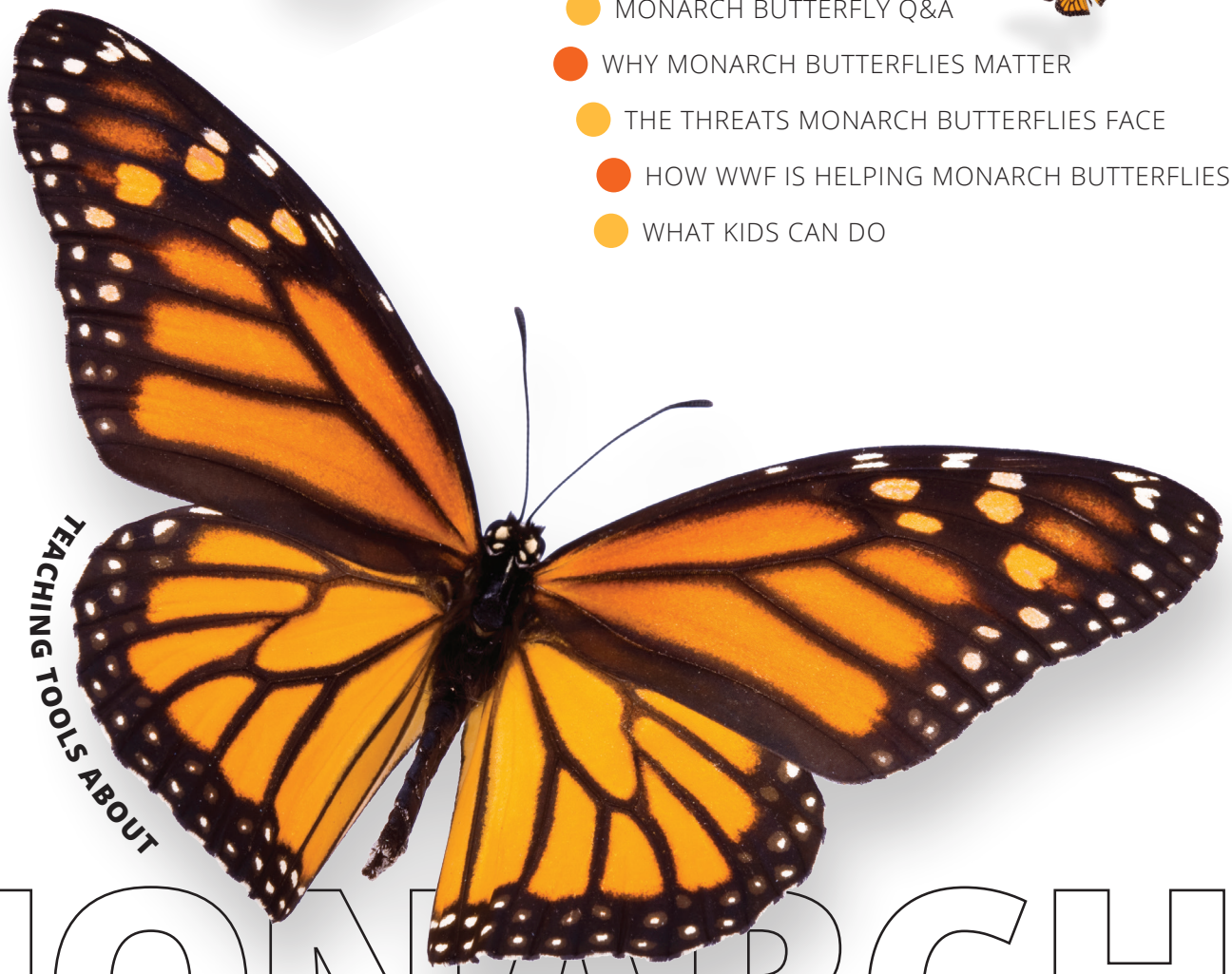


- MONARCH BUTTERFLY FUN FACTS
- MONARCH BUTTERFLY Q&A
- WHY MONARCH BUTTERFLIES MATTER
- THE THREATS MONARCH BUTTERFLIES FACE
- HOW WWF IS HELPING MONARCH BUTTERFLIES
- WHAT KIDS CAN DO





TEACHING TOOLS ABOUT

MONARCH BUTTERFLIES

WWF

WILD CLASSROOM

EDUCATOR'S RESOURCE GUIDE

WWF's Wild Classroom connects educators and parents with the tools and resources they need to help kids explore and understand the world around them. Visit wildclassroom.org to choose from a growing library of animal- and nature-related teacher's guides, fact sheets, and activity plans that you can use to enhance your science, writing, art, and other lessons.

Together we can inspire the next generation to build a future where people and nature thrive!

MONARCH BUTTERFLIES

Monarch Butterfly Fun Facts

- The name "monarch" was given to the butterflies by European colonists in the United States and Canada in honor of King William III, Prince of Orange and King of England.
- Monarch butterflies migrate between 1,200 and 2,800 miles or more in autumn from the United States and Canada to central Mexican forests where they hibernate. They can travel between 50 and 100 miles a day, and it can take up to two months to complete their journey.
- Monarchs know when it's time to migrate south for the winter based on signals from the environment indicating the seasons are changing. When it's time, the butterflies will lift up on air currents high into the sky and embark on their journey. A glider pilot observed a monarch 11,000 feet in the air (almost two miles up), the highest on record.
- Migrating monarch butterflies are guided by the sun's orbit as they travel through North America. Even on cloudy days, they're able to stay on track thanks to an internal biological compass that functions based on the movement of the sun.
- The scientific name for monarch butterfly is *Danaus plexippus*, which in Greek means "sleepy transformation," a reference to the butterfly's ability to hibernate and metamorphize.
- Millions of monarch butterflies share a single acre of forest at their hibernation site in the Monarch Butterfly Biosphere Reserve in Mexico.
- A group of monarch butterflies is called a flutter.
- A monarch flaps its wings five to 12 times per second, approximately 720 times per minute.
- Male monarchs are slightly bigger than females and have black dots along the veins of their wings.
- Milkweed is the only plant that monarchs will lay their eggs on, because it is the only source of food for the emerging baby caterpillars.

- Monarchs are pollinators and play a huge role in the health of our food system by fertilizing flowering plants. Without them, many fruits and vegetables that people and animals rely upon would decrease in quantity and quality.
- The bright orange and black colors of the monarch warn predators that they are inedible, due to their diet of toxic milkweed. Few animals can eat monarchs without getting sick. Other nontoxic butterfly species, such as the viceroy butterfly, take advantage of the monarch's defenses and have evolved to look exactly like them to fool predators into thinking they, too, are toxic and inedible. This phenomenon of nature is called mimicry.
- The monarch butterfly has been named the official state insect or butterfly in Alabama, Idaho, Illinois, Minnesota, Texas, Vermont, and West Virginia.

Monarch Butterfly Q&A

What is a monarch butterfly's extinction risk?

The species is not in danger of disappearing; however, their migratory phenomenon is categorized as near threatened in the International Union for Conservation of Nature Red List, a tool used to measure biodiversity loss and species that are most at risk of extinction.

How many monarchs are in the wild?

Counting monarchs can be extremely difficult, due to the large number that exist. Scientists try to survey populations by measuring the area of forest they hibernate in during the winter. Since this too can be difficult, scientists focus primarily on watching trends in the population that could indicate threats to their survival.

Where do monarchs live?

Monarchs can be found in different places throughout North, Central, and South America because they keep migrating throughout their entire life cycle. A large population that migrates from southern Canada and the northern United States travels through the US and parts of Mexico, as the butterflies head to their hibernation sites in the mountains in central Mexico.

Why do monarchs migrate?

Monarchs travel from southern Canada and the northern United States to escape the harsh winters. They navigate across the US, and two months later they arrive at the mountain forests in Mexico, where they find perfect climate conditions for hibernation.

From the beginning of November until March, they spend most of their time resting, to recuperate from the long journey. As the climate starts to warm up in February and March, they move around the forest to drink water and return to their trees. When spring arrives, they mate and begin the return journey north to the US.

Once they are back in the US, they will lay their eggs on milkweed and die, and the new generation will continue flying north. This generation and the ones to follow will have a regular life cycle, surviving roughly four to five weeks. These generations will also mature, lay eggs, die, and continue traveling north, until they reach the northern US and southern Canada. The butterflies emerging in that area will be a little different; they are larger in size, will live seven to eight months, and will be the generation to start the migration south again, arriving in Mexico to hibernate. That's why they are sometimes called the "super generation."

What is a monarch butterfly's weight?

Less than an ounce.

How big is a monarch butterfly?

An average adult monarch butterfly's wingspan is approximately four inches.

What do monarch butterflies have to do with food?

Monarch butterflies, along with bees, birds, and bats, are pollinators. Pollinators are responsible for carrying pollen from one flowering plant to another, fertilizing the plant and supporting its capacity to produce seeds and fruit. A large percentage of the world's food supply comes from pollinated plants. If we lost pollinators, we'd also lose a vast amount of food we need to live.



What is a monarch butterfly's life-span?

Monarch butterflies go through four stages during one life cycle: egg, larva (caterpillar), pupa (chrysalis), and, last, adult butterfly. In one year, there are four to five generations of butterflies.

On average, the first three generations of adult monarch butterflies only live about four to five weeks as they gradually make the journey north. The fourth or fifth generation is the generation that will migrate south to warmer climates to avoid a cold winter and will live for seven to eight months until it's time to start the whole process over again.

How do young monarchs grow and develop?

Each stage of a monarch's life cycle features an impressive transformation. The duration of each stage can vary depending on the climate of the areas in which the butterflies live. It begins with a female monarch laying about 400 tiny eggs on the undersides of milkweed leaves. After three or four days, caterpillars (larvae) emerge from the eggs and begin feeding on the milkweed leaves for about nine to 14 days. Due to rapid growth during this period, the caterpillars shed their skin about five times. At the end of this larval stage, the caterpillars will weigh 3,000 times what they did as a tiny egg. During its final molting, the caterpillar transforms itself into a chrysalis, a sack inside which it develops for eight to 13 days, before finally emerging as a monarch butterfly. Adult butterflies develop sex organs within three days and begin to reproduce just five days later.



A monarch butterfly on a roost tree in Michoacán, Mexico.

Why Monarch Butterflies Matter

They help produce our food.

Butterflies, bees, and other insects are important pollinators of crops and wild plants in North America. As these insects land on plants to drink the nectar and gather energy, pollen from the plant sticks to their legs and bodies. This can occur unintentionally, as in the case of butterflies, or intentionally, as is the case with female bees that purposely collect pollen for their young. When the insect travels to the next plant, the pollen is also transported and fertilizes the plant, helping it reproduce. Bees and butterflies are both considered important pollinators, as they produce many flowering plants and help a lot with the growing of fruits and vegetables. A significant amount of all food produced worldwide is made possible by pollinators.

Conserving monarch habitat benefits all of us.

The Monarch Butterfly Biosphere Reserve in Mexico, the winter home of monarchs, is the only place on Earth where monarchs congregate by the millions. This is a spectacular natural phenomenon that provides visitors and nature lovers with a unique experience while providing income to the region's local communities through tourism. These ecosystems are critical to the survival of many other flora and fauna that also call these forests home. The forests provide and distribute clean water to surrounding towns, and also prevent erosion. In addition, forests help slow climate change by absorbing carbon dioxide from the air. In North America, the prairies and grasslands that monarchs call home during the rest of the year are also home to a variety of other species, such as songbirds. These habitats have an abundance of wildflowers that support other pollinators, including native bees. Like forests, the grasses and flowers found in these environments have complex root systems that help filter water, reduce runoff, and control erosion, all of which benefits people.

Monarchs are an inspiration.

What makes the migration of monarchs so remarkable is that the butterflies that travel to Mexico to hibernate have never actually been there before. Several generations of butterflies have passed since the generation that completed that journey the year before. This 2,800-mile migration is one of the most impressive migration patterns observed in nature. Around the world, people view the butterfly as a symbol of endurance, change, hope, and life.

The Threats Monarch Butterflies Face

The same threats that monarch butterflies face—including the expansion of agriculture, illegal logging, and climate change—also put other important species across North America, from bumblebees to bison, at risk.

Loss of forest habitat

The Mexican forests at the Monarch Butterfly Biosphere Reserve provide monarchs with their much-needed winter home, offering shelter from the cold. Unfortunately, unsustainable use of forests, conversion to agriculture, and illegal logging have been diminishing the region's forested area. The cutting of the trees modifies climate conditions, humidity, and other factors that butterflies need.

Loss of food resources

Milkweed in the midwestern areas of the United States has drastically disappeared in the past several decades due to agriculture, development, and chemical use. Herbicides are used to protect crops, but they also damage milkweed plants. Monarch caterpillars depend on milkweed to feed and grow before becoming butterflies. Milkweed grows among corn and soy fields in the United States and Canada, making the plant vulnerable to changes from agriculture. In one year alone, 2.5 million acres of grasslands across the Great Plains were lost to agriculture. In some states it is estimated that 90% of all milkweed has disappeared due to herbicide use, agricultural expansion, and urbanization.

Climate change

Shifting weather conditions caused by climate change are affecting the monarch butterfly's migration pattern, as well as its winter and summer homes. Colder, wetter winters threaten a monarch's ability to survive, and hotter, drier summers could push them farther and farther north looking for suitable habitat. Monarchs cannot fly if their body temperature is less than 86 degrees. They will sit in the sun or "shiver" their wings to warm up. In addition, abnormal rainfall throughout their northern breeding areas impacts the growth of milkweed, affecting the food supply for caterpillars and ultimately the survival rate of monarchs.





How WWF Is Improving Our Food Practices and Helping Monarchs

WWF is working hard to conserve monarch butterflies and their miracle of migration by protecting the areas they depend on. By more sustainably managing forests and grasslands, as well as promoting better food habits, we can realize benefits for both people and nature.

Conserving forest habitat

WWF has increased its work in the monarch butterfly region considerably since 1998, when it supported the Mexican government with scientific information to create the Monarch Butterfly Biosphere Reserve in 2000. Within the reserve, WWF supports proper forest management and sustainable projects such as mushroom production units and tree nurseries that provide alternative income to local communities. WWF also helped create the Monarch Butterfly Conservation Fund—jointly managed by WWF and the Mexican Nature Conservation Fund—which assists communities that protect their forests. The fund provides uniforms and training for tour guides, and radio equipment to volunteers who patrol the forest and report any illegal logging or forest fires to authorities. These measures have been very successful in engaging local communities and reducing illegal logging and forest degradation to the lowest levels since 2000.

Maintaining healthy grasslands

WWF works with public agencies, local tribes, and ranchers to care for the grasslands and conserve biodiversity in the Northern Great Plains. WWF aims to ensure that all public land management plans protect grasslands that serve as vital habitat for monarchs, songbirds, bison, black-footed ferrets, and many other species. We also help ranchers and farmers understand the benefits of protecting the natural grassland vegetation. More diverse vegetation between fields and alongside streams supports monarchs and other pollinators while helping the land absorb heat-trapping greenhouse gases (keeping them out of our atmosphere), store water, and keep soil, fertilizers, and other compounds from polluting nearby waterways.

Promoting good food habits

WWF is striving to help people understand how they can contribute to a more sustainable future for food that doesn't impact species and their habitats. Animal products containing meat or dairy tend to require more resources and have a greater impact on the environment than fruits and vegetables. By eating a balanced diet and following nutritional guidelines, you're helping conserve the environment affected by agriculture. WWF also urges people not to waste food (making sure food goes into our bodies, not in the trash bin). Wasting food means you're wasting everything it took to make that food, including land and water. Making educated decisions and conscious efforts when shopping and eating could benefit monarchs as well as other wildlife and wild places.

What Kids Can Do

Plant milkweed

Help replenish the monarch's migration route by planting milkweed native to your area in your garden at home or school. Check the WWF website or ask your local nursery or extension agency about the right type of milkweed to plant in your region (planting milkweed that isn't native can actually harm monarchs.) You can also include flowering plants that require pollination and are popular sources of nectar for monarchs in your garden. By creating a garden for pollinators, you will provide a critical area for monarchs to lay their eggs and feed during their long migratory journeys.

Avoid using pesticides

Although herbicides and insecticides are not intended to harm pollinators like monarch butterflies, they can have a harmful effect as these species travel between plants. Encourage friends and family to avoid using pesticides whenever possible to help save the monarch and many other harmless insects that visit plants to feed and that help pollinate.

Visit monarch sanctuaries

Tourism to the Monarch Butterfly Biosphere Reserve in Mexico provides income opportunities for local communities while protecting important habitat for these butterflies. The butterfly sanctuaries are open to tourists the last week of November, once butterflies are almost fully settled in the trees, through March. If you visit, remember not to bother the butterflies resting in the trees (they're sleeping!). Try to avoid making excessive noise and harming the forest plants. If you see someone bothering the butterflies or disrupting the sanctuary, report it to a guide or someone in authority.

Reduce your food waste

The increasing human demand for food has caused much of the land that monarch butterflies rely on for habitat to be lost to agriculture. We can help by not wasting food and making sure food is consumed or used efficiently. At meals, try to take only as much food as you realistically think you'll eat. If you do end up with leftovers, save it for another time or repurpose it, rather than throw it away. Foods like fruits and vegetables that are often thrown away can be frozen and used in smoothies, sauces, or soups. You can also encourage your school or home to compost food waste and use it for a garden.

Spread the word

Kids can talk to their parents and friends about what they have learned about monarchs and food, and ask them to do the things on this list, too! The more knowledgeable people are about what they can do to make a difference, the more likely they are to take a stand and protect monarch butterflies!

Start a fundraiser to help monarchs and nature

By creating a fundraiser with WWF, you're inspiring your students to protect the wildlife and wild places they've been studying. It's a great opportunity to teach the importance of philanthropy and the difference we can make when we work together. Get started at worldwildlife.org/pages/fundraise-for-wwf.



Monarch butterflies hang from roost trees in Michoacán, Mexico.

More Monarch Teaching Tools

Monarch fill-in-the-blank word puzzle

At the end of this guide, you'll find a word puzzle (with an answer key) based on the educational content covered in this guide.

Monarch learning activities

Within the Monarch Butterfly Toolkit, you'll find six fun, engaging activities designed to help students learn about monarchs and their habitats:

How Much Water Is in Your Lunch?
Students will comprehend the amount of resources, namely water, required to produce various food items by comparing data and creating a pictograph.

Don't Treat Soil Like Dirt!
Students will perform science projects that require them to observe and record conditions of soil samples in order to understand its importance to healthy life.

Origami Butterfly Planters
After learning about monarchs' reliance on milkweed, students will participate in providing for monarchs along their journey by creating their very own planter.

Flutters and Flowers
In this pollinator-themed twist on freeze tag, students will learn the importance of pollinators such as butterflies, bees, and bats for food availability around the world.

The Great Monarch Migration
Students will familiarize themselves with geography and map creation by plotting the remarkable journey of monarchs.

Eating Our Planet
Students will compose a creative letter to a future pen pal describing Earth's environmental health as a result of the impacts of food.

Monarch posters

Create an inviting learning space with these free, downloadable posters of monarchs (along with fun facts).

WWF Together app

For more fun, interactive tools and information about monarch butterflies and other wildlife, download the WWF Together app.

Photos: pages 4, 9 © Paul Bettings/WWF-Canada; all others © istockphoto.com

WILD CLASSROOM

MONARCH BUTTERFLIES



Name: _____ Date: _____

MONARCH BUTTERFLY WORD PUZZLE

Complete the puzzle with words related to monarch butterflies. Use your monarch fact sheets to help you.

1. ____ is the only plant that monarchs will lay their eggs on. **M** ___ ___ ___ ___ ___ ___ ___
2. Millions of monarchs share a single acre of ____ during hibernation. ___ **O** ___ ___ ___ ___
3. A monarch flaps its ____ five to 12 times per second. ___ ___ **N** ___ ___
4. Monarchs migrate when the environment indicates the ____ are changing. ___ ___ **A** ___ ___ ___ ___
5. Monarchs help produce many ____ and vegetables that we eat. ___ **R** ___ ___ ___ ___
6. The monarchs' diet is ____ to other animals. ___ ___ ___ ___ **C**
7. Monarchs travel south to escape the cold and to _____. **H** ___ ___ ___ ___ ___ ___ ___ ___
8. Monarchs are guided by the sun's ____ as they travel. ___ ___ **B** ___ ___
9. A group of monarchs is called a ____. ___ ___ **U** ___ ___ ___ ___
10. Their scientific name refers to their ability to hibernate and ___. ___ ___ **T** ___ ___ ___ ___ ___ ___ ___ ___ ___
11. Monarchs travel south to escape the harsh cold of ____. ___ ___ ___ **T** ___ ___
12. It can take up to two months for monarchs to reach ____. ___ **E** ___ ___ ___ ___
13. Monarchs ____ between 1,200 and 2,800 miles or more. ___ ___ ___ **R** ___ ___ ___
14. Monarchs play a huge role in the health of our ____. **F** ___ ___ ___
15. Along with bees, birds, and bats, monarchs are ____. ___ ___ ___ **L** ___ ___ ___ ___ ___ ___ ___
16. Viceroy butterflies fool predators through ___, looking just like monarchs. ___ **I** ___ ___ ___ ___ ___
17. During their life cycle, after the egg stage, they emerge as a ___. ___ ___ ___ **E** ___ ___ ___ ___ ___ ___ ___
18. The ____ generation of monarchs is the biggest and travels the farthest. **S** ___ ___ ___ ___

WILD CLASSROOM

MONARCH BUTTERFLIES



MONARCH BUTTERFLY WORD PUZZLE | ANSWER KEY

Complete the puzzle with words related to monarch butterflies. Use your monarch fact sheets to help you.

1. ____ is the only plant that monarchs will lay their eggs on. — M I L K W E E D
2. Millions of monarchs share a single acre of ____ during hibernation. — F O R E S T
3. A monarch flaps its ____ five to 12 times per second. — W I N G S
4. Monarchs migrate when the environment indicates the ____ are changing. — S E A S O N S
5. Monarchs help produce many ____ and vegetables that we eat. — F R U I T S
6. The monarchs' diet is ____ to other animals. — T O X I C
7. Monarchs travel south to escape the cold and to _____. — H I B E R N A T E
8. Monarchs are guided by the sun's ____ as they travel. — O R B I T
9. A group of monarchs is called a ____. — F L U T T E R
10. Their scientific name refers to their ability to hibernate and ___. — M E T A M O R P H I Z E
11. Monarchs travel south to escape the harsh cold of ____. — W I N T E R
12. It can take up to two months for monarchs to reach ____. — M E X I C O
13. Monarchs ____ between 1,200 and 2,800 miles or more. — M I G R A T E
14. Monarchs play a huge role in the health of our ____. — F O O D
15. Along with bees, birds, and bats, monarchs are ____. — P O L L I N A T O R S
16. Viceroy butterflies fool predators through ___, looking just like monarchs. — M I M I C R Y
17. During their life cycle, after the egg stage, they emerge as a ___. — C A T E R P I L L A R
18. The ____ generation of monarchs is the biggest and travels the farthest. — S U P E R

Learning Activity:

Origami Butterfly Planters

Activity Type	Arts and crafts
Focus Areas	Arts education, science
Time Required	30–45 minutes

Overview

Milkweed, the only plant on which monarchs lay their eggs and the only source of food for baby caterpillars, can grow in areas all over the United States. Unfortunately, a lot of milkweed habitats are disappearing due to land conversion for agriculture use. Students can help these amazing butterflies by creating a monarch-themed planter to grow milkweed native to their area in their own backyard or school.

Objective

At the completion of the activity, students should be able to:

- Explain the importance of milkweed to monarch butterflies.
- Describe the current threat habitat conversion poses to milkweed plants and monarchs' survival.
- Provide examples of ways they can help monarch butterflies.



Coming in for a landing, a monarch butterfly joins a honeybee to feed from a patch of goldenrod in Iowa, United States.

Subject and Standards

National Core Arts Standards

- Creating
  - Anchor Standard #1: Generate and conceptualize artistic ideas and work.
  - Anchor Standard #2: Organize and develop artistic ideas and work.
- Connecting
  - Anchor Standard #10: Synthesize and relate knowledge and personal experiences to make art.

Next Generation Science Standards

- 3-LS4-4 Biological Evolution: Unity and Diversity
  - Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

Materials Needed

- FSC-certified blank, recycled paper (or newspaper)
- Scissors
- Coloring utensils
- Soil mix
- Milkweed seeds specific to your region
- Monarch Educator's Resource Guide (for reference)



Vocabulary

- **Adaptation:** changes to a plant or animal that make it better equipped to survive under the conditions of its environment
- **Agriculture:** the process of farming soil, producing crops, and raising livestock
- **Biodegradable:** capable of being broken down by living things (such as microorganisms)
- **Habitat:** a natural environment in which plants and animals live, breed, and get their food, water, and shelter
- **Habitat loss:** the disappearance of natural environments (required for plants' and animals' survival) due to harvesting for human consumption and/or clearing to make way for agriculture, housing, roads, pipelines, and other forms of industrial development
- **Herbicide:** a chemical substance used to destroy or stop plant growth
- **Migration:** the act of passing periodically from one region or climate to another for feeding or breeding
- **Pollination:** the transfer of pollen from male plant parts to female plant parts, resulting in fertilization, fruits, and seeds
- **Sustainable:** of, relating to, or being a method of harvesting or using a natural resource so that the resource is not depleted or permanently damaged; an effective and innovative way to efficiently use natural resources and ensure their continued supply



Monarch butterfly on Mexican sunflower.

Activity Procedure

Part 1: Introduction and Preparation

- Planting milkweed that isn't native to your area can actually harm monarchs, so prior to leading this activity, you will need to determine the right variety of milkweed for your region. You may use this WWF website as a guide, or visit your local nursery, extension agency, or plant retailer. Be sure to purchase enough seeds so that each student has a few to plant.
- Begin by asking students to provide examples of species that migrate and include reasons why these animals migrate. Migration is an example of an animal adaptation—a change in behavior in order to fulfill basic survival needs, often during a changing climate. Like birds, whales, and other animals that migrate, monarch butterflies also exhibit a signature migration pattern—one of the most impressive migrations ever seen in nature. Take a few minutes to explain the monarch migration pattern and why it is so notable:
  - Monarch butterflies do not have long life spans. It takes one year for monarchs to complete a full migration cycle, and during this cycle, each of four to five different generations of butterflies will complete a leg of the journey until the cycle starts over with a new generation. So, unlike other migrating species that may travel to an area for a period of time before returning home, the monarch that returns home is not the same one that originally left.
  - A large population of monarch butterflies migrate to the forests of central Mexico from southern Canada and the northern United States. These butterflies head south in the fall to escape the oncoming harsh winter by hibernating in an area with a much more suitable climate. This leg of the journey takes one generation of monarchs to complete; those monarchs will live seven to eight months and will hibernate until spring, when they awake, mate, and set out on the return trip home. They will lay eggs in the southern part of the US and then die, leaving the next generation to emerge and continue the journey. The journey heading north requires three or four butterfly generations to complete; as these butterflies emerge, they will keep traveling northward—stopping to eat, reproduce, and eventually die after only four to five weeks—until they reach the northern United States and Canada in the summer.
- Ask students to brainstorm some of the things monarchs might need as they travel these long migration distances. As these generations of monarchs complete their respective leg of the journey, they rely on healthy habitat along the way to provide an ideal location to rest and lay their eggs. Milkweed is the only plant that monarchs will lay their eggs on in order to provide food for the emerging hungry caterpillars. Different varieties of milkweed can be found all over the United States and Canada.

- Unfortunately, monarchs are losing the milkweed they desperately need to survive. Discuss with students what is causing the decline in milkweed habitats.
  - The grasslands where milkweed typically grows are being plowed to make room for more agriculture. As the demand for food continues to increase, pressure is placed on farmers to convert areas suitable for growing more crops. In addition, herbicides are being used to enhance crop growth but are killing other vegetation, including milkweed, in the process. Without milkweed, the survival of monarch generations is at severe risk.

Part 2: Activity

In this activity, students will help monarchs by using sustainably sourced paper to construct their own biodegradable butterfly planter for milkweed specific to their region.

- Distribute a pair of scissors, one piece of paper or newspaper, and coloring utensils to each student.
- Instruct them to make a square out of the rectangular paper by folding one corner up until it is aligned with the opposite side, then trimming the excess off.
- Allow the students several minutes to decorate their planters. Encourage them to color both sides of the paper, incorporating what they have learned about butterflies. Refer to the Monarch Educator's Resource Guide for fun facts on monarchs.
- Take students step by step through the origami process. They will create a simple box to hold their plant. It will be helpful to go one step at a time, making one of your own to show them during each step.
  - Start by folding the square diagonally in half each way, matching opposite corners in the center and creasing.
  - Open up the square again, and take each of the four corners and fold them toward the center (creating four small triangles, all facing each other).
  - Now unfold the paper, and take each of the four corners and fold them to the crease lines you just made (making four smaller triangles).
  - With these small triangles still in place, fold over each of the edges at the crease line that the triangle is pointing to (it'll look like the square has a thick border).
  - Flip the paper over and fold the top and bottom edges in toward each other, meeting in the center. Crease well, then unfold.

- Now fold over the left and right edges toward the center in the same fashion. Crease well and unfold.
- Take the top edge and fold it back toward the center once again. Unfold the top-most flap (you should see a triangle). Now fold the two bottom corners inward so that they align with the crease. Then take that top-most flap and fold it back over, covering the two folded-in corners. Crease well.
- Repeat the step above with the bottom edge. Fold bottom edge inward toward the center, then flip up the top-most layer (revealing the triangle). Fold the bottom two corners inward to align with the crease. Then fold the top-most flap back down over the folded-in corners. Crease well.
- Grabbing from the middle and gently pulling up and out, carefully form the box, straightening up the sides and creasing the corners.

- Have students fill their completed planters three quarters of the way full of soil. Then, distribute a few milkweed seeds to each student and have them bury them a few centimeters deep into the soil.
- Students may add their planters to a school garden or take their planters home and find a location to bury them in the ground. Explain to them how the biodegradable nature of the paper serves as a sustainable transition to planting the milkweed into the ground and will allow the plant to fully develop.
- Remind students when planting their milkweed planters to find an area shielded from wind with plenty of sun and healthy soil. Encourage students to grow more milkweed plants in a garden at home, making sure to research which variety to plant ahead of time.



Part 3: Discussion and Assessment

- Reiterate to students the importance of milkweed to monarchs. Just as monarchs rely on milkweed for food for their young, people rely on monarchs for food too, but in a different way. Monarchs are pollinators, responsible for fertilizing plants by transporting pollen between them. Plants then produce seeds and fruit; if it weren't for pollinators like monarchs, plants would yield fewer of the fruits and vegetables necessary to make products we eat.
- Share with students other ways they can help monarchs. The world's food consumption has put great pressure on areas to produce more and more food, destroying crucial habitats in the process.
  - Everyone can make an effort to avoid wasting food—wasting food means you're wasting everything it took to make that food, including water. Only take as much food as you think you'll eat, and repurpose leftovers by eating them another time or sharing them with a friend.
  - Eat a balanced diet and follow recommended nutritional guidelines. The manufacture of products with ingredients like beef, chicken, or pork typically requires more resources than those made from vegetables and fruits. Making an effort not to eat more than what is recommended of various food groups will help conserve resources and habitats.

Extended Learning Options

- Rather than leading the activity in step-by-step directions, provide students with an instruction sheet and challenge them to follow the directions on their own.
- Reference this gardening sheet when providing students with tips for planting their milkweed. They can research other plants that monarchs are attracted to and plant those in their garden, as well.
- If your school doesn't currently have a garden, start a milkweed garden so that students can monitor the project and watch for monarchs.
- Tie this activity with other activities from the Monarch Butterfly Toolkit, such as the "The Great Monarch Migration" social studies activity or the "Flutters and Flowers" game.
- You can also use the Food Waste Warrior Toolkit to have your students learn more about the impact of food by investigating the amount of food wasted at school.
- Use a tablet or smartphone (if available) to download the WWF Together app. Encourage students to explore the monarch segment to learn more about the importance of milkweed.
- Start a class fundraiser to protect monarchs and other wildlife and their habitats using WWF's online fundraising tool. Learn more at worldwildlife.org/pages/fundraise-for-wwf.

Additional Background Info

You can use the information found at the links below to enhance your discussion with the class, or you may want to share some links directly with students if you determine they are grade-level appropriate.

- **Article:** Working Together for Monarchs—a story of two Iowa families' dedicated efforts to help monarchs
- **Article:** Monarch Heroes—highlights monarch conservation actions from community members
- **Article:** Monarch Butterfly Plants: How Garden Milkweed Gives Butterflies a Boost—short article on how planting milkweed helps recharge monarchs along their migration routes
- **Article:** What Kind of Milkweed Should You Plant to Help Monarchs?—interactive tool that determines the right type of milkweed to plant based on where you live and the steps to do so

For more fun classroom activities with a focus on wild species and conservation, visit wildclassroom.org.



Monarch butterfly on flower in the Mindo-Nambillo Reserve at approximately 1,500 meters, Andes mountains, western Ecuador.

Photos: page 1 © Morgan Heim/Day's Edge Productions/WWF-US; page 6 © WWF-US/Gregory Snook; page 8 © Kevin Schafer/WWF; all others © istockphoto.com

Learning Activity:

Eating Our Planet

Activity Type	Language arts
Focus Areas	Reading and writing
Time Required	30–45 minutes

Overview

Our need for food, how we get food, and how we use food are some of the biggest environmental threats our planet faces. Students will read about how our current food practices are affecting the health of the Earth, as well as what we can do to help pave the way for a brighter food future. In this activity, they will imagine it is 50 years from now and write a letter to an alien pen pal describing food impacts on the Earth through the years. Using what they've learned about the impacts of food and the positive change we can make, students will creatively describe how they envision the future environmental health of our planet.

Objective

At the completion of the activity, students should be able to:

- Name ways that food impacts the environment and wildlife.
- Provide suggestions of ways people can help prevent the current problems around food.
- Compose a fictional writing sample citing factual information about the impacts of food.



Subject and Standards

Common Core Standards: English Language Arts

- RI. 3.2: Determine the main idea of a text; recount the key details and explain how they support the main idea.
- RI. 3.3: Describe the relationship between a series of historical events, scientific ideas or concepts, or steps in technical procedures in a text, using language that pertains to time, sequence, and cause/effect.
- RI. 3.4/4.4/5.4: Determine the meaning of general academic and domain-specific words and phrases in a text relevant to a grade 3/4/5 topic or subject area.
- RI. 4.7: Interpret information presented visually, orally, or quantitatively (e.g., in charts, graphs, diagrams, time lines, animations, or interactive elements on webpages) and explain how the information contributes to an understanding of the text in which it appears.
- RI. 5.6: Analyze multiple accounts of the same event or topic, noting important similarities and differences in the point of view they represent.
- W. 3.3/4.3/5.3: Write narratives to develop real or imagined experiences or events using effective technique, descriptive details, and clear event sequences.
- W. 3.8: Recall information from experiences or gather information from print and digital sources; take brief notes on sources and sort evidence into provided categories.
- W. 4.4/5.4: Produce clear and coherent writing in which the development and organization are appropriate to task, purpose, and audience.
- W. 4.7: Conduct short research projects that build knowledge through investigation of different aspects of a topic.
- W. 4.9/5.9: Draw evidence from literary or informational texts to support analysis, reflection, and research.

Materials Needed

- Copies of "Eating Our Planet" handout, included at the end of this activity
- Pencil
- Monarch Educator's Resource Guide (optional, for reference)

Vocabulary

- **Agriculture:** the process of farming soil, producing crops, and raising livestock
- **Consumption:** the act of using, typically referring to eating or drinking, especially in great quantity
- **Ecosystem:** the living (plants, animals, other organisms) and nonliving (air, water, soil) components of an area that interact with each other in an interconnected way
- **Habitat:** a natural environment in which plants and animals live, breed, and get their food, water, and shelter
- **Habitat loss:** the disappearance of natural environments (required for plants' and animals' survival) due to harvesting for human consumption and/or clearing to make way for agriculture, housing, roads, pipelines, and other forms of industrial development
- **Overharvesting:** excessively gathering, catching, hunting, or killing for human use, sport, or population control
- **Sustainable:** of, relating to, or being a method of harvesting or using a natural resource so that the resource is not depleted or permanently damaged; an effective and innovative way to efficiently use natural resources and ensure their continued supply



Monarch butterfly during migration.

Activity Procedure

Part 1: Introduction and Preparation

- Begin by asking students to brainstorm current factors that are negatively affecting the health of our planet. As they think of examples, it may be helpful to record their answers on the board. If unmentioned, ask students—what about food? The way food is currently grown, distributed, managed, and wasted has a huge impact on the environment. Provide students with background information on the causes and effects of the harmful ways food is currently being produced. You can use the information found in the Monarch Educator's Resource Guide and the information below:
  - As human populations continue to increase, critical habitats that wildlife depends upon are being plowed to grow more crops for agriculture. This is happening all over the world and affecting many species—from jaguars in South America to elephants, orangutans, and tigers in Asia to monarchs, black-footed ferrets, and bison in North America. Although food is being produced, it's not all being used. Currently, around 30%–40% of all food is wasted—it spoils on the farm, is lost during distribution, or gets thrown away by grocery stores, restaurants, and home kitchens. When we waste food, we waste all the resources used to make that food—including water and electricity.
  - If we don't change how we produce and consume food, the negative impacts will only intensify. By 2050, the world's population will increase by 2 billion (totaling 9 billion). If things don't change, we will need the resources of at least two Earth-like planets to support all of us.
- Distribute copies of the "Eating Our Planet" handout included in this activity to each student. Have students read about the five ways food impacts the Earth and discuss as a class. Then have students read the page that follows on ways people can help prevent these negative food impacts. Encourage them to discuss additional ways they can help at home or in school.



Part 2: Activity

In this activity, students will use information they've read about various ways food impacts our planet and ways we can help to compose a fictional, creative writing piece that predicts the future health of the Earth.

- To prepare students for the writing assignment, instruct them to fill out the graphic organizer page (located at the end of the activity). Students should complete both outcome sections in the handout—first, they describe a future that resulted from improved food practices and second, a future where we have not made any changes to how we produce and eat food. Students should hypothesize what the planet will look like based on the information they have read in the "Eating Our Planet" handout.
- To start the writing exercise, divide the class in half. Using the ideas they generated in the graphic organizer, one half will write a letter from the perspective of a healthy Earth as a result of improved food practices, and the other half will write the letter from the perspective of an unhealthy Earth. Tell students to pretend they are living 50 years in the future and they are writing a letter to a pen pal on another planet. When writing to their alien pen pal, they will look back 50 years (to our present day) and forward 50 years to describe the Earth to someone who has never seen the planet before. Students should include descriptive language around the condition of landscapes, animals, and people to illustrate the changes in nature and communities through the years.
- They should include suggestions of how people need to treat both the production and consumption of food in order to keep the Earth healthy for years to come. Although their writings are fictional and creative, students should incorporate factual information based on their reading as supportive details to describe the health of the environment on Earth to someone who had never lived here.



Monarch butterfly at the El Rosario Sanctuary located within the Monarch Biosphere Reserve, Mexico.

Part 3: Discussion and Assessment

- Pair students who were assigned to write to their pen pal from the healthy future Earth with students who wrote from the opposite perspective. Have pairs share their letters with one another, comparing the future described in each. Remind students to describe to their partner how they incorporated food challenges and solutions into their letters.
- Hold a class discussion on how we could address these problems so that we won't need two planets to support us by 2050. Reiterate the message to students that in order to avoid living on an unhealthy Earth in the future, we all need to do our part to make a difference. Organizations like WWF are working hard to develop more sustainable methods to harvest food as well as encourage people, governments, and businesses to make better environmental choices. Students should understand that it is possible to provide enough food for our planet's increasing population while at the same time protecting wild places and wildlife; each one of us needs to make small changes and better decisions every day. Assess student comprehension by asking them to recall ways mentioned in the reading that they could make a difference with better food practices.



Monarch butterflies in wintering area, highlands of Mexico.

Extended Learning Options

- Divide the class into five groups; assign each group one of the environmental impacts of food, as listed in the attached reading. Have each group research their assigned topic and create a public service announcement in the form of an advertisement promoting ways you can help reduce that negative impact.
- You could also have students learn more about different types of food production, including beef, dairy, and soy, and how each one specifically impacts the environment. Find out more about these significant contributors on the WWF Food webpage.
- Connect this activity to others from the Monarch Butterfly Toolkit, such as the "How Much Water Is in Your Lunch?" math activity.
- Use the activities in the Food Waste Warrior Toolkit to have students explore the impacts of food right in their own school by calculating the amount of food waste in the cafeteria.
- Use a tablet or smartphone (if available) to download the WWF Together app. Encourage students to explore the monarch segment to learn more about the connection of food to wildlife.
- Start a class fundraiser to protect monarchs and other wildlife and their habitats using WWF's online fundraising tool. Learn more at worldwildlife.org/pages/fundraise-for-wwf.

Additional Background Info

You can use the information found at the links below to enhance your discussion with the class, or you may want to share some links directly with students if you determine they are grade-level appropriate.

- **Article:** Inspired Innovation—a story of a young girl's invention that changed the expiration date of food
- **Article:** Small Steps to Reduce Food Waste—easy tips for reducing food waste
- **Article:** Rethinking Food—outlines the nine areas where WWF is looking to effectively change the future of food
- **Web Feature:** Eating Our Planet—WWF page on how food impacts Earth off which the reading is based
- **Web Feature:** The Plate-Planet Connection—how the food we eat impacts the wildlife we care about

For more fun classroom activities with a focus on wild species and conservation, visit wildclassroom.org.

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Eating Our Planet

5 ways food is currently impacting Earth

LAND	• 40% of Earth's habitable surface is currently used to make food; by 2050, we'll need twice as much land to make enough food for people. • With so much land being used to make food, wildlife that rely on that land, such as monarch butterflies, lose important habitat.
FRESHWATER	• From the farm all the way to your grocery store, every step of food production requires water. • Many everyday foods eaten around the world require a lot of water to make—for instance, one hamburger uses 460 gallons! So when food gets wasted, so does water!
CONSUMPTION	• The average American eats 2,000 pounds of food a year … that's a lot! • Humans are currently eating 1.5 times what Earth can provide, using up natural resources faster than they can be replenished. By 2050, we'll need two Earth-like planets to provide for the 9 billion people expected to live here.
OVERFISHING	• To keep up with increasing human populations and food needs, people are fishing illegally (without a license or fishing more than what is allowed). • Approximately one-third of the world's fisheries are overharvested. This means fish are being caught at a faster rate than they can reproduce, which threatens the survival of fish species and the entire ecosystem.
FOOD WASTE	• Between 30% and 40% of all food goes to waste—it can turn rotten on the farm, get lost in transit, or get thrown out by people. • When you waste food, you waste everything it took to make that food—water, electricity, fuel, animals, etc.

Eating Our Planet

5 ways we can prevent food from impacting Earth

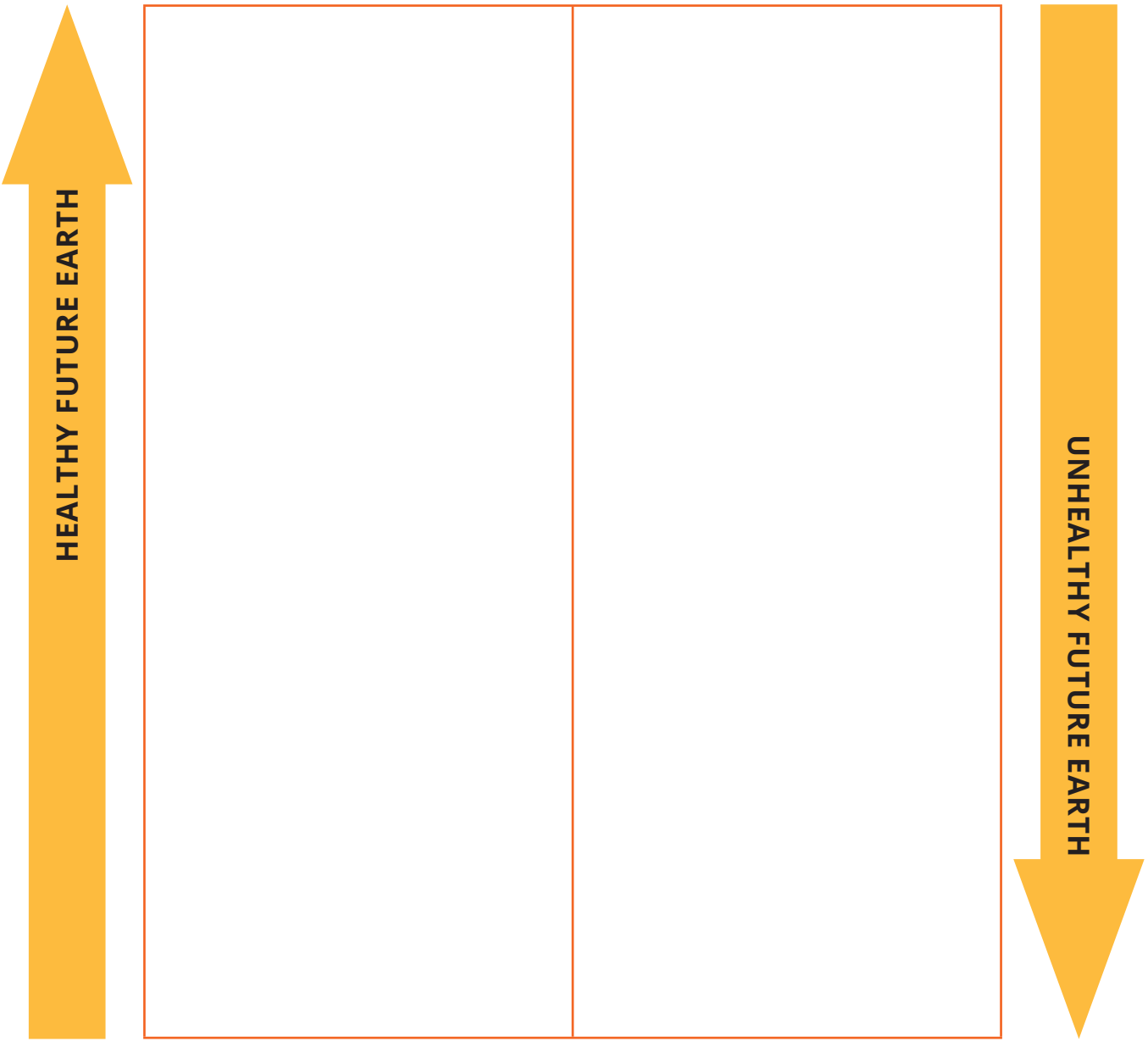
SAVE THE FOOD	• Avoid throwing food out! Take only what you plan to eat, and reuse the rest. Eat leftovers or give them to a friend. • Encourage your school or home to compost. This is a sustainable alternative to throwing food away in the garbage.
BALANCE YOUR DIET	• Meat products tend to require more resources to make than do foods made from fruits and veggies. Make sure you eat a balanced diet and follow nutritional recommendations. • Get creative for how to use aging fruits or veggies. Old fruits can be frozen and used in smoothies or baking. Vegetables can be used in soups or sauces for rice and pasta.
DO MORE WITH LESS	• Scientists are researching ways to improve agriculture practices to be able to grow more crops without needing more land. • WWF is working with food businesses to ensure they still make money, but do so without harming the environment.
SHOP SMART	• Don't grocery shop on an empty stomach! This can lead to buying more than what you really need. • When shopping, look for food items that are certified as sustainable. This includes seafood, which will display a label from the Marine Stewardship Council (MSC) indicating it was caught responsibly, helping to prevent illegal fishing or overfishing.
SPREAD THE WORD	• To create significant change, we need people, governments, and companies from all over the world to pledge to change their behaviors and policies to make smarter food choices that will affect our future. • Start by spreading the word to family and friends about these easy ways they can help.

Name: _____ Date: _____

Eating Our Planet

Graphic Organizer

Picture the Earth in 50 years. Describe the Earth from both perspectives: one where food is properly managed (healthy Earth), and one where it is not (unhealthy Earth). Think of your readings as the causes; you fill in the effects.



Name: _____ Date: _____

Eating Our Planet

Writing Assignment

Pretend it is 50 years from now on Earth. Write a letter to an alien pen pal who has never visited Earth. Describe how the health of the environment on Earth changed from the past to now, and what you predict Earth will be like in the future based on what you've learned about the impacts of food. Be sure to include the points from your graphic organizer of your assigned perspective in your letter.

Learning Activity:

How Much Water Is in Your Lunch?

Activity Type	Analyzing statistics and graphing
Focus Areas	Math, science
Time Required	30–45 minutes

Overview

Around the world, human populations are increasing, and more people means more mouths to feed. The pressure on agriculture to increase productivity has had a negative effect on the environment. In order to produce more food, habitats are being destroyed, wildlife is being threatened, and resources—such as water—are being consumed at a faster rate than they can be replaced. This activity will introduce students to the global challenge of keeping up with food demand while also making sure that nature is protected. Students will create a pictograph to display data on the amounts of water required to produce familiar food items. By learning about the full environmental impact of growing food, students will gain the knowledge they need to make conscious choices that help conserve resources and protect the health of our planet.

Objective

At the completion of the activity, students should be able to:

- Provide examples of how water is used throughout the process of food production.
- Explain the current food crisis and how it's impacting species such as monarchs.
- Name several actions they can take to help prevent monarch habitat loss and reduce waste.



Subject and Standards

Common Core Standards: Math

- MP.4: Model with mathematics
- 3.OA.A.1: Interpret products of whole numbers; e.g., interpret 5x7 as the total number of objects in 5 groups of 7 objects each.
- 3.OA.A.3: Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities; e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.
- 3.MD.A.3: Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs.

Next Generation Science Standards

- 3-LS4-4 Biological Evolution: Unity and Diversity
  - Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
- 4-ESS3-1 Earth and Human Activity
  - Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.
- 5-ESS3-1 Earth and Human Activity
  - Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.

Materials Needed

- Paper
- Pencil
- Colored pencils

Vocabulary

- **Agriculture:** the process of farming soil, producing crops, and raising livestock
- **Consumption:** the act of using, typically referring to eating or drinking, especially in great quantity
- **Habitat:** a natural environment in which plants and animals live, breed, and get their food, water, and shelter
- **Habitat loss:** the disappearance of natural environments (required for plants' and animals' survival) due to harvesting for human consumption and/or clearing to make way for agriculture, housing, roads, pipelines, and other forms of industrial development
- **Pictograph:** a diagram representing statistical data with pictures
- **Pollution:** the act of contaminating an environment, especially with man-made waste
- **Runoff:** the portion of precipitation on land that ultimately reaches streams



A monarch butterfly colony overwinters in Michoacán, Mexico.

Activity Procedure

Part 1: Introduction and Preparation

- Begin the discussion by asking students where their food comes from. Although many may say the grocery store, remind them that food goes through a lot of stages before it ever reaches their plate. Crops that provide essential ingredients in our food products are grown, treated, stored, and transported before they're prepared for us to eat. Each of these steps requires a lot of resources, including land, people, fuel, and water—lots and lots of water. When considering how much water it takes to produce a food product, the amount polluted during each step should also be included, from the beginning of the process when the crops are grown all the way until the end, when it reaches the person eating the food item. Provide students with some background information on the role of water in the creation of food:
  - Water is used in a number of ways during the food production process. Water that falls as precipitation is absorbed by the soil and used by crops to grow. Water is then used by people for various agricultural and manufacturing steps, including crop irrigation, hydration for livestock, fuel for transportation that moves food from one location to another, and power for factories that make the food products.
  - In addition to being consumed, water is also polluted during each stage of food production. Both farms and factories produce pollution, which can end up in the local freshwater resources directly through a pipe or indirectly through runoff.
- Continue the discussion on water usage to introduce students to the current food problem facing our planet. We consume food at a rate of 1.6 times what Earth's resources (land, water) can naturally supply. In other words, based on how we produce food, what we eat, and the rate our population is growing around the world, we would need over one and a half Earth-like planets to support all of us comfortably. Ask students to predict how this could present a problem for the future. By the year 2050, the world's population is expected to be 9 billion and will require the resources of two Earth-like planets. We don't have two Earths; how will we provide food for everyone without using all of Earth's resources?

Part 2: Activity

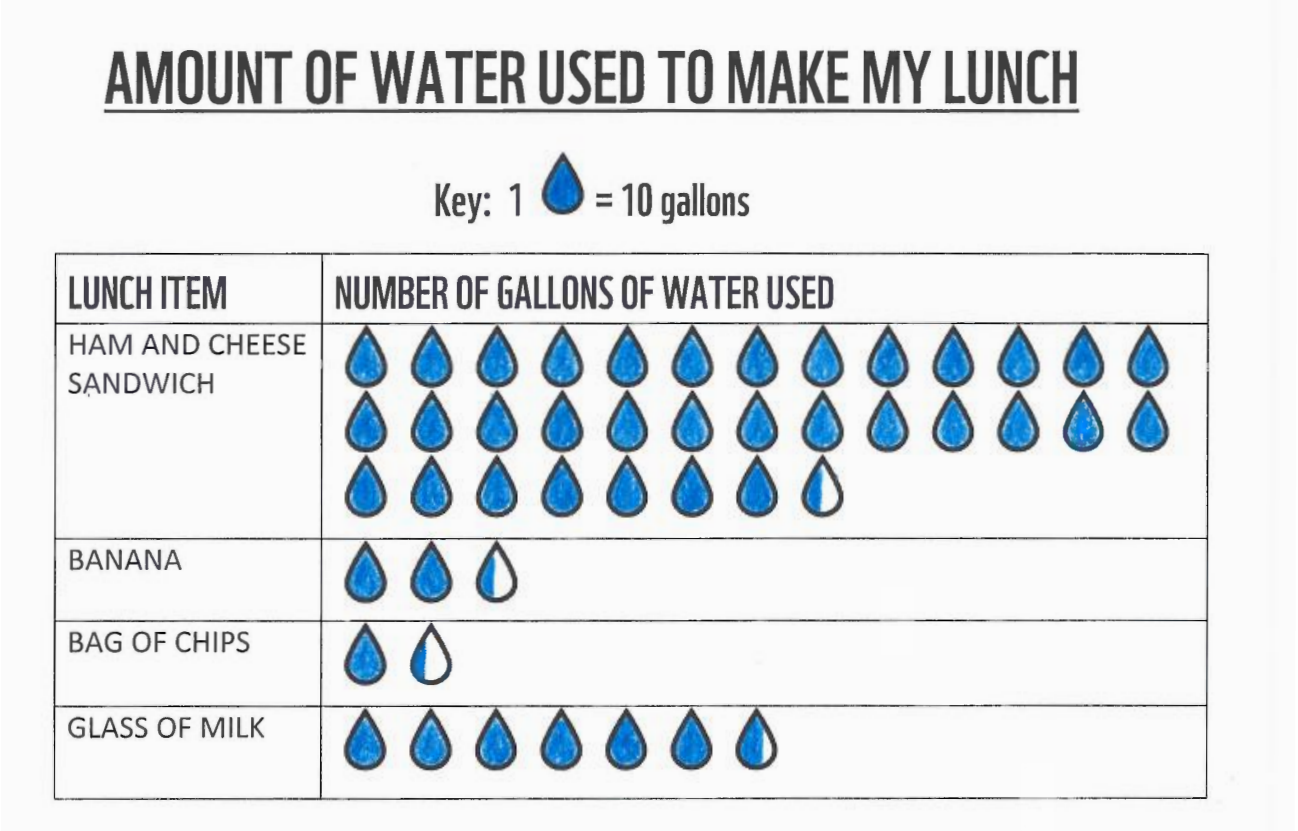
In order to understand the impact of food production on our planet's natural resources, students will create a pictograph of the amount of water used to produce some popular food products.

- Display the following chart or distribute it as a handout for students to reference. This chart provides statistics on how many gallons of water are consumed and polluted in order to produce many popular food items. These numbers provide a glimpse into how much pressure each of these products has put on Earth's freshwater resources. In order to give students a visual image of a gallon unit of measurement, it may be helpful to display an empty gallon container for reference.
- Allow students several minutes to review the data. Ask them if they notice any trends, such as what types of food require the most water in comparison to the least; animal products generally use more water to create than crop products, primarily due to the water needed to provide the animal with food and hydration.

Food Item	Gallons of Water Used
1 hamburger patty	460
1 small cheese pizza	333
1 chocolate bar	200
1 cooked chicken breast	197
1 slice of ham	134
1 cup of cooked rice	132
1 glass of milk (8 ounces)	67
1 egg	53
1 cup of orange juice	49
1 peach or nectarine	37
1 corn on the cob	29
1 salad (with tomato, lettuce, and cucumber)	24
1 slice of cheese	24
1 banana	24
1 apple	22
1 orange	21
1 slice of bread	21
1 small bag of chips	12

Source: waterfootprint.org

- Instruct students to choose several items they eat from the chart; perhaps have them choose foods that they would have for lunch, such as a ham and cheese sandwich.
- Distribute paper and coloring utensils. Ask students to use statistics shown in the chart for the foods they selected to create a pictograph. Using what they know about graphing, remind them to include a title (an example could be "Amount of Water Used to Make My Lunch"), labels, and a legend that displays the symbol(s) they decided to use and the amount that each will represent.
- As students choose their items to include in their pictograph, remind them that they will need to add up the number of gallons for each of the items on the list.
  - For example, if they eat a ham and cheese sandwich, they will need to total the number of gallons needed for 2 slices of bread + ____ slices of ham + ____ slices of cheese.



Part 3: Discussion and Assessment

- Call for student volunteers to share their pictographs, noting which of their favorite foods uses the largest amount of water.
- Discuss with students the additional impacts food production has on our environment, such as the release of greenhouse gases and the impact on land use. Greenhouse gases are emitted from transportation vehicles and factories during the food production process; these gases collect in our atmosphere and are the main drivers of climate change. In addition, lush grasslands that make up the Northern Great Plains of the United States are being plowed and converted to grow crops for agriculture, to support the increasing human need for food. These grasslands are made up of rich soil and vegetation that species, including monarch butterflies, rely on for food and habitat. By plowing and converting the grasslands, we are changing the ecosystems and impacting the plants and animals that can thrive there. Species such as monarchs, which depend on milkweed plants found in grasslands to lay their eggs and feed their young, lose this essential vegetation and are forced to search for alternative habitat.
- Finish the activity by discussing ways in which organizations like WWF and students can help conserve water and land by changing food practices.
    - WWF is working to improve food production practices to grow more food without damaging the natural surroundings in order to prepare us for the increasing demand for food in the future.
    - Students can help conserve water and land by:
        - Avoiding wasting food. Wasting food means you're wasting everything it took to make that food, including water. Take only as much food as you think you'll eat, and repurpose leftovers by eating them another time or sharing them with a friend.
        - Eating a balanced diet and following nutritional guidelines. Manufacturing products made of ingredients like beef, chicken, or pork tend to require much more water than those made of vegetables and fruits.
        - Planting milkweed native to your region. By incorporating milkweed into your home or school garden, you're providing monarch butterflies with a critical resource to lay their eggs and provide food for their future baby caterpillars.

Extended Learning Options

- Use this activity as a precursor to lead into a discussion on renewable versus nonrenewable resources. Ask the students what type of resource they think water is classified as. Despite the massive role water plays in the everyday lives of people and wildlife, it is a limited resource. This is why it's even more important to make conscious choices regarding our water use.
- Tie this activity in to another from the Monarch Butterfly Toolkit, such as the "Eating Our Planet" language arts activity, to have students learn more about the effect food has on the environment.
- You can also have students calculate the amount of food that gets wasted in their school by using activities in the Food Waste Warrior Toolkit.
- Use a tablet or smartphone (if available) to download the WWF Together app. Encourage students to explore the monarch segment to learn more about the impact of food production on butterfly habitat.
- Start a class fundraiser to protect monarch butterflies and other wildlife and their habitats using WWF's online fundraising tool. Learn more at worldwildlife.org/pages/fundraise-for-wwf.

Additional Background Info

You can use the information found at the links below to enhance your discussion with the class, or you may want to share some links directly with students if you determine they are grade-level appropriate.

- **Video:** Change the Way You Think about Food—a short video that outlines the current problem of overconsumption and poses a solution around altering agricultural practices
- **Video:** Change the Way You Think—uses a morning coffee as an example to describe the need to do more with less in order to conserve our natural resources
- **Article:** The Plate-Planet Connection—discusses how the food we eat impacts the wildlife we care about
- **Article:** Hello World: Our Food, Our Wildlife, Our Responsibility—short bios of other wildlife affected by our food system
- **Web Feature:** Waterfootprint.org—a tool for comparing how much water is used to make other food products and for exploring how to reduce your water usage

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Learning Activity:

Flutters and Flowers

Activity Type	Game
Focus Area	Physical education
Time Required	20–30 minutes

Overview

A significant amount of all food produced worldwide is made possible by pollinators. These species, which include monarch butterflies, bees, birds, and bats, are significant contributors to healthy ecosystems—distributing pollen between flowering plants, prompting fertilization and seed and fruit production. Without pollinators, many of the foods, beverages, and medicines we rely on would no longer be available. To represent the critical role of pollinators, students will engage in a pollination-themed twist on the game of freeze tag. By playing this game, students will gain an understanding of why species like monarchs are important and what we can do to protect them.

Objective

At the completion of the activity, students should be able to:

- Explain the role of pollinators and why they're important.
- Describe the current threat habitat conversion presents for grasslands and monarchs.
- Provide examples of ways people can help monarch butterflies.



A monarch caterpillar eating a large leaf.

Subject and Standards

Shape America National PE Standards—Highly Effective Physical Education

- Standard 1: The physically literate individual demonstrates competency in a variety of motor skills and movement patterns.
- Standard 2: The physically literate individual applies knowledge of concepts, principles, strategies, and tactics related to movement and performance.
- Standard 4: The physically literate individual exhibits responsible personal and social behavior that respects self and others.
- Standard 5: The physically literate individual recognizes the value of physical activity for health, enjoyment, challenge, self-expression, and/or social interaction.

Materials Needed

- Open space
- Brightly colored items to distinguish players (optional)

Vocabulary

- **Agriculture:** the process of farming soil, producing crops, and raising livestock
- **Compost:** a mixture that consists mainly of decayed organic matter and is used for fertilizing land
- **Fertilization:** the combining of male and female sex cells to form a new living thing
- **Grassland:** a landscape (also known as a prairie) that has too little rain for trees to grow in great numbers but instead has grass and grass-like plants that grow close to the soil
- **Habitat:** a natural environment in which plants and animals live, breed, and get their food, water, and shelter
- **Habitat loss:** the disappearance of natural environments (required for plants' and animals' survival) due to harvesting for human consumption and/or clearing to make way for agriculture, housing, roads, pipelines, and other forms of industrial development
- **Herbicide:** a chemical substance used to destroy or stop plant growth
- **Pollination:** the transfer of pollen from male plant parts to female plant parts, resulting in fertilization, fruits, and seeds

Activity Procedure

Part 1: Introduction and Preparation

- Students should have a basic understanding of pollination. If the concept is new to them, take several minutes to review the process so that they become familiar with why pollinating species have an important role.
  - In order for flowering plants to grow seeds and produce fruits or vegetables (which we need for food, beverages, and medicines), the male reproductive part of a plant (with the pollen) has to travel to a female reproductive part of a plant. This can happen within the same plant (self-fertilization) or between different plants (cross-fertilization), through wind or species carrying the pollen to other plants.
  - Some of the most well-known pollinators are insects such as butterflies, bees, flies, and wasps. These insects visit flowering plants to drink nectar found inside. While the insect is feeding, pollen grains will often stick to the insect's legs or body. This often occurs unintentionally, with the exception of female bees that purposely collect pollen to give to their young to eat. As the insect travels, these pollen grains go for a ride and get dropped off at the next plant(s) that the insect visits.
  - At this point, the pollen has fertilized the plant, prompting it to reproduce and grow seeds. This benefits the plants themselves, as well as all of the species that rely on the fruits and vegetables that these plants generate. Examples of produce that result from pollinated plants include apples, blueberries, chocolate, vanilla, peaches, and potatoes.
- Ask students to brainstorm essentials that pollinators might need in order to perform this important job. Like all living things, they require survival basics such as water, food, and habitat. In addition, monarchs depend on milkweed—a grassland plant that provides monarchs with a place to lay their eggs and a source of food for their baby caterpillars once they emerge. Milkweed and other plants are disappearing as grasslands are converted to fields of corn, wheat, or other crops to feed a growing human population. The plants get plowed or covered in herbicide, eliminating them so that they don't interfere with the growth of crops. If monarchs lose these plants critical to their survival, they won't be around to pollinate and help produce the fruits and vegetables we depend upon.

Part 2: Activity

In this activity, students will demonstrate the important role of pollinators by playing a game of freeze tag where the goal of the monarchs is to distribute pollen to the "frozen" flowers so that they can live healthy reproductive lives.

- Lead students to an open area with plenty of space, preferably outside or in a gymnasium.
- Depending on the size of the group participating, assign one or two people as the taggers and one or two people as "monarchs." It may help to have the players wear something to distinguish them, such as different colors. The rest of the participants are "flowers."
- The game can be played similarly to freeze tag; however, the participants start out "frozen." Instruct all of the flowers to find a spot and do their best flower pose. They should make sure it's a position they can hold for several minutes because they must hold it until a monarch pollinates them. Upon being freed from their stance by a pollinating monarch, the goal of the flowers is to run freely and avoid the taggers. If a tagger tags them, they will go back to being frozen and in need of pollination from a monarch to be released again.
- The goal of the monarchs will be to avoid the taggers and travel to each frozen flower and "distribute pollen" (tag them). This will "unfreeze" the flowers, releasing them from their stance to move around (indicating they've been pollinated) and spread their pollen. You can incorporate a fun monarch-themed alternative to simply tagging—which will help distinguish a tag from a monarch versus a tag from a tagger—such as having the monarchs make light taps on the person's back to indicate they've been pollinated.
- The role of the taggers will be to tag the monarchs, eliminating them from the game, and to tag any flowers who have been pollinated and are now mobile (refreezing them). Students can imagine the taggers as plows or herbicides—preventing the flowers from reproducing by damaging monarch grassland habitat.
- The game ends when all monarchs have been eliminated and all flowers are frozen. The game can continue for many rounds, alternating the roles of the students.



Part 3: Discussion and Assessment

- Recap the activity by reiterating to students that those who were "flowers" needed the "monarchs" to move around. In reality, the pollen is being moved, not the flower, but without monarchs and other pollinators, the flowers would not be able to reproduce and produce fruit-bearing seeds that benefit everyone.
- Ask students to predict what would happen if these flowering plants didn't have the help of pollinators like monarchs to reproduce. As more and more land is converted for agricultural use and pesticides cover the landscape, the grasslands that contain the wildflowers and milkweed plants critical to monarchs are threatened. Without the grasslands, monarchs are forced to relocate in search of food and habitat, impacting their migration patterns, their survival, and the life cycle of flowering plants relying on them for fertilization and seed production. Since so many products we currently depend on are produced from plants that require pollination, this will also impact our food. Think of all the food products that would no longer be available!
- Share with students some suggestions of what they can do to help monarchs and their fellow pollinators. Students can plant milkweed native to their region in a garden at home or school and help provide food and habitat for monarchs. Students can also help by trying not to waste food. The increasing need for food leads to a loss of monarch habitat to agriculture. However, we can all improve our use of the food available to us by taking only the amounts we need and not wasting leftovers (you can eat them, give them away, incorporate them into another dish, or use them as compost).



Extended Learning Options

- Bees, bats, and songbirds are also pollinators affected by habitat loss. Assign a follow-up project requiring students to further research what they can do to help these species.
- Tie this activity with another from the Monarch Butterfly Toolkit such as the "Origami Butterfly Planters" arts and crafts activity. Students can design their own milkweed planters to help kickstart their garden for monarchs.
- For a more in-depth look at the impact of food production, use the Food Waste Warrior Toolkit to lead students on a mission to determine the amount of food waste in their own school.
- Use a tablet or smartphone (if available) to download the WWF Together app. Encourage students to explore the monarch segment. They can play a game that matches their speed against that of flapping monarch wings.
- Start a class fundraiser to protect monarchs and other wildlife and their habitats using WWF's online fundraising tool. Learn more at worldwildlife.org/pages/fundraise-for-wwf.

Additional Background Info

You can use the information found at the links below to enhance your discussion with the class, or you may want to share some links directly with students if you determine they are grade-level appropriate.

- **Article:** Monarch Butterfly Plants: How Garden Milkweed Gives Butterflies a Boost—short article on how planting milkweed helps recharge monarchs along their migration routes
- **Article:** What Kind of Milkweed Should You Plant to Help Monarchs?—interactive tool that determines the right type of milkweed to plant based on where you live and the steps to do so
- **Web Feature:** Monarch Butterfly—WWF page featuring monarch butterfly facts, why they matter, threats, and how to help
- **Web Feature:** Pressured by the Plow—how agriculture has affected the health and wildlife of the Northern Great Plains

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Learning Activity:

Don't Treat Soil Like Dirt!

Activity Type	Lab
Focus Area	Science
Time Required	30–45 minutes during day 1, then 5–10 minutes daily for at least one week

Overview

Countless species rely on the grasslands of the Northern Great Plains for habitat, food, and water, including black-footed ferrets, bison, monarch butterflies, and humans. A key element of the health of this ecosystem is its characteristic vegetation—the grassy plants that cover grasslands thrive in the environment's rich soil. Grassland soil serves a variety of functions, including the capacity to store large amounts of water. If the properties of this soil were to change, a domino effect would result in the inability of plants, and the species dependent on those plants, to thrive. In this science lab, students will grow grass in varying soil compositions and observe differences in water absorption and the resulting health of the grass. Students will then use their findings to draw conclusions regarding the importance of caring for our grasslands.

Objective

At the completion of the activity, students should be able to:

- Complete a science lab report requiring them to observe and record results.
- Define characteristics and benefits of healthy soil.
- Describe the connection between soil, grasslands, and species health.



Landscape photographs of Rockhills Ranch, Lowry, South Dakota.

Subject and Standards

Next Generation Science Standards

- 3-LS4-3 Biological Evolution: Unity and Diversity
  - Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- 3-LS4-4 Biological Evolution: Unity and Diversity
  - Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
- 5-LS1-1 From Molecules to Organisms: Structures and Processes
  - Support an argument that plants get the materials they need for growth chiefly from air and water.
- 5-ESS3-1 Earth and Human Activity
  - Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment.
- 3-5-ETS1-3 Engineering Design
  - Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.



Coming in for a landing, a monarch butterfly joins a honeybee to feed from a patch of goldenrod in Iowa, United States.

Materials Needed

- Copies of student handout (included in this activity)
- Pencils
- Permanent markers
- Thumbtack
- Clear cups of two different sizes (preferably 16 ounces and 12 ounces)
- Soil (rich, dark in color, moist texture)
- Dirt (silty, light in color, sandy texture)
- Mulch
- Grass seedlings
- Water



Monarch butterfly at the El Rosario Sanctuary located within the Monarch Biosphere Reserve, Mexico.

Vocabulary

- **Agriculture:** the process of farming soil, producing crops, and raising livestock
- **Climate change:** a change in climate over time due to natural causes or human activity
- **Ecoregion:** a large area of land or water that has distinct species, biological communities, and environmental conditions
- **Ecosystem:** the living (plants, animals, other organisms) and nonliving (air, water, soil) components of an area that interact with each other in an interconnected way
- **Grassland:** a landscape (also known as a prairie) that has too little rain for trees to grow in great numbers but instead has grass and grass-like plants that grow close to the soil
- **Habitat:** a natural environment in which plants and animals live, breed, and get their food, water, and shelter
- **Habitat loss**: the disappearance of natural environments (required for plants' and animals' survival) due to harvesting for human consumption and/or clearing to make way for agriculture, housing, roads, pipelines, and other forms of industrial development
- **Herbicide:** a chemical substance used to destroy or stop plant growth
- **Pollution:** the act of contaminating an environment, especially with man-made waste
- **Runoff:** the portion of precipitation on land that ultimately reaches streams
- **Sustainable:** of, relating to, or being a method of harvesting or using a natural resource so that the resource is not depleted or permanently damaged; an effective and innovative way to efficiently use natural resources and ensure their continued supply



Activity Procedure

Part 1: Introduction and Preparation

- Ask students if they're familiar with the Northern Great Plains and its location. The Northern Great Plains is considered an ecoregion (see definition in vocabulary section) because it is a distinct habitat that provides for defined characteristic species. The bulk of the grasslands that make up the Northern Great Plains extends over five US states (Nebraska, North Dakota, South Dakota, Wyoming, Montana) and two Canadian provinces (Saskatchewan and Alberta). If possible, use a map to show students the area encompassed by the Northern Great Plains.
  - The Northern Great Plains primarily consist of grasslands, which provide many benefits to species and humans. The grasses continue to grow while being nibbled on; hence the grasslands are home to many grazing species, including over 300 species of birds, 220 species of butterflies, and 95 species of mammals. When grazing by these species is balanced with new growth, healthy vegetation is maintained, allowing the ground to absorb more water. Grasslands are also important because the roots of these grasses can store massive amounts of carbon, an element found in nature and living things but when released in excess, can contribute to climate change. Grasslands also provide water storage—one acre of intact, unplowed, healthy grassland is believed to store thousands of gallons of water that would otherwise be lost, but instead provide for millions of people and animals.
- Introduce students to one of the biggest environmental threats currently facing the Northern Great Plains: loss of grassland habitat to allow for more agriculture. Native grasslands are being plowed, treated with herbicide chemicals, and converted to farmland to produce crops like corn and soy for the growing population. While it is important for us to produce food, talk to your students about how these agricultural practices could be harmful to the ecosystem:
  - Water—Without the thick, grassy vegetation to pull moisture into the soil, the soil can't capture as much water.
  - Carbon—When grasses that have stored carbon in their roots get cut down, that carbon is released into the atmosphere and contributes to climate change.
  - Habitat—Wildlife, including monarch butterflies, lose critical habitat and will relocate or perish in the process.

When land is modified in this way, those changes affect the soil's ability to do its job. Soil plays a huge role in the overall health of any environment; without healthy, functioning soil, there won't be healthy plants or animals. Not only does soil provide the stability, water, and nutrients that grasses need to grow, there is more biodiversity in one teaspoon of soil than throughout all terrestrial land, which means there are more things living underground than above ground. One way you can tell if soil is suitable to provide for species is to determine how well it can absorb water.

Part 2: Activity

Students will perform an experiment that monitors water capture and storage in different soil samples. This will allow them to understand the benefits of natural, healthy soil for living things and ecosystems.

- Determine whether students will work independently or in groups. Each student/pair/group will need two large (16-ounce) clear cups and two smaller (12-ounce) clear cups for the soil cup samples. Using the thumbtack, carefully poke several holes into the bottoms of the 12-ounce cups only. It may help to prepare the cups ahead of time before handing them out to the students.
- Distribute all materials to students including copies of the lab report found at the end of this activity, samples of both soil types, the cups (four in total), grass seedlings, and permanent markers.
- Instruct students to label their large cups using their permanent markers—one marked "Soil #1" and one "Soil #2." Students should also write their names on their large cups.
- Have the students fill their two smaller cups—one with the rich soil and one with the dirt. They should put enough soil/dirt in the cups so that they're approximately one-half to three-quarters full. Then, take a pinch of grass seedlings and push them down into each sample, approximately ½–1 inch below the surface.
- If the rich soil sample did not already contain additional organic material such as leaves or twigs, students should place a small amount of mulch to cover the top layer of their rich soil sample only. The mulch represents the nutrients that exist naturally in grassland soil, due to the vast root structure that lives and decays underground. These roots contribute to the health and stability of the soil underground, providing for all of the living plants, in a way that's similar to how mulch contributes above the ground.
- Lastly, students should place each of the smaller cups inside of the larger cups—placing the rich soil cup into the large cup labeled "Soil #1" and the dirt cup inside of the "Soil #2" cup. Have them place their two cups in a sunny location in the classroom or outside.

- Set aside time every day for at least one week to have students water their two samples (staying consistent and using the recommended amount of water each time according to the directions on the seedlings). Students should record their observations each day on their lab sheet. They should take note of both the differing water amounts that seeped into the bottom cup and the growth of each of their grass samples.



Part 3: Discussion and Assessment

- After a week of collecting data, hold a class discussion that allows students to compare their results from the two samples. Be sure to have students share observations about their soil, the amount of water that ended up in the larger cup, and the health of their plants. Soil sample #1 (the rich soil) should have had more water pass through it than soil sample #2 (dirt). Sample #1 represents the type of soil that exists in a healthy grassland ecosystem—one that can hold and store water, allowing vegetation to thrive. Sample #2 represents the soil once the land has been changed and/or overused—in the case of the grasslands of the Northern Great Plains, such changes often occur because the grasses are removed in order to plant crops.
- Discuss with students other factors that could impact soil health.
  - In addition to grasses being removed to make room for crops, herbicides are applied to protect the crops. These chemicals can seep into the soil and surrounding areas, poisoning many life forms that come into contact with it underground or above ground. When it rains, herbicides can also end up as runoff—washed away and polluting nearby waterways that people depend on.

  - Grassland soil is also heavily impacted by climate change. The increasing temperatures and extreme weather events are impacting the soil's ability to hold moisture. This affects the plants that can grow, which in turn affects the ability of wildlife that depend on those plants to survive.

- Share with students what WWF is doing to help protect grasslands like those in the Northern Great Plains.
  - WWF works to bring together communities and governments to restore the region by expanding conserved habitat and protecting the species that rely on it. WWF is also working with farmers to establish more sustainable methods without such a high impact on the environment. Incorporating more natural ways of managing the landscape—involving less plowing, less herbicide use, and less water loss—is beneficial for both people and the wildlife that depend on this region.

Extended Learning Options

- Students can include additional soil samples in their experiment to observe other properties of varying soil compositions. You might also have them record observations for two weeks, instead of one, in order to draw an even more accurate conclusion.
- Introduce students to sources of error that could account for varying results. Students should become familiar with recognizing outliers in their experiment conclusions. An example might be the amount of water or sunlight the plants received.
- Encourage students to research other animals impacted by grassland conversion, such as black-footed ferrets, pronghorn antelope, bison, swift fox, the mountain plover, the greater sage-grouse, and the yellow bumblebee.
- Connect this activity with another from the Monarch Butterfly Toolkit, such as "The Great Monarch Migration" social studies activity, for students to learn more about the importance of grassland ecosystems.
- Lead the students in an activity from the Food Waste Warrior Toolkit so they can understand how they can help the environment and make a difference in their own school cafeteria.
- Use a tablet or smartphone (if available) to download the WWF Together app. Encourage students to explore the monarch segment to learn more about the impact of food production on butterfly habitat.
- Start a class fundraiser to protect monarch butterflies and other wildlife and their habitats using WWF's online fundraising tool. Learn more at worldwildlife.org/pages/fundraise-for-wwf.

Additional Background Info

You can use the information found at the links below to enhance your discussion with the class, or you may want to share some links directly with students if you determine they are grade-level appropriate.

- **Article:** Exploring the Inner Workings of the Northern Great Plains—provides a colorful breakdown of the ecological, social, and economic workings of the Northern Great Plains
- **Article:** Animals of the Northern Great Plains—short bios of other animals dependent on this rich ecoregion
- **Video:** Rangelands Alive!—a beautiful video showcasing some of the species of the Northern Great Plains
- **Video:** Healthy Grasslands, Healthy Wildlife—shows a similar experiment WWF scientists performed to test the water absorption abilities of varying grassland terrain
- **Web Feature:** Northern Great Plains, USA & Canada—webpage of WWF International highlighting the key features of the ecosystem and why it's at risk
- **Web Feature:** Northern Great Plains—outlines the importance of the Northern Great Plains and what WWF is doing to help

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A monarch butterfly colony overwinters in Michoacán, Mexico.

Photos: page 1 © Day's Edge/WWF-US; page 2 © Morgan Heim/Day's Edge Productions/WWF-US; page 3 © Eric Rock/Natural Habitat Adventures; page 7 © WWF-US/Keith Arnold; page 9 © naturepl.com/Ingo Arndt/WWF-Canon; all others © istockphoto.com

Name: _____ Date: _____

Don't Treat Soil Like Dirt!

Student Lab Sheet

Observe and record the status of your soil samples after watering them each day. Pay special attention to the amount of water in the large cup and the growth of your grass.

Day	Soil Sample #1		Soil Sample #2	
1	Picture:	Description:	Picture:	Description:
2	Picture:	Description:	Picture:	Description:

MONARCH BUTTERFLIES

Name: _____ Date: _____

Day	Soil Sample #1		Soil Sample #2	
3	Picture:	Description:	Picture:	Description:
4	Picture:	Description:	Picture:	Description:

MONARCH BUTTERFLIES

Name: _____ Date: _____

Day	Soil Sample #1		Soil Sample #2	
5	Picture:	Description:	Picture:	Description:
6	Picture:	Description:	Picture:	Description:

Name: _____ Date: _____

Day	Soil Sample #1		Soil Sample #2	
7	Picture:	Description:	Picture:	Description:

Conclusion

Which soil do you think would be best to have in grasslands, and why?

Learning Activity:

The Great Monarch Migration

Activity Type	Geography and map creation
Focus Areas	Social studies, science
Time Required	30–45 minutes

Overview

The nearly 3,000-mile journey that monarch butterflies make during their migration is one of the most incredible behaviors observed throughout the animal kingdom. To gain a deeper understanding of the migration route and its impact on the monarch butterfly, students will create a map that tells the story of this long journey. If technology allows, students can participate in an interactive game on the WWF Together app to learn about a monarch's stamina, and test their own speed against that of fluttering monarch wings.

Objective

At the completion of the activity, students should be able to:

- Map the migration route of monarchs, including the areas they travel between and stops they make along the way.
- Describe the threats to monarchs' migration patterns and how these threats affect their population.
- Explain the importance of monarch migration and what we can do to help.



A monarch butterfly on a roost tree in Michoacán, Mexico.

Subject and Standards

C3 Framework for Social Studies State Standards

- D2. Geo.1.3-5: Construct maps and other graphic representations of both familiar and unfamiliar places.
- D2. Geo.2.3-5: Use maps, satellite images, photographs, and other representations to explain relationships between the locations of places and regions and their environmental characteristics.
- D2. Geo.3.3-5: Use maps of different scales to describe the locations of cultural and environmental characteristics.

Next Generation Science Standards

- 3-LS4-3 Biological Evolution: Unity and Diversity
  - Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
- 3-LS4-4 Biological Evolution: Unity and Diversity
  - Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.
- 4-ESS2-2 Earth's Systems
  - Analyze and interpret data from maps to describe patterns of Earth's features.

Materials Needed

- Copies of student map worksheet (included in this activity)
- Pencil
- Colored pencils
- Smartphones or iPads (if available)
- Monarch Educator's Resource Guide (for reference)

Vocabulary

- **Adaptation:** changes to a plant or animal that make it better equipped to survive under the conditions of its environment
- **Agriculture:** the process of farming soil, producing crops, and raising livestock
- **Climate change:** a change in climate over time due to natural causes or human activity
- **Deforestation:** the conversion of forest to another land use or the long-term reduction of the tree canopy cover; this includes conversion of natural forest to tree plantations, agriculture, pasture, water reservoirs, and urban areas
- **Grassland:** a landscape (also known as a prairie) that has too little rain for trees to grow in great numbers but instead has grass and grass-like plants that grow close to the soil
- **Habitat:** a natural environment in which plants and animals live, breed, and get their food, water, and shelter
- **Herbicide:** a chemical substance used to destroy or stop plant growth
- **Hibernation:** a period of rest or inactivity, usually during winter
- **Migration:** the act of passing periodically from one region or climate to another for feeding or breeding
- **Near Threatened:** a species that is close to meeting the threatened classification or that would be threatened if not for conservation efforts
- **Pollination:** the transfer of pollen from male plant parts to female plant parts, resulting in fertilization, fruits, and seeds
- **Sustainable:** of, relating to, or being a method of harvesting or using a natural resource so that the resource is not depleted or permanently damaged; an effective and innovative way to efficiently use natural resources and ensure their continued supply



Activity Procedure

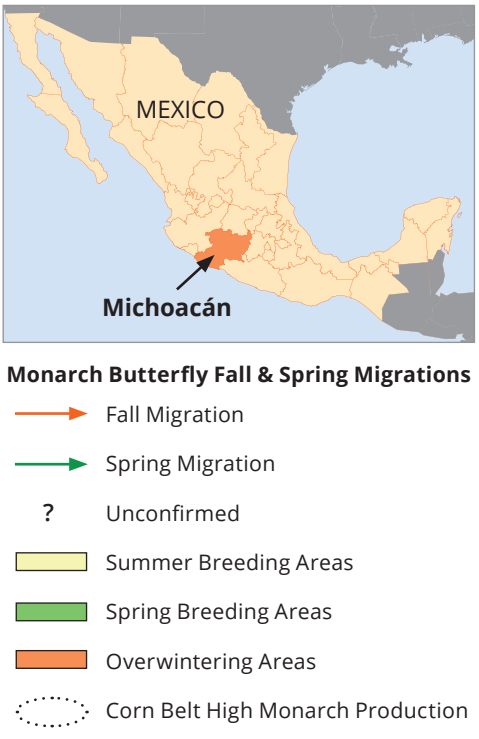
Part 1: Introduction and Preparation

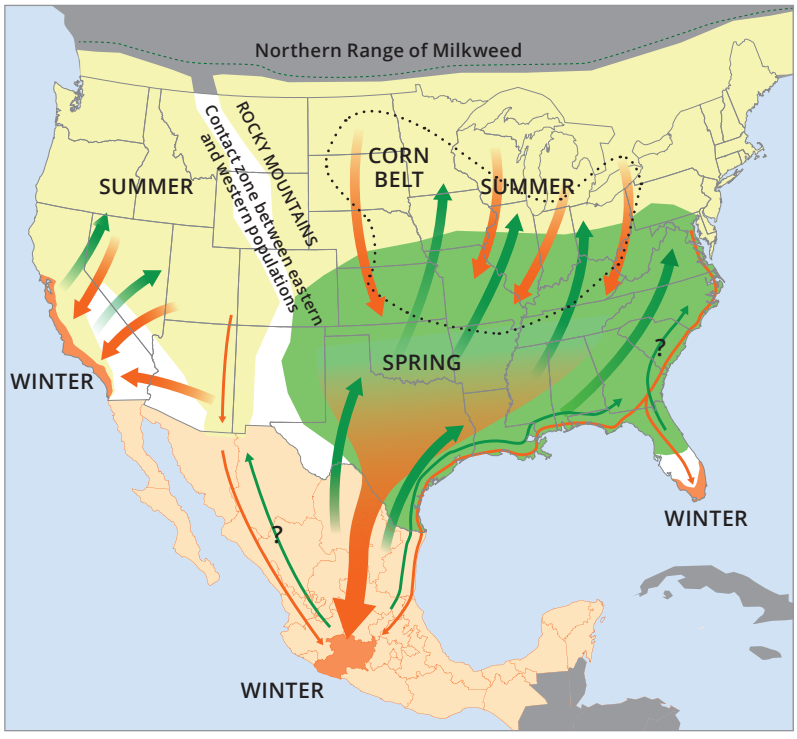
- Start the discussion by asking students to define migration. Migration is an example of an animal adaptation, a behavior passed down through generations that helps the species survive. Animals that migrate exhibit this behavior for different reasons—most often to avoid a changing climate, to look for food, or to reproduce. Encourage students to name examples of species that migrate.
- Explain to students the significance of the monarch migration. During the spring and summer months, there is a large population of monarchs dispersed throughout areas of the northern United States and southern Canada. As fall approaches, these monarchs set out on the nearly 3,000-mile journey to the forests of central Mexico that will provide them with shelter from the winter cold. The butterflies will hibernate in these forests for several months until the temperature indicates it is safe for them to emerge. Then they will begin the journey home, traveling north, stopping to reproduce along the way. What makes the migration pattern of monarchs so unique and fascinating is not only the vast distance covered, but the fact that it takes several generations of butterflies to complete the journey from start to finish in one year. This means that each butterfly is traveling a route that it has never seen before and that the butterfly completing the cycle by arriving back home is several generations beyond the original butterfly that began the journey. Describe to the students this migration route taken by many monarchs so they fully understand the concept. It may help to display your own map and refer to it while explaining.
  - First leg: Fall is approaching, temperatures are dropping, and monarch butterflies throughout the northern United States and southern Canada are heading out on a long journey. This generation of butterflies is responsible for traveling all the way to the forests of the Monarch Butterfly Biosphere Reserve in Michoacán, Mexico, to hibernate in Mexico's warm climate and avoid the harsh cold of winter. Once their winter hibernation is over and temperatures indicate spring has arrived, typically by March, these butterflies will awake and begin the journey north.
  - Second leg: As this generation of butterflies heads north, they will stop to eat and reproduce along the way, laying eggs along milkweed plants. This generation lives the longest, about seven or eight months, hence why they're referred to as the "super generation". After a few weeks of traveling north, these butterflies reach Texas and die, leaving a new generation to emerge from their eggs and continue the journey north.

– Third leg: This next generation of butterflies will continue to travel north for about four to five weeks, stopping in various states along the way to eat and lay eggs, before eventually dying. Their offspring will emerge and continue the journey from where their parent butterflies left off for approximately four to five weeks before dying.

– Fourth leg: This pattern happens one or two more times, resulting in a fourth or fifth butterfly generation completing the last leg of the journey to areas of the northern United States and Canada where they rest and reproduce during the warm months. One of the most popular areas for monarchs during the summer is the grasslands of the Northern Great Plains, spanning Nebraska, North Dakota, South Dakota, Wyoming, and Montana in the United States, as well as Saskatchewan and Alberta in Canada. These grasslands provide ideal habitat for monarchs to feed and lay eggs.

- Emphasize to students the relevance of this monarch migration to people. Monarchs are pollinators, responsible for transporting pollen between flowering plants, fertilizing them. The plants then produce seeds and fruit, all of which humans use to make various food products. Without monarchs and other pollinators, a lot of the food we routinely depend on would not exist. It's important for monarchs to complete their migration cycle with the necessary habitat to reproduce and continue their role of pollinating.





Part 2: Activity

In order to understand the geographical significance of the monarch's efforts, students will create maps that chart the butterflies' migration pattern.

- Distribute the student map handout included in this activity, as well as coloring utensils, to each student.
- Now that they are familiar with the migration pattern of monarch butterflies, instruct students to be creative and incorporate the information to illustrate this route on their map. Their maps should include the following:
  - Michoacán, Mexico, the location of the Monarch Butterfly Biosphere Reserve and the place where many monarchs spend their winters
  - The states and provinces that comprise the Northern Great Plains, where many monarchs spend their summers (Nebraska, North Dakota, South Dakota, Wyoming, and Montana in the United States; Saskatchewan and Alberta in Canada)
  - The migration steps discussed at the beginning of the activity, showing the multiple generations of monarchs and the directions they travel, estimating the distance covered by each as they complete their leg of the journey
  - A legend, including symbols to represent the directional flying routes, seasons, the monarchs themselves, forests, grasslands, etc.



Colony of monarch butterflies overwintering in Michoacán, Mexico.

Part 3: Discussion and Assessment

- Although monarchs themselves are not considered an endangered species, their migration route is classified as near threatened by the International Union for Conservation of Nature due to habitat loss in both Mexico and the United States. Unsustainable use of forests in Mexico, including conversion for agriculture and illegal logging, has diminished the region's forested areas. In the United States, grasslands are also converted for agriculture and are treated with herbicide, eliminating monarch caterpillars' primary food source (milkweed) and disrupting the butterflies' ability to reproduce. Share with students what WWF is doing to help restore monarch migration routes and ways they can help too.
  - WWF is helping educate people on the importance of these forest and grassland regions and is encouraging sustainable forestry and agriculture. By adopting more efficient ways of using our natural resources, people can continue to rely on forests and grasslands, but in a way that doesn't harm species and their habitats.
  - Students can help monarchs by planting milkweed native to their region in a garden at home or school. This will provide monarchs with a place to lay their eggs and will provide a food source for emerging caterpillars along the monarchs' migration journey.
  - Everyone can help by changing the way they think about food. The increased demand for food has resulted in the loss of much of the land that monarchs rely on. By limiting the amount of food we put on our plates, as well as consciously repurposing leftovers, we can make a big difference for monarch habitat.
- Ask students to consider other possible threats to monarchs in addition to habitat loss. Monarchs are sensitive to temperatures and cannot fly if their body temperature is less than 86 degrees. To warm up, they will try to sit in the sun or "shiver" their wings. Challenge students to think of reasons why it's important for monarchs to be able to fly and how effects of climate change (fluctuating temperatures, irregular rainfall and humidity, and increased extreme weather events) may affect their ability to fly, ultimately impacting their survival. You can find more information on threats to monarchs in the Monarch Educator's Resource Guide.
  - If technology is available, have students explore the monarch segment of the WWF Together app. Encourage students to participate in the interactive challenge to understand the stamina and effort monarchs must exert to complete their migration. Monarchs flap their wings five to 12 times per second, approximately 720 times per minute. Understanding the distance these butterflies travel, combined with how quickly they must flap their wings, students can imagine how hard monarchs must work in order to complete their migration!

Extended Learning Options

- Rather than use the attached student handout, you may choose to provide students with blank paper for them to draw their own outline of North America.
- Suggest that students incorporate the monarchs' role of pollination in their maps as well. This could be represented by a symbol in the states the butterflies visit in the spring and summer. In addition, you may choose to have students label each state in the United States, specifying with a designated color the ones where monarchs are found throughout their journey.
- Encourage students to research other migration routes of monarchs. The most frequently observed route is from their hibernation forests in Michoacán, Mexico, to areas spread throughout the northern United States and southern Canada. However, there are populations of monarchs known to travel other routes, including to areas of southern California. Students can also research the migration patterns of other species and compare them to those of monarchs.
- Tie this activity to another from the Monarch Butterfly Toolkit, such as the "Origami Butterfly Planters" arts and crafts activity or the "Flutters and Flowers" game to have students learn more about the importance of monarchs and how to help them along their migration route.
- For a more in-depth look at the impact of food production, use the Food Waste Warrior Toolkit to lead students in a project to determine the amount of food waste occurring in their own school.
- Start a class fundraiser to protect monarch butterflies and other wildlife and their habitats using WWF's online fundraising tool. Learn more at worldwildlife.org/pages/fundraise-for-wwf.

Additional Background Info

You can use the information found at the links below to enhance your discussion with the class, or you may want to share some links directly with students if you determine they are grade-level appropriate.

- **Article:** Extreme Weather Threatens Monarch Butterfly Habitat—describes the impacts of climate change on the forests of Mexico
- **Article:** Monarch Butterflies and Climate Change—a report that assesses the vulnerability of monarch butterflies to the resulting effects of climate change
- **Article:** As Monarch Butterflies Lose Ground in Mexico, WWF Seeks Solutions in America's Heartland—touches on the work of WWF to restore the grasslands of America's Northern Great Plains

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Name: _____ Date: _____

Mapping Monarch Migration

Use what you've learned about monarch migration to show the steps of their round-trip journey on the map below. Remember to include a legend that defines every symbol you use.

