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| Local Adaptation of Milkweed – *Milkweed, a Critical Food Source for Monarchs* |
| Introduction |
| This lesson moves from the monarch population decline to the milkweed population decline. Students will engage in a discussion of milkweed and its native range. Students will also discuss what effects climate change might have on the ranges of both monarch butterflies and common milkweed plants.  This lesson plan is a component of the *EXPLORE* stage of the 5E Learning Model for the overall curriculum. |
| Objectives |
| After this lesson, students will be able to:   * identify common milkweed, its life cycle, and its parts, * identify the native range of common milkweed * describe the benefits of eating milkweed for monarchs, and * distinguish between different milkweed species and their ranges, and predict the effects of climate warming on the ranges. |
| NGSS Performance Expectations Addressed |
| Standards  Middle School:   * MS-LS1-5. Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms. [Clarification Statement: Examples of local environmental conditions could include availability of food, light, space, and water. Examples of genetic factors could include large breed cattle and species of grass affecting growth of organisms. Examples of evidence could include drought decreasing plant growth, fertilizer increasing plant growth, different varieties of plant seeds growing at different rates in different conditions, and fish growing larger in large ponds than they do in small ponds.]   Science and Engineering Practices   * Asking Questions and Defining Problems   Disciplinary Core Ideas   * LS1.B: Growth and Development of Organisms * LS2.C: Ecosystem Dynamics, Functioning, and Resilience * ESS3.D: Global Climate Change   Crosscutting Concepts   * Cause and Effect |
| Information for Classroom Use |
| Approximate Duration for the Task  30 minutes or half of a class period.  Assumptions  Students should know or be familiar with:   * Monarch butterfly anatomy, life cycle and migration patterns   Teachers should know or be familiar with:   * The scope of, and protocols for, the lab   Additional Materials Needed   * Computer with internet and projector capabilities * Lab notebooks/folders * Milkweed seedlings or cut plants can be useful supplements for station 1.   Supplementary Resources   * Monarch Joint Venture: <http://monarchjointventure.org/> * Project Monarch Health: <http://monarchhealth.wix.com/monarch> * Information on monarch-milkweed interactions: <http://monarchlab.org/biology-and-research/biology-and-natural-history/breeding-life-cycle/interactions-with-milkweed/> * *We recommend following this lesson with the Milkweed Measurement Practice Activity to help students practice the skills they will use in the lab*. |
| Classroom Task |
| Context  This lesson plan, which includes a multi-station activity, is meant to familiarize students with the plant they will be working with in their lab. Since the students may or may not have the vocabulary yet for local adaptation, explain that they will be observing the range of variation seen in common milkweed. One of the reasons we are studying common milkweed is that Malcolm, Cockrell and Brower (1989) found that most monarchs wintering in Mexico had eaten common milkweed while a caterpillar. Throughout the lab and subsequent lessons, they will learn more about the research question we are addressing- is common milkweed locally adapted, and what implications will this have on conservation efforts?  Task Components  *ENGAGE*   1. Have students watch the video of a monarch caterpillar eating milkweed: <https://youtu.be/VhLuis4vTls>. Inform the students that their lab will be focused on common milkweed, one of many milkweed species.   *EXPLORE*   1. Divide students into groups; they will rotate through three stations to learn more about milkweed. 2. Station 1- Common Milkweed Anatomy and Life Cycle 3. Station 2- Milkweed Species and their Ranges 4. Station 3-- Monarch Interactions with Milkweed   *Note: You may access the information on the internet at the link provided above. The information has been copied into a word document if you need to print/edit the information to make it accessible for your students.*   1. Allow students enough time to complete each station and check their work using the answer keys provided.   *EXPLAIN*   1. As a class, discuss the lab they will be undertaking. At this point, students should read through and complete the milkweed measurement practice guide. Teachers should assess student understanding and ability to follow the protocols before collecting data. We recommend assessing students using live plants.   *ELABORATE*   1. The “elaborate” portion of this lesson plan will be covered by completing the lab.   *EVALUATE*   1. The “evaluate” portion of this lesson plan will be covered by completing the lab. |
| Alignment and Connections of Task Components to NGSS Performance Expectations |
| Standards  Middle School:   * MS-LS1-5. *This standard is addressed by having students discuss a plants’ native range and local conditions.*   Science and Engineering Practices   * Asking Questions and Defining Problems – *This practice is addressed by students’ investigation of the research question.*   Disciplinary Core Ideas   * LS1.B: Growth and Development of Organisms – *This idea is addressed by having students learn the anatomy of a common milkweed plant and identify common milkweed.* * LS2.C: Ecosystem Dynamics, Functioning, and Resilience – *This idea* * ESS3.D: Global Climate Change – *This idea is addressed by having students discuss the possible impact of climate change on monarchs and milkweed.*   Crosscutting Concepts   * Cause and Effect – *This concept is addressed by having students discuss the possible impact of climate change on monarchs and milkweed.* |