



The Monarch Mission

Empowering Students to Improve Habitat for Monarchs

A Next Generation Science Standards–based curriculum K-12



LEGO Community Fund U.S.





National Wildlife Federation

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The mission of the **National Wildlife Federation** is to inspire Americans to protect wildlife and natural resources for our children's future. The National Wildlife Federation has been a leader in developing high quality educational programming focused on the study and observation of nature, earth systems and wildlife to advance science learning for nearly 50 years. Combined, our K-12 programs reach 8,300 schools, approximately five million students and thousands of educators every year. For more about the National Wildlife Federation visit our website at www.nwf.org



The LEGO Community Fund U.S. (LCFUS) mission is to inspire and develop the builders of tomorrow to reach their potential by supporting programs benefitting children 0-14, primarily in the areas of learning, creativity or creative problem solving. We will support programs in the U.S. communities where the LEGO Group operates, and will give preference to programs benefitting disadvantaged children.

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Introduction: For many of us, one of our fondest memories of elementary school is observing monarch butterflies in the classroom and learning about metamorphosis as these remarkable creatures transformed from caterpillars to butterflies right in front of our eyes. As educators, many of you have probably used the monarch butterfly to teach about life cycles and migration. But this iconic species is in trouble and like many of our pollinator species is in decline.



These brilliant orange and black butterflies are among the most easily recognizable of the butterfly species. Their migration takes them as far north as Canada and, during the winter months, as far south as Mexico City. A single monarch can travel hundreds to thousands of miles. Monarchs are truly spectacular migrants, because the butterflies know the correct direction to migrate even though they have never made the journey before. They follow an internal "compass" that points them in the right direction each spring and fall. The monarch migration is one of the greatest natural phenomena in the insect world.

But it is this migration and the habitat the monarch depends upon during this journey that has resulted in the species decline. It was in 2014, when biologists and the US Fish and Wildlife Service became concerned about the monarch butterfly's population numbers. According to scientists, the continent's monarch population has declined by more than 80 percent from its average during the past two decades—and by more than 90 percent from its peak of nearly one billion butterflies in the mid-1990s.

Why is the Monarch Butterfly in Decline?

The U.S. Fish and Wildlife Service is currently studying the status of the species to determine if it should be listed as a threatened species under the Endangered Species Act. The reason for the precipitous decline is primarily due to the loss of the monarch's exclusive larval host plant and a critical food source – native milkweed. These plants have been eradicated and/or severely degraded in many areas across the U.S. due to the overuse of pesticides by commercial agriculture and conventional gardening practices in suburban and urban areas. The accelerated conversion of the continent's native short and tall grass prairie habitat to crop production has had an adverse impact on the monarch, and climate change has intensified weather events which may also be impacting their populations. It is estimated that one million acres of milkweed must be planted annually simply to keep pace with new losses. Creating all of the habitat that monarchs need will require a massive habitat restoration program.

What is the National Wildlife Federation and our Partners Doing to Help?

The National Wildlife Federation (NWF) recognizes the increased need for native milkweed to restore monarch habitat across large landscapes, suburban and urban gardens. Because, the lack of native milkweed is a limiting factor for the monarch butterfly, localized efforts to increase the supply of native milkweed is critical. This is especially important in Texas where the butterflies make their first stop after overwintering in Mexico before starting the annual migration north. Without sufficient habitat and milkweed in this region, the migration of the monarch stops. On a national level, NWF and U.S. Fish and Wildlife Service and many other partners have joined forces to help protect the monarch by working to bring back native milkweed and nectar producing plants that the species rely upon for breeding and feeding along its migratory route.



How Can Schools Help Monarch Butterflies?

As monarchs lose more and more habitat on agricultural lands, backyards have become increasingly important. As part of a larger effort to protect pollinators, NWF and the U.S. Fish and Wildlife Service recently signed an agreement, calling on citizens to help monarchs by cultivating milkweed and native nectar plants. With a long history of creating habitat for wildlife, National Wildlife

Federation believes that individuals, schools and whole communities can play a key role in helping monarchs recover.

Studying pollinators and the monarch butterfly gives students the opportunity to become engaged in and empowered to help solve a current and tangible ‘real-life’ environmental problem. The monarch butterfly is a species that students can have a direct positive impact on; a species they see in their schoolyards, backyards and at their local parks. The study of the monarch butterfly also lends itself beautifully to project-based learning. Students learn the importance of pollinators, develop plans, and implement effective solutions—such as creating monarch gardens with native nectar and milkweed (host) plants—that can make a concrete difference for the species.

Here’s how your schools can play a role in this nationwide monarch-recovery effort:

Create a NWF Schoolyard Habitat® NWF’s Schoolyard Habitat™ Program

(<http://www.nwf.org/Garden-For-wildlife/Create/Schoolyards.aspx>) now with 5,000 participating schools, is the single largest school garden program in America. It supports school and educator efforts to develop wildlife and ecosystem education programs directly on the school grounds and provides children with opportunities to learn in outdoor classrooms. Schools can also participate in **NWF’s Eco-schools USA program** and explore the Schoolyard Habitat pathway earning additional recognition and awards for your work. (www.eco-schoolsusa.org)

Plant milkweeds native to your region. Because they coevolved with your region's wildlife, native milkweeds are best. Sources of native milkweeds include Monarch Watch's Milkweed Market and the Xerces Society's Milkweed Seed Finder.

Cultivate native nectar plants. Nectar sources are especially important during spring and fall when monarchs migrate and need to fuel their flights, which can reach 2,000 miles during fall. Sources for native nectar plants include the Lady Bird Johnson Wildflower Center's Native Plant Database and regional planting guides published by the Pollinator Partnership.

Avoid pesticides use. In particular, steer clear of systemic insecticides such as neonicotinoids. These are taken up by plants' vascular systems, leaving caterpillars and butterflies that feed on leaves, nectar and pollen exposed to the poison long after it has been applied. A new study provides evidence that milkweed leaves treated with one neonicotinoid, Imidacloprid, kill monarch caterpillars that eat them.

Get your students involved in citizen science (see page the appendix, E-4). Biologists need volunteers to help study monarchs and students are great scientists. Programs such as Monarch Watch, the Monarch Larva Monitoring Project, and Journey North are great programs to involve your students in real science and support in helping monarchs.

About Monarch Mission

The lessons and activities that are part of ***The Monarch Mission, Empowering Students to Improve Monarch Habitat*** were created to complement your NWF Eco-Schools USA and Schoolyard Habitat® work and to accompany the construction of your school's Monarch Recovery Gardens and monarch observations.

The curriculum is only one component to the overall experience. The Monarch Recovery Gardens project is not a short-term learning project. It is a long-term learning experience that will allow students to:

- 1) Increase the available habitat needs of the monarch, subsequently leading to an increase in monarch numbers,
- 2) Provide a variety of field experiences for students, allowing them to apply new learning and practice critical science, engineering and 21st century skills, and
- 3) Build awareness in the community about a national environmental issue, while providing local solutions that can help bring them together, resulting in positive impacts for pollinator species, specifically the monarch butterfly.

Each of these lessons and activities were designed starting with the Next Generation Science Standards (NGSS) standards for the following grade bands, K-2, 3-5, 6-8 and 9-12.

As lessons and activities are being developed from the NGSS we are focusing on three key components,

- **Project-Based Learning:** using Monarch Recovery Gardens as the focus for place- and project-based, learning experiences.
- **Green STEM:** Using the natural world as the lens in which to integrate:
 - science content,
 - technology via web-based applications and online digital publishing tools
 - engineering to create models, to demonstrate change over time and to solve design challenges to creating sustainable monarch habitat, and
 - Math to develop equations, measure plant growth, project progress, change over time and the rate of population growth/decline.
- **Interdisciplinary Instruction:** a scientifically literate student is able to communicate about topics in science and understand the historical value or nature of an issue and to use art to drive creativity and innovation.





Introduction to Citizen Science

What is Citizen Science?

Citizen Science is the collection and analysis of data relating to the natural world by members of the general public, typically as part of a collaborative project with professional scientists.

Goals and Objectives in the Classroom

The goal of Citizen Science in the classroom is to engage the student to not only learn about science but to be the scientist. Through discovering new things and increasing their own knowledge of the world students understand that science is not just memorizing a set of facts. By participating in Citizen Science they are now empowered to contribute to the ongoing process.

Students will make use of a number of skills such as collecting and analyzing data, interpreting results, making new discoveries, and developing and solving complex problems. According to the National Science Foundation, the constructs of citizen science are knowledge, engagement, skills, attitudes and behaviors. This creates a new science learning environment for students in the classroom.

Validity and Success

Citizen scientists collecting and reporting data to Monarch Butterfly projects provide information that contributes to the successful conservation of monarchs and their threatened migratory phenomenon.

For elementary grade level students Journey North's Monarch Butterfly Migration Project is a great place to start. According to its creators Journey North is "a global study of wildlife migration and seasonal change." Most students are familiar with this specie and the project is easy to participate in. With the appropriate building blocks even kindergartners can ask questions about data-another skill critical to building a scientific frame of mind. Students track the migration of the monarchs and learn about animal behavior and adaptations as well as the life cycle of the monarch butterfly representing key topics in life science. The project addresses content objectives through inquiry perspective which provides students with a way to build scientific skills and habits of mind.

One school in Brookshire, TX has taken their Citizen Science participation to new heights. With a new schoolyard Monarch Waystation garden in place they decided to embark on a sustained program where the students would be part of a world community. They would learn about science and conservation while helping the monarch population in their annual migration. They followed the suggested lessons from the Journey North website and shared their sightings of adult monarchs, eggs, chrysalides and caterpillars. Their students also participated in the Symbolic Migration and the school was plotted on the map of participating schools. One key element of their sustained inquiry was the Q/A with Dr. Karen Oberhauser where they learned important lessons about conservation and citizenship.

A more advanced Citizen Science project suitable for secondary grade level students is the Monarch Larval Monitoring Project (MLMP). The MLMP is a program in which volunteer citizen scientists collect and report real scientific data on monarch egg and larval distribution and abundance from their monarch breeding habitat(s).

The project involves youth and adult volunteers from across the United States and Canada in monarch research. It was developed in 1997 by researchers at the University of Minnesota. Students can begin the project by viewing the online training video series and the instructions provided on the activity datasheets.

Citizen Science helps students to understand that science is a way of thinking about the world that involves observing, questioning, analyzing, revising and collaborating. It exposes students to learning opportunities relevant to the real world and allows integration of inquiry into the teaching of content. Children learn science by actually doing science.



National Wildlife Federation, Journey North and the Monarch Larval Monitoring Project are partners of the Monarch Joint Venture (MJV). The (MJV) is “a partnership of federal and state agencies, non-governmental organizations, and academic programs that are working together to support and coordinate efforts to protect the monarch migration across the lower 48 United States”. The MJV is committed to a science-based approach to monarch conservation work, guided by the North American Monarch Conservation Plan (2008).

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