucn.org/press-release/202207/migratory-monarch-butterfly-now-endangered-iucn-red-list>.
- ²¹ Jim Robbins, “The Year the Monarch Didn’t Appear,” *New York Times*, 22 November 2013, <https://www.nytimes.com/2013/11/24/sunday-review/the-year-the-monarch-didnt-appear.html>; Verlyn Klinkenborg, “Monarchs Fight for their Lives,” *New York Times*, 12 October 2013, <https://www.nytimes.com/2013/10/13/opinion/sunday/monarchs-fight-for-their-lives.html>.
- ²² Christopher Sherman, “Monarch Population Up 144 Pct at Mexico Wintering Grounds,” *The Associated Press*, 30 January 2019, <https://apnews.com/article/217a8d01ef384fa3847fd63baa96c201>.
- ²³ Some policymakers are urging farmers to convert the soy that was sold as a miracle crop to the United States for livestock feed in the postwar era—but which is under increasing competition from South America and hampered by restrictive Chinese tariffs on US goods—to milkweed and other native plants. “Hold the Soy, Save the Pollinators,” *Makewayformonarchs.org*, accessed 12 January 2019, <https://makewayformonarchs.org/i/archives/2917>; Robbins, “The Year the Monarch Didn’t Appear.”
- ²⁴ “Monarch Butterfly Biosphere Reserve,” UNESCO World Heritage Convention, accessed 10 November 2022, <https://whc.unesco.org/en/list/1290/>.
- ²⁵ “Petition to Protect the Monarch Butterfly (*Danaus Plexippus Plexippus*) Under the Endangered Species Act,” submitted 26 August 2014, https://xerces.org/sites/default/files/2018-07/14-058_01_monarch-esa-petition.pdf.
- ²⁶ “US Fish and Wildlife Service Finds Endangered Species Act Listing for Monarch Butterfly Warranted but Precluded,” US Fish and Wildlife Service Press Release, 15 December 2020, https://www.fws.gov/press-release/2020-12/endangered-species-act-listing-monarch-butterfly-warranted-precluded?ref=u.s.-fish-and-wildlife-service-finds-endangered-species-act-listing-for-&_ID=36817.

²⁶ Chip Taylor, "ESA Listing Decision for the Monarch," 15 December 2020, <https://monarchwatch.org/blog/2020/12/15/esa-listing-decision-for-the-monarch/>.

²⁷ "Migratory Monarch Butterfly Now Endangered—IUCN Red List," ICUN Press Release, 21 July 2021, <https://www.iucn.org/press-release/202207/migratory-monarch-butterfly-now-endangered-iucn-red-list>; Catrin Einhorn, "Monarch Butterflies are Endangered, Leading Wildlife Monitor Says," *New York Times*, 21 July 2022, <https://www.nytimes.com/2022/07/21/climate/monarch-butterflies-endangered-iucn.html?smid=url-share>.

²⁸ Many policy proposals focus on rebuilding the diverse ecosystems of the Great Plains and prairie province, dating back to many Indigenous nations' calls for Land Back (long before the current language became common), and resurging with Deborah and Frank Popper's 1980s call for a "Buffalo Commons."

²⁹ "Grassland Ecosystems," Bill Moyers Reports: Earth on Edge, <https://www.pbs.org/earthonedge/ecosystems/grasslands.html>; World Wildlife Fund, *Plowprint Annual Report 2016*, accessed 6 December 2022, http://assets.worldwildlife.org/publications/946/files/original/plowprint_AnnualReport_2016_GenInfo_FINAL_112016.pdf?1479923301.

³⁰ Sourakov, "Monarch Butterfly."



Sara M. Gregg is an associate professor of history at Indiana University-Bloomington. Her work focuses on environmental change, agricultural history, and land policy, and her current project, *Little Piece of Earth: The Hidden History of Homesteading on the Great Plains* examines the process of state formation in the US West from the first years in the contact zone through the several Homestead Acts and to the present. She was a Carson Fellow from May to August 2017.



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Cite this article

Gregg, Sara M. "Monarchs of the Great Plains: Plant Power and Colonial Legacies in North America." *Springs: The Rachel Carson Center Review*, no. 2 (December 2022). <https://doi.org/10.5282/rcc-springs-2864>.

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ISSN 2751-9317

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