



## Monarch Butterfly Research

**Subject:** Science / **Grade Level:** / 6<sup>th</sup>-8<sup>th</sup> grade

### **Materials:**

- One notecard per student, a ball of string or yarn, pen or marker, tape
- Technologies such as computers, laptops, iPads, etc.
- Books
- Magazines/Journals
- <http://dnr.mo.gov/education/monarchs>

### **Vocabulary:**

**Abiotic:** a term applied to non-living physical or chemical factors in the environment such as air, water, and soil

**Biotic:** a term applied to living components in the environment such as humans, plants, birds, microorganisms, and insects

**Climate:** the average weather or the regular variations in weather in a region over a period of years

**Deforestation:** the action or process of clearing trees or forests

**Habitat:** an environment where humans, animals, and/or plants grow and live

**Herbicide:** a pesticide used to kill unwanted plants leaving the desired crop relatively unharmed

**Migrate:** to move from one habitat or environment to another in response to seasonal changes and variations in food supply

**Native Species:** a plant or animal that originates from a particular area

**Weather:** the state of the atmosphere at a location and time

### **Essential Learning Outcomes:**

Students will be able to:

- Construct an argumentative writing piece to support an explanation to the changes to a population in an ecosystem caused by disruption to a physical or biological component of that ecosystem.
- Use empirical evidence and scientific reasoning to support an argument.

### **Lesson Objective(s):**

Students will know that:

- Ecosystems are dynamic in nature
- The characteristics of ecosystems can vary over time

Students will understand that:

- Disruptions to any physical or biological component of an ecosystem can lead to shifts in all the ecosystem's populations.
- Evaluating empirical evidence can be used to support arguments about changes to ecosystems.

### **ENGAGE: (String Activity) Access prior learning / Stimulate interest / Generate Questions**

#### **Have students participate in the interactive string activity:**

Materials: one notecard per student, a ball of string or yarn, pen or marker, tape

Task: Place cards on the table and let everyone pick an aspect of the environment that they would like to be. Options could include but are not limited to water, soil, the sun, a bee, a flower or many other things. Each person should play a different role. Use an index card to label what your role is.



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One person should hold the end of the string and pass the ball of string to another student in the circle with whom she can be “related.” The first person will then explain to the whole group what the relationship is to the person to whom they have just passed the ball of string. If students have trouble identifying the relationship between the aspects of the environment, be sure to scaffold (support) them to help them achieve the answer.

For example, the daisy student holds the end of the string. She passes the ball to the “water” student and says, “I need water to grow.” The “water” student takes hold of the string, passes the ball to the “fish” student and says, “I am your home.” This activity continues one move at a time, showing relationships in the circle. Students may end up holding several portions of the string that are connected to many different things.

Pose questions to the students: “What would happen if one part of the environment was removed?” Test the prediction. As a group, pick one person to let go of the string. Which part(s) of the environment would you *not* want to release the string? Which parts seem to be the most important for maintaining the relationships in the circle? Look at the connections to air and water. Why are there so many? (If one part of the environment was removed, many other parts of the environment would be affected. Most students would probably agree that the students representing air and water should not release the string because these are extremely important parts of the environment. Many living things require air and water; therefore, many connections show these interactions.)

What does the circle look like? Does any living thing in the circle exist alone? Would removing mosquitoes from the circle make any difference? How? (The circle may look like a spider’s web. No living thing in the circle should exist alone. Everything is connected directly or indirectly to everything else. If mosquitoes were removed from the circle, some birds and bats would lose a source of food. There would be one less type of organism dependent on water and air.)

Why does the string connect the earthworm and the soil? The answer is quite simple: the earthworm lives in the soil and gets its food there. The earthworm interacts with the soil. The game, wherever one part of the environment is connected by the string to another part, there is an interaction. What interaction takes place between the earthworm and the bird? What interaction takes place between the air and the soil? (The bird uses the earthworm for food. Air is an important part of soil. It provides oxygen and other gases to plants and animals that live in the soil.)

What would happen if something harmful occurs to the abiotic factors in the environment? What would happen if there was an oil spill within the waters? (The water would become contaminated and all of the animals that either live in or drink from the stream could become sick and die, which would further affect the food chain. It is a continuous cycle.)

### **EXPLORE: (Research) Concrete experiences / Describe hand-on, minds-on activities / Describe appropriate background**

Various changes in the abiotic and biotic factors of the Monarch butterflies’ environment have made an impact on their population and migratory patterns. It is the students’ job to identify changes in the environment that have affected, are affecting, or may affect the butterflies. After they have identified these effects, they must create a possible solution to help decrease the impact that the environmental changes have on the Monarch butterflies. Students should have an idea of possible things the Monarch Butterflies need for survival through the engage phase of the lesson. Within their research, students must also identify constraints to their chosen solution. Students will



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use various websites, magazines, videos, and books to conduct their research.

### **EXPLAIN: (Paper and Presentation) Focus student understanding on concepts / Brief and direct explanation of concepts, skills, or abilities**

Students will represent their findings/argument in a written format as well as create a visual representation of their work (e.g., PowerPoint, poster, model). Once completed, students will present their research findings, possible solutions, and constraints to their classmates. Through discussions and reasoning as a class, students will then determine which presented solution they think will make the most positive impact on Monarch butterflies. Not only will students choose the solution that will create the most positive impact, but they will also propose revisions that their peers' solutions could use. Like many plans that people have, they need constant revision to be effective.

### **ELABORATE: (Plant Milkweed) Confronted with a related, but new activity / Requires transfer of concepts, skills, or abilities / Student develops a deeper and broader understanding / Apply to daily life / Introduce vocabulary**

As a class, research native milkweed plants and find a location where you can buy or even pick some milkweed or milkweed seeds up for free. Then, plant native milkweed around the school or community together. If available, offer the students milkweed plants or seeds to take home and plant. After the plants are planted (if able to find actual plants) have students look for monarchs around the milkweed planted at school as well as the milkweed they possibly planted at home. Create an ongoing chart of findings located within the classroom for student viewing. Lead a discussion with students about a plan that could be utilized in the community to help out the Monarch butterfly population. It is great that there are milkweed plants within the school that they are at, but how can the class involve the community, and beyond, on helping preserve the Monarch Butterfly?

### **EVALUATE: Throughout / Used to reveal the adequacy of their understanding / New, but related activity that requires knowledge and abilities developed in the instructional sequence /**

Construct an argumentative writing piece to support an explanation to the changes to a population in an ecosystem caused by disruption to a physical or biological component of that ecosystem. The paper should be two pages in length and follow the rubric given.



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Score	4	3	2	1	NS
Purpose/Organization	<p>The response has a clear and effective organizational structure, creating a sense of unity and completeness. The response is fully sustained and consistently and purposefully focused:</p> <p>Claim is introduced, clearly communicated, and the focus is strongly maintained for the purpose, audience, and task</p> <p>Effective introduction and conclusion</p> <p>Logical progression of ideas from beginning to end</p>	<p>The response has an evident organizational structure and a sense of completeness, though there may be minor flaws and some ideas may be loosely connected. The response is adequately sustained and generally focused:</p> <p>Claim is clear, and the focus is mostly maintained for the purpose, audience, and task</p> <p>Adequate introduction and conclusion</p> <p>Adequate progression of ideas from beginning to end</p>	<p>The response has an inconsistent organizational structure, and flaws are evident. The response is somewhat sustained and may have a minor drift in focus:</p> <p>Claim is somewhat unclear, or the focus may be insufficiently sustained for the purpose, audience, task</p> <p>Introduction and conclusion may be weak</p> <p>Uneven progression of ideas from beginning to end</p>	<p>The response has little to no discernible organizational structure. The response may be related to the claim but may provide little to no focus:</p> <p>Claim may be confusing or ambiguous; response may be too brief or the focus may drift from the purpose, audience, or task</p> <p>Introduction and conclusion missing</p> <p>Frequent extraneous ideas may be evident, ideas may be randomly ordered or have unclear progression</p>	<ul style="list-style-type: none"> <li>• Unintelligible</li> <li>• Off-topic</li> <li>• Copied text</li> <li>• Off-purpose</li> </ul>
Evidence/Elaboration	<p>The response provides thorough and convincing support/evidence for the argument(s) and claim that includes the effective use of sources. The response clearly and effectively expresses ideas, using precise language:</p> <p>Comprehensive evidence from sources is integrated; references are relevant and specific</p> <p>Vocabulary is clearly appropriate for the audience and purpose</p> <p>Effective, appropriate style enhances content</p>	<p>The response provides adequate support/evidence for the argument(s) and claim that includes the use of sources. The response adequately expresses ideas, employing a mix of precise with more general language:</p> <p>Adequate evidence from sources is integrated; some references may be general</p> <p>Vocabulary is generally appropriate for the audience and purpose</p> <p>Generally appropriate style is evident</p>	<p>The response provides uneven cursory support/evidence for the argument(s) and claim that includes partial or uneven use of sources. The response expresses ideas unevenly, using simplistic language:</p> <p>Some evidence from sources may be weakly integrated, imprecise, or repetitive; references may be vague</p> <p>Vocabulary is uneven or somewhat ineffective for the audience and purpose</p> <p>Inconsistent or weak attempt to create appropriate style</p>	<p>The response provides minimal support/evidence for the argument(s) and claim that includes little or no use of sources. The response's expression of ideas is vague, lacks clarity, or is confusing:</p> <p>Evidence from the source material is minimal or irrelevant; references may be absent or incorrectly used</p> <p>Vocabulary is limited or ineffective for the audience and purpose</p> <p>Little or no evidence of appropriate style</p>	<ul style="list-style-type: none"> <li>• Unintelligible</li> <li>• Off-topic</li> <li>• Copied text</li> <li>• Off-purpose</li> </ul>
Score	2	1	0	NS	

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<b>Conventions</b>	<p><b>The response demonstrates an adequate command of conventions:</b></p> <p>Adequate use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling</p>	<p><b>The response demonstrates a partial command of conventions:</b></p> <p>Limited use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling</p>	<p><b>The response demonstrates little or no command of conventions:</b></p> <p>Infrequent use of correct sentence formation, punctuation, capitalization, grammar usage, and spelling</p>	<ul style="list-style-type: none"> <li>• Unintelligible</li> <li>• Off-topic</li> <li>• Copied text</li> <li>• Off-purpose</li> </ul>
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### Differentiated Instruction / Modifications:

- Provide prepared links and materials for students to help research native milkweed, and the things that could hurt a Monarch Butterflies' habitat. Start with the Youth Education and Interpretation [Monarch page](#).
- Acquire materials that require different levels of reading skills when students are researching native milkweed plants. Having articles at students' reading level will allow for everybody to contribute to discussion.
- Provide an outline for what should be included in an argumentative piece of writing.
- Allow students to work with a partner if needed on their paper at the end of the lesson.

### Higher Order Thinking Questions:

- How do you plan to analyze the information you find from your research?
- How can you summarize information you find?
- Can you compare multiple solutions before you choose one to write your informative piece about?
- How will you support your solution with evidence you find from research?
- How effective is your solution?
- Can you defend your solution and persuade your classmates that you have created the best solution?
- How effective do you think your solution is?
- How can you express your findings to your classmates?
- How will you design a presentation that showcases the research and solutions you have made?

### Resources:

<http://dnr.mo.gov/education/monarchs.htm> : Map of monarch butterflies' migratory path  
<http://www.worldwildlife.org/species/monarch-butterfly>: Briefly discusses threats to monarch butterflies  
<http://www.flightofthebutterflies.com/home/>: Trailer for the movie *Flight of the Butterflies*  
<http://monarchjointventure.org/>: Resource for students to use to conduct research

### Misconceptions:

- Dead organisms are abiotic factors (remain as a biotic factor)
- Ecosystems are just made up of the living aspects or biotic factors (ecosystems include the abiotic and biotic factors)

### Extensions:

Students can search for particular organizations or groups that make an impact on the Monarch butterflies' well-being. They can then conduct research on that group and what they're doing to help the butterflies, or they can figure out how they can get involved. Students can craft a plan to get the entire community involved to help make a positive impact on Monarch butterflies from researching the different organizations and groups.

### Missouri Learning Standards: Grades 6-8 [K-5 Correlations]



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### Science Grade Level Expectations:

#### Life Sciences

#### LS2 – Ecosystems: Interactions, Energy, and Dynamics

##### Concept A: Interdependent Relationships in Ecosystems

- 6-8-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on individual organisms and populations of organisms in an ecosystem. [Clarification Statement: Emphasis is on cause and effect relationships between resources and growth of individual organisms and the numbers of organisms in ecosystems during periods of abundant and scarce resources.]
- 6-8-LS2-2: Construct an explanation that predicts the patterns of interactions among and between the biotic and abiotic factors in a given ecosystem. [Clarification Statement: Relationships may include competition, predation, and symbiosis.]

##### Concept C: Ecosystem 6-8 Dynamics, Functioning and Resilience

- M-LS2-4: Constructed by and argument supported by empirical evidence that explains how changes to physical or biological components of an ecosystem affect populations. [Clarification Statement: Emphasis is on recognizing patterns in data and making inferences about changes in populations, defining the boundaries of the system, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

#### Engineering, Technology, and Application of Science

#### ETS1 – Engineering Design

##### Concept A: Defining and Delimiting Engineering Problems

- 6-8-ETS-1: Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

### Social Studies Grade Level Expectations:

#### 2. Government Systems and Principals

##### Theme 1: Tools of Social Science Inquiry

##### 6-8 Geography

- B. Analyze current human environmental issues using relevant geographic sources to propose solutions.

#### 3. Geographic Study

##### Theme 1: Tools for Social Science Inquiry

##### 6-8 Geography

- A. Create and use maps, graphs, statistics, and geo-spatial technology in order to explain relationships and reveal spatial patterns or trends

### English Language Arts Standards:

#### Writing

#### 1. Approaching the Task as a Researcher

##### A. Research [K-5 correlation W3A]

- Conduct research to answer a question, drawing on several sources; integrate information using a standard citation system.
- Gather relevant information multiple print and digital sources; assess the credibility of each source; and quote or paraphrase the data conclusions of others while avoiding plagiarism and providing basic bibliographic information for sources.



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### 2. Approaching the Task as a Writer

#### C. Development [K-5 correlation W1A, W1B, W1D, W2A, W2B, W2C]

- Argumentative: Develop argumentative writing by introducing and supporting a claim with clear reasons and relevant evidence.

#### Speaking and Listening

### 2. Presenting

#### A. Verbal Delivery [K-5 correlation SL4A]

- Speak clearly, audibly, and to the point, using conventions of language as appropriate to task, purpose and audience when presenting including appropriate volume.

### NGSS:

#### MS.Matter and Energy in Organisms and Ecosystems

**MS-LS2-4:** Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations. [[Clarification Statement: Emphasis is on recognizing patterns in data and making warranted inferences about changes in populations, and on evaluating empirical evidence supporting arguments about changes to ecosystems.]

#### MS. Interdependent Relationships in Ecosystems

**MS-LS2-5:** Evaluate competing design solutions for maintaining biodiversity and ecosystem services. [[Clarification Statement: Emphasis is on predicting consistent patterns of interactions in different ecosystems in terms of the relationships among and between organisms and abiotic components of ecosystems. Examples of types of interactions could include competitive, predatory, and mutually beneficial.]

#### MS. Engineering Design

**MS-ETS1-1:** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

**MS-ETS1-3:** Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

#### Science and Engineering Practices:

##### Engaging in Argument from Evidence

Engaging in argument from evidence in 6–8 builds on K–5 experiences and progresses to constructing a convincing argument that supports or refutes claims for either explanations or solutions about the natural and designed world(s).

- Construct an oral and written argument supported by empirical evidence and scientific reasoning to support or refute an explanation or a model for a phenomenon or a solution to a problem. (MS-LS2-4)

#### Disciplinary Core Ideas:

##### LS2.C: Ecosystem Dynamics, Functioning, and Resilience

- Ecosystems are dynamic in nature; their characteristics can vary over time. Disruptions to any physical or biological component of an ecosystem can lead to shifts in all its populations. (MS-LS2-4)

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**ETS1.A: Defining and Delimiting Engineering Problems**

- The more precisely a design task's criteria and constraints can be defined, the more likely it is that the designed solution will be successful. Specification of constraints includes consideration of scientific principles and other relevant knowledge that are likely to limit possible solutions. (MS-ETS1-1)

**ETS1.B: Developing Possible Solutions**

- Sometimes parts of different solutions can be combined to create a solution that is better than any of its predecessors. (MS-ETS1-3)

**For more information call or write:**

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