

MONARCHS AND MILKWEED: UNDERSTANDING



DESERT BOTANICAL GARDEN &
USA NATIONAL PHENOLOGY NETWORK

THEIR RELATIONSHIP



A project of the USA-NPN

Grade Levels

9–12 Grade

Overview

Students will learn how to identify monarchs and learn about select phenophases while also understanding the ecological relationship they have with milkweed plants. They will be able to explore the impact milkweed phenophases have on the Monarch populations and why it's vital to understand the basic phenology between the two species in order to successfully monitor, observe, and record data on monarch butterflies and milkweed plants. Students will have the opportunity to see real observational data visualized through [USANPN Visualization Tool](#) to show the significance that monitoring contributes when trying to understand phenological changes in monarch populations caused by a number of factors.

Background

Phenology is the study of the timing of life cycle events, done mostly through personal observations. Phenophase is the observable stage or phase in the annual life cycle of a plant or animal that can be defined by a start and end point.

Real-world Connection

Monarch populations have been declining in recent years, with a major cause being habitat loss. Volunteer observers can help scientists learn more by submitting their observations through citizen science programs such as *Nature's Notebook*.

Citizen Science Connection

This activity can be completed with or without a *Nature's Notebook* account. Completing it with an account can provide an opportunity to teach students about the importance of citizen science, and how their contributions help us to better understand the world around us. Learn more about the Desert Refuge research campaign at <https://www.usanpn.org/nn/campaigns/DesertRefuge>

Learning Objectives

- Understand basic monarch and milkweed anatomy and how to identify them.
- Learn about the phenological changes that occur that affect Monarchs' relationship of dependency on milkweed plants.
- Understand that the timing of phenological events can vary depending on climate and ecological principles affecting the species

Next Generation Science Standards

LS: Life Science

Grades 6–8

MS-LS2-2

Construct an explanation that predicts patterns of interactions among organisms along multiple ecosystems.

MS-LS2-2-5

Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

Grades 9–12

HS-LS2-2

Design, evaluate, and refine a solution for reducing the impacts of human activities on the environment and biodiversity.

HS-LS2-7

Use mathematical representations to support explanations of factors affecting biodiversity and populations in ecosystems at different scales.

Materials

- Sufficient copies of the activity pages for students to complete
- Pen or Pencil
- Optional: laptops with internet access

Engage

Prior to activity, explain to students the definition of phenology and phenophases. Proceed to organize students into small groups (2 or 3 students per group, maximum). Make students complete pages 6 & 7 of this activity. After each group has finished (about 15 minutes), ask students to share one question out of the three from each group. Have a discussion with your students about the importance of volunteer work within the field of phenology.

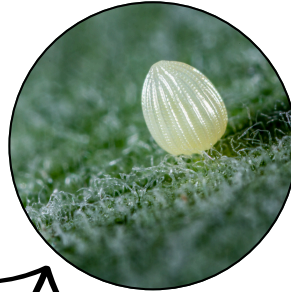
Evaluate

This activity is designed to be open-ended with no right or wrong answers. Our suggestion is for students to be evaluated based on participation, engagement, and critical thinking skills when answering questions.

MONARCH BUTTERFLY DESCRIPTION AND PHENOPHASES

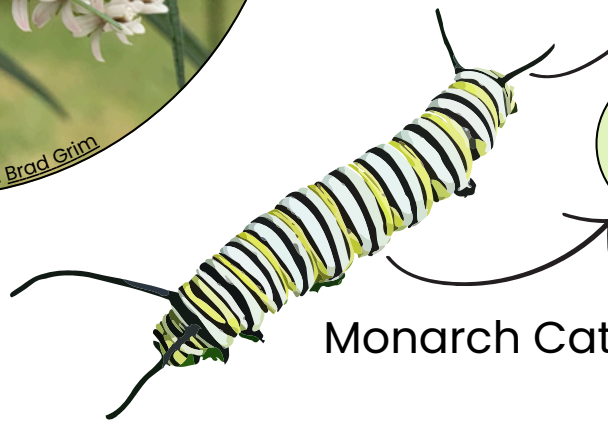


Arizona Milkweed
Asclepias angustifolia



Monarch eggs are small, **oval**, and **cream-colored**, with tiny ridges or bumps! They're laid by the female butterfly **underneath** milkweed leaves.

Check for **two groups of thin filaments**, one set in the front and one in the back.



Patterned in stripes of **yellow, white, and black**, which usually seem to be about the same width.

Monarch Caterpillar

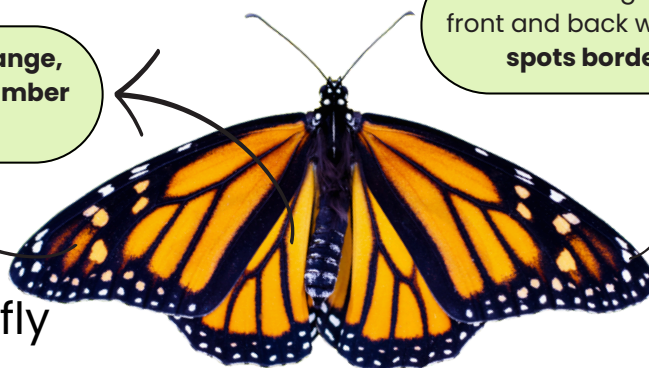


Jade-green with gold spots, hangs delicately from a leaf or twig. As the butterfly develops inside, the outer casing becomes **translucent** and you can start to see the wing patterns

Monarch Chrysalis

The hindwings are a **lighter shade of orange**, while the forewings are primarily a **rich amber color**.

When the wings are shut, both the front and back wings display **white spots bordered by black**.



Adult Monarch Butterfly
Danaus plexippus

UNDERSTANDING THE PHENOLOGY OF THE MONARCH BUTTERFLY

Name: _____

Class: _____

Date: _____

Phenology is the study of the timing and cyclical patterns of events in the natural world, particularly those related to the annual life cycles of plants, animals, and other living things. A phenophase is an observable stage or phase in the annual life cycle of a plant or animal that can be defined by a start and end point.

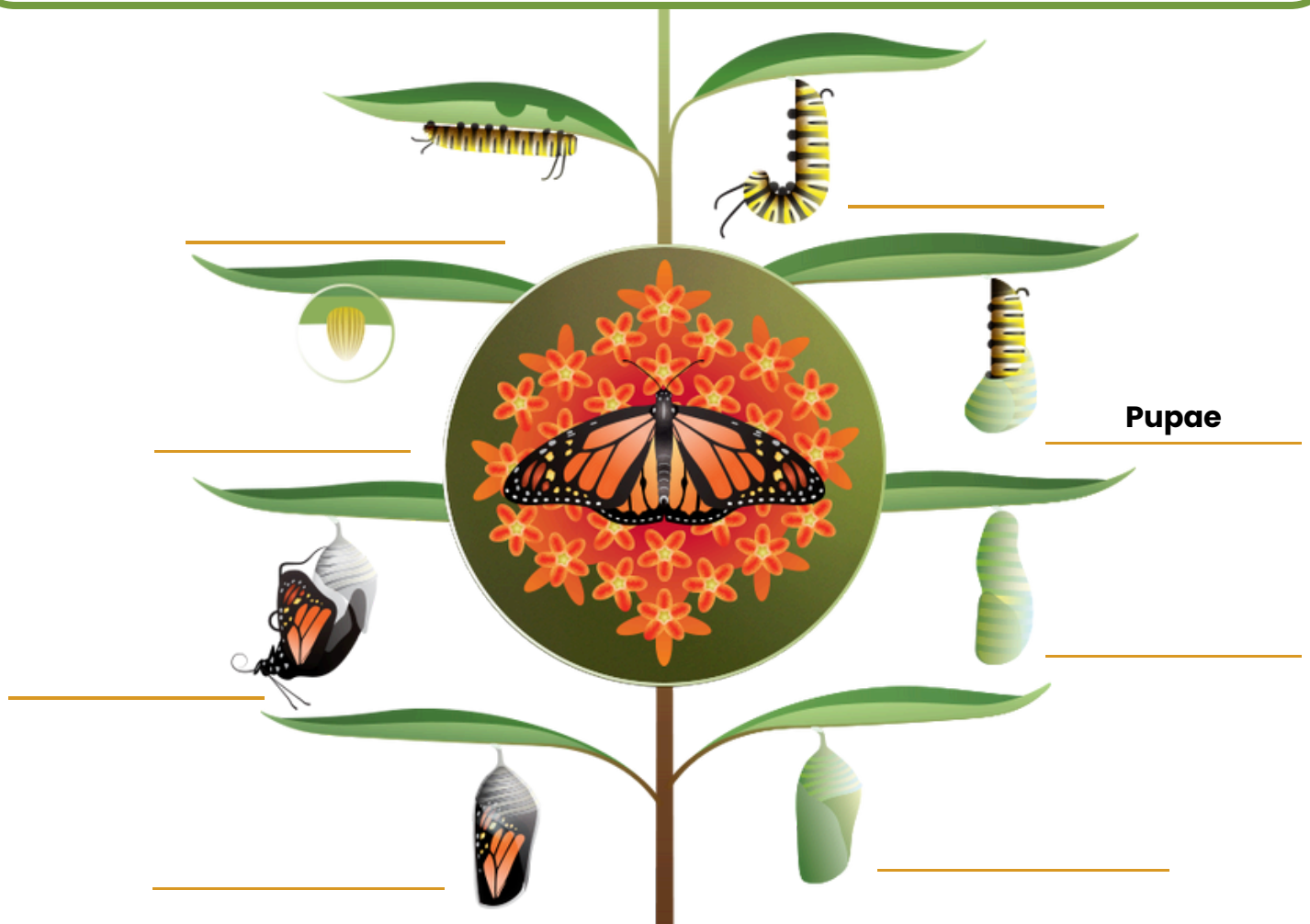
Match the corresponding specific phenophase stage. Fill in the blank space with the corresponding Nature's Notebook Phenophase Definition. Note that a phenophase can be entered more than once. (<https://naturesnotebook.usanpn.org/npnapps/species/Danaus/plexippus>).

Pupae

Egg

Active Caterpillar

Active Adult



Pupae

WHAT CAN WE DO TO HELP MONARCHS?

Name: _____

Class: _____

Date: _____



Climate Change



Habitat Loss



Pesticide Use

Monarch butterflies rely on milkweed for breeding and diverse flowering plants for nectar during migration. Habitat loss, pesticides, and climate change endanger these food sources, affecting monarchs and other pollinators. Preserving habitats, reducing pesticides, and raising awareness are vital for the protection of monarchs and the ecosystem in which they reside.

Citizen science is an inclusive approach to scientific research where everyday individuals, with or without a scientific background, choose to volunteer and contribute to various research projects. Citizen science programs such as Nature's Notebook can be used to document patterns of plant and animal phenology. Researchers rely on the assistance of dedicated volunteers like you to better understand the seasonal changes of plants and animals!




Why do you think data collected by volunteer scientists would be helpful for understanding Monarch migration patterns across the United States and Mexico?

Setting up a Desert Refuge Local Phenology Program at your School.

By observing milkweed for 10 minutes a week, you can help researchers better understand the overwintering patterns of Arizona Monarchs. Visit usanpn.org/nn/faq for more details about creating a local phenology program at your school

- 1 Create a Nature's Notebook Account**
You can create your account at usanpn.org or using the Nature's Notebook mobile app
- 2 Request a Local Phenology Program at your school and create a personal site.** Your personal site should have at least one milkweed species from the Nature's Notebook species list (naturesnotebook.usanpn.org/npnapps/species) that you can visit at least once a week
- 3 Add the sites where your students will be collecting monarch and milkweed phenology data.**
You can add/edit the plants and animals at your site under "personal sites" in your observation deck online, or on the Nature's Notebook mobile app
- 4 Have your students create their own Nature's Notebook accounts and join your program.** Once they join your program, they will be able to collect data on your milkweed and monarchs.
- 5 Record observations at least weekly.** Check your milkweed for at least 10 minutes weekly to search for monarch butterflies or caterpillars.
- 6 Discuss your results.** The data tab on your Local Phenology Program's profile page will give you access to your students' data and visualizations. Have your students explore and reflect on the data collected at your school.



Learn more about the Desert Refuge Campaign, a USA-NPN and Desert Botanical Gardens collaboration, and how to get involved!

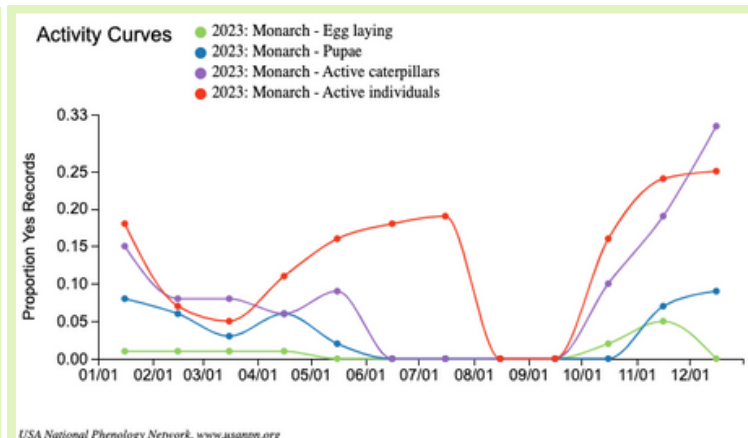
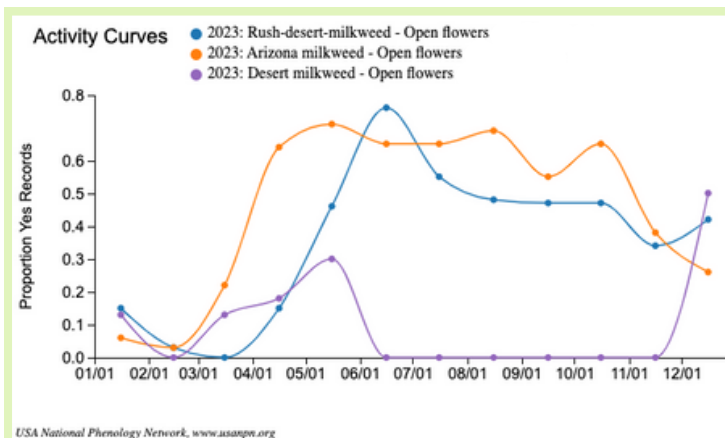
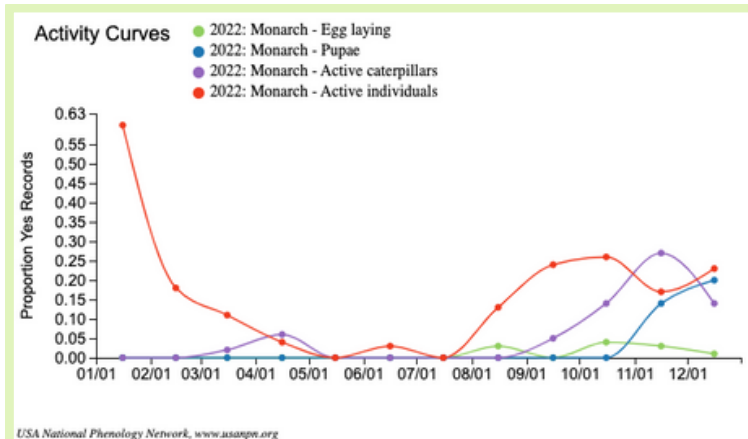
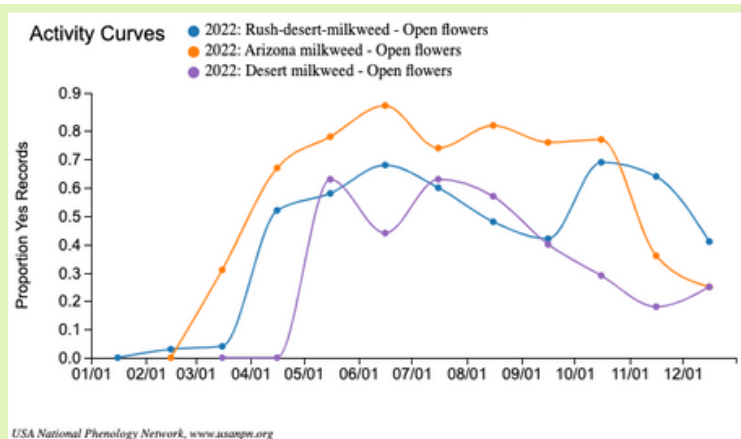
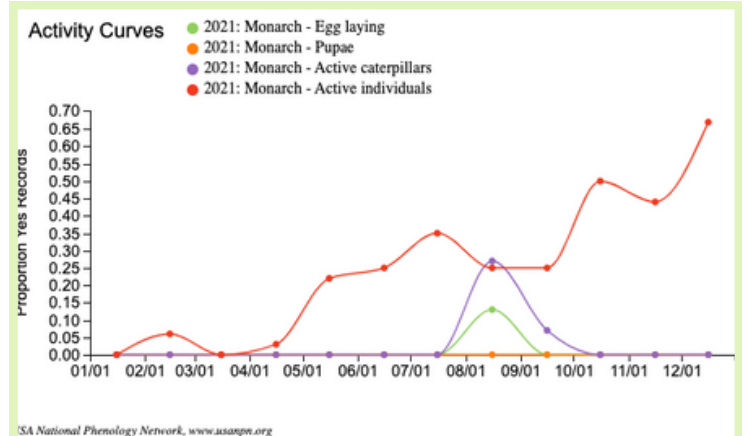
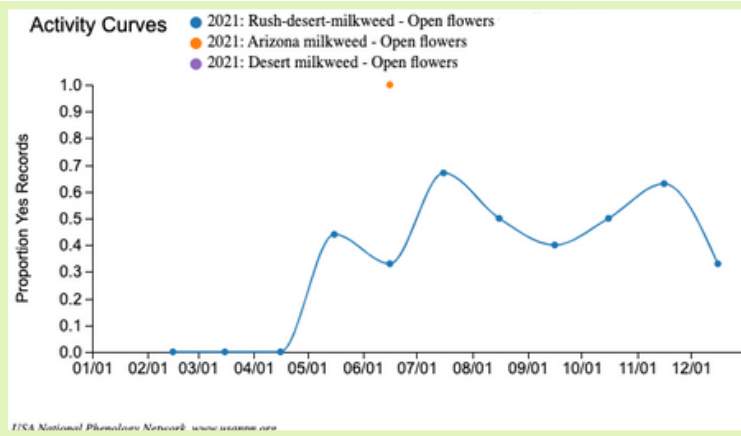


Sign up for the Nectar Connectors Newsletter. You will receive messages full of findings, observation tips, and campaign-specific opportunities.



EXPLORING NATURE'S NOTEBOOK DATA

Use the graphs below or the visualizations from your school's Local Phenology Program and answer the questions on the following page. Below are milkweed and monarch phenology observations collected by Nature's Notebook observers throughout 2021-2023. The milkweed graphs show how many open flowers were observed by volunteers on the y axis and during what time of the year on the x axis. The monarch graphs show how many eggs laid, pupae, active caterpillars, and active individuals were observed by volunteers on the y axis and during what time of the year on the x axis.



Want to Make your Own Visualization with USA NPN Data?
<https://www.usanpn.org/data/visualizations>



EXPLORING NATURE'S NOTEBOOK DATA

Use the graphs below or the visualizations from your school's Local Phenology Program and answer the questions below. (These are milkweed and monarch phenology observations collected by Nature's Notebook observers in 2023). Explain what the X axis and Y axis are,

What do these graphs show about the phenology of milkweeds and monarchs? What correlations do you notice about the timing of milkweed flowering and monarch phenology?

How are these patterns similar or different in each year? What are some possible explanations for any variations in the timing of the phenological patterns of milkweed flowering and monarchs?

Based on the information shown in these graphs, design your own study about monarch and milkweeds in Arizona, what phenological relationships would you like to explore?

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