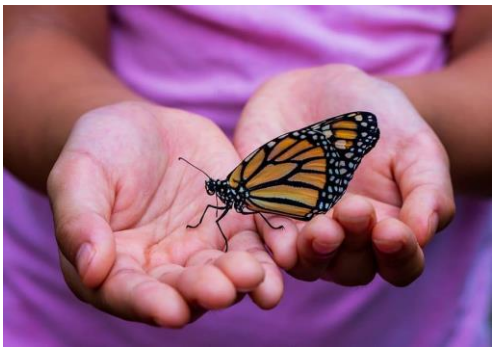

LESSON #6:

TAKING CARE OF BUTTERFLIES

SCIENCE

K- 5TH GRADE

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July 2021

INTRODUCTION

The *Genomic Logic for Underlying Morphological Divergence (EPSCoR)* project aims to bring science-related learning experiences to schools. This lesson is the last of six, designed to facilitate learning the concepts of biodiversity (lesson 1), adaptation (lesson 2), evolution (lesson 3), plant and animal structures (lesson 4), heredity (lesson 5), and the care of butterflies (lesson 6). These lessons will serve as a tool for the trainer or professional in charge of teaching (teacher, professor, among others). For participants, they can be teachers (as part of their professional development) or students.[1]

In this sixth lesson, the instructors or teachers of the elementary level, and their students, will actively participate in some activities where they will understand how to monitor the growth and care of butterflies as well as that of some plants that serve as pollinator host plants.

This lesson includes:

- ✓ Scientific background of the concepts
- ✓ Glossary
- ✓ Alignment of the content to the standards, expectations, and specificities of the Department of Education of Puerto Rico (DEPR)
- ✓ Educational Process
- ✓ Detailed activities to carry out in the classroom.

[1] Unless otherwise stated, the neutral term will be used with nouns such as teacher/s, participant/s, professor/s, instructor/s, and/or student/s.

TEACHER'S GUIDE

SUBJECT: Science **LEVEL:** Elementary (K-5)

PRIMARY CONCEPT: care of butterflies and host plants

SECONDARY CONCEPT: biodiversity, species, adaptation, evolution, plant and animal structures

PRIOR KNOWLEDGE: similarities and differences, characteristics of living beings

SPECIFIC LEARNING OBJECTIVES

Conceptual objectives:

- Monitor the growth and care of some plants that serve as host plants for pollinators.
- Record plant growth in a data table.
- Establish an action plan for plant care.
- Determine through observation how the availability of host plants attracts pollinators to the schoolyard.
- Reflect on the fragility of a species' growth and how we can care for it.
- Mention how human intervention can contribute to or affect the availability of a species.
- Recognize particular characteristics that help a species survive in a given environment.
- Describe the structures of plants (host plants) and animals (butterflies).
- Describe the phases of a plant's life cycle and the life cycle of a butterfly.
- Discuss and understand the order of events in the life cycle of butterflies.

Procedural objectives:

- Observe and identify organisms that share similar and different characteristics and belong to the same species.
- Use drawings or diagrams to explain the structural similarities between species.
- Investigate how butterflies came into being (their evolutionary history).

Attitudinal objectives:

- Value and show appreciation for nature and the diversity of life.
- Recognize the importance of caring for biodiversity.
- Reflect on the fragility of a species in order to grow and how we can care for it.

- Accept, respect, and recognize the work and ideas of others.

STANDARDS, EXPECTATIONS, AND SPECIFICATIONS:

Grade: 1st-3rd (Indicators according to content standards)

Standard: Structure and Levels of Organization of Matter

- Recognize structural similarities and differences between humans, plants, and animals (you may use drawings, sculptures, or dramatic representations).
- Make observations with the purpose of describing the structures that plants and animals need to survive and grow.
- Develop logical arguments about the fact that plants and offspring closely resemble their parents, but are not exactly the same as them.

Standard: Conservation and Change

- Interpret information related to the concept of biodiversity, emphasizing appreciation for nature and the diversity of life.
- Recognize that matter (living and nonliving things) changes over time.
- Describe patterns of change in matter.
- Recognize that reproduction is a form of conservation of living things.
- Deduce that living things change over time.
- Identify characteristics that are passed on and conserved from generation to generation.

Standard: Interactions and Energy

- Build an argument based on evidence to explain that in a particular environment, some types of organisms survive better, others live with more difficulty, and others do not survive.
- Explain how variations in characteristics among individuals of the same species offer advantages for survival, finding a mate, and reproduction.
- Describe the life cycle of organisms (birth, growth, reproduction, and death).
- Analyze and interpret data to provide evidence that plants and animals have characteristics inherited from their parents, which vary within organisms belonging to the same group.
- Explain how variations in characteristics among individuals of the same species offer advantages for survival, finding a mate, and reproduction.

- Observe plants and animals to compare the diversity of life in a variety of habitats.

Grade 4th and 5th (Indicators according to content standards)

Standard: Structure and Levels of Organization of Matter

- Mention and discuss the functional advantages of structural adaptations in living things.

Standard: Conservation and Change

- Identify ways to conserve the survival of organisms in their environment.
- Recognize that reproduction is necessary to perpetuate the species.
- Infer that reproduction allows some characteristics of species to be conserved or changed.
- Explain changes related to the form, structure, and vital functions of organisms.
- Recognize that organisms have life cycles and change over time.
- Recognize that the form, structure, and vital functions of organisms can change throughout their stages of development.

BACKGROUND

When we talk about **adaptation**, we refer to the characteristics that a species possesses that gives it the capability of survival in the environment it inhabits. A **species** is a group of organisms that share the same characteristics that can cross and produce a fertile descendance. However, individuals of one same species can show mild variations. These variations may be favorable or unfavorable. This lets the species survive in a particular environment. Depending on environmental factors, after many generations, a population can look very different. Adaptations can be **structural** or **physiological**. Butterflies are a particularly strong example of structural adaptations. These adaptations in butterflies include the way in which they use **mimicry**, **camouflage**, and even their capability to fly. Some examples of adaptations that butterflies possess are:

Camouflage = The principal structural adaptation of butterflies is in their wings and how they use them to hide. The wings of many species have evolved to imitate its surroundings, with the common green as a particularly good example. These butterflies have wings that have a color and shape that match exactly to the leaves in which they are found, which makes it more difficult for predators to find them.

Disguise and subterfuge = Many butterflies have developed “eye spots” on their wings. When their wings are open, these spots give the butterfly the appearance of a much larger creature, terrifying possible predators. In that same way, viceroy butterflies deliberately imitate the appearance of a monarch butterfly, which has evolved to be toxic upon consumption. As a result, predators avoid hunting both species. Another example that we can mention are the colors of *Heliconius*, who have red because animals associate it with a bitter taste.

Delight = Butterflies are cold-blooded creatures, which means that they need to heat their wings before taking off. That is where they are more vulnerable to predators, but it is a vital part in the progress of the butterfly. Butterflies may simply fold their wings if they overheat.

Sensibility to light = Every fourth generation of monarch butterflies migrates 2,000 miles (3,220 kilometers), traveling from as North as Canada to places to hibernate in Mexico. Monarch butterflies use their antennae to detect the basic level of light around them. This lets them know the time of the day depending on the amount of light that they can see, which also lets them stay alert.

Examples of adaptation in living beings

Species	Adaptation	How can adaptation help it survive in the environment?
Crocodiles	Digestive apparatus	Adapted to ingest a large variety of preys
Fish	Travel	It is favored by the wavelike movements of its body
Horse	Growth in size	To face prairie predators
Wolves	Development of muscles for chewing	It makes it easier to chew their prey
Anteater	Tail	It works as a coat
Mollusks	Large muscular foot	It allows them to set themselves on the sand to travel
Primates	Fingers	To collect tree branches
Butterflies	Camouflage	It allows them to imitate its surroundings with makes it harder for predators to find them

GLOSSARY

1. **Similarity** – relation among people, animals or things that have common traits.
2. **Difference** – quality that lets something distinguish itself from another thing.
3. **Species** – a group of organisms that can interbreed to produce fertile descendants.
4. **Biodiversity** – variety of organisms in our Planet.
5. **Adaptation** – traits form an animal that helps it survive in a specific environment.
6. **Structural adaptations** – adaptations that include changes in structure of some parts of the species' body.
7. **Mimicry** – structural adaptation that provides protection to an individual, letting it copy the appearance of other species.
8. **Camouflage** – structural adaptation that lets the individual blend into its surroundings. It involves the individual's change in color.

9. **Physiological adaptations** – changes in metabolic processes of an organism.

Evolution – change in inheritable traits of a population through time.

EDUCATIONAL PROCESS

This lesson is long running (it will depend on the selected plants). It is inspired by the Plant *Study-Measuring* lesson from the book *Math in the Garden* (White, Barrett & Kopp2006, pp. 64-67). The teacher should inform students that the plants used in this lesson are examples of host plants that attract pollinators, in this case, *butterflies* (although they can attract bees and other insects). The teacher should study or investigate how to care for the selected plants to guide students in this lesson. It is suggested to have plants available for students to begin their research. Examples of digital material to know the plants and butterflies can be:

http://www.learnaboutbutterflies.com/North%20America%20-%20Agraulis%20vanillae.htm

http://www.butterfliesofcuba.com/agraulis-vanillae---gulf-fritillary.html

http://www.projectnoah.org/spottings/15940311/fullscreen

http://www.mariposapedia.com/mariposa-cebra/

http://www.uprutuado.edu/sites/default/files/documents/tecnologia-agricola/zebrabrocure.pdf

http://www.floridanaturepictures.com/butterflies/butter.html

BEGINNING

1. Every organism has needs or requirements to be able to live. Habitat and food are vital for the development and maintenance of all species.
2. The teacher should explore the prior knowledge students have about the care and needs of a butterfly.
3. The teacher asks the students “What materials do we need to have butterflies in our schoolyard?”
4. Students can mention:
   a. plant flowers
   b. prepare a garden
   c. reproduce the plants that feed caterpillars
   d. once caterpillars become butterflies, take care of them

   5. The teacher uses the following question to move on to the development of the activity: “Do you know what a host plant is?”

DEVELOPMENT

1) The teacher begins the class by explaining what a host plant is and showing the host plants selected to work the activity. The teacher explores whether students can recognize them.
2) Students will be told that they will take care of the plants for 10 days and will write down observations of how the plant will develop.
3) The teacher will form working groups (depending on the available plants). Each group can have a different plant. They will be given an illustrated card according to the assigned plant (optional).
    - ✓ It is recommended to have the plants prepared, ready for students to begin their observations. Students can also participate in the process of planting the plant if sufficient time is available.
    - ✓ Similarly, the educator can show images of the caterpillar and butterfly that benefit from this plant (see attached table).
4) In the working groups, students should describe what the host plant they are going to care for is like. This will be the #1 day of observation.
5) Observations should be in a table (see **Worksheet #1: Plants for butterflies)** and should include: number of leaves, presence or absence of flowers, height (in centimeters, cm), other observations.
    - ✓ In the column of other observations, students can write whether the plant lost leaves, whether new leaves grew, and any other type of observation.
    - ✓ If students are at the K-3 level, they must use the **Worksheet #1** of their level.

6) Then, make the observations corresponding to the day #2. Write down the observations in the **Worksheet #1: Plants for butterflies.**
7) The educator will remind students that every day at some available time in the class, they must continue with observations of their plants until the day #10 of the observations are complete.

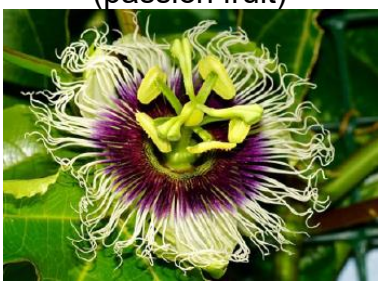
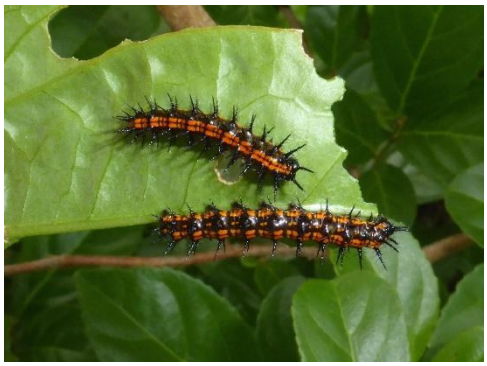
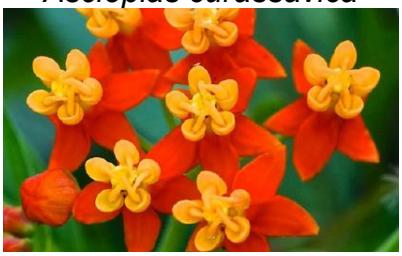
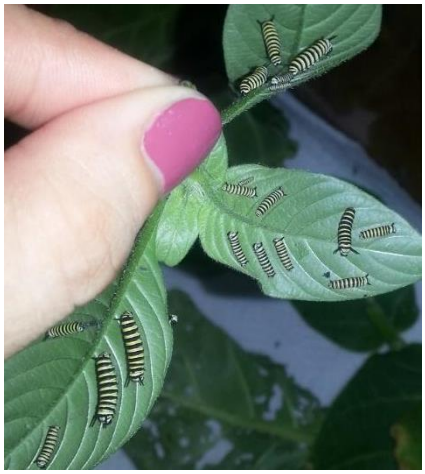
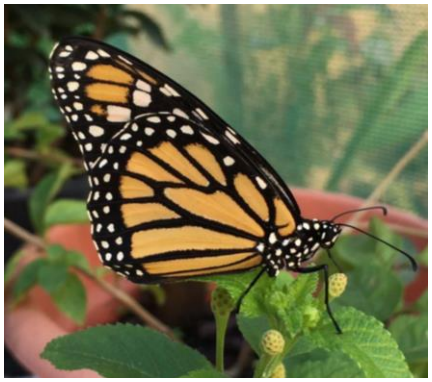
CLOSURE

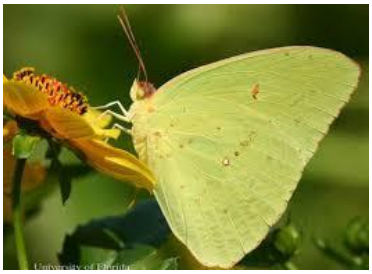
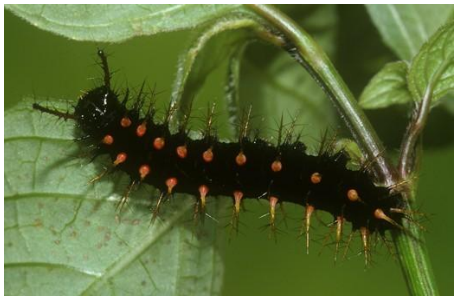
In this activity the student recognizes the human actions that allow or do not allow to protect biodiversity, in this case host plants and butterflies.

1. The teacher gives several students pictures in which various human actions are presented that allow or do not allow the protection of the species of host plants and butterflies studied in the class.
2. The teacher writes on one side of the board "**Actions that protect biodiversity**" and on the opposite side of the board **"Actions that do not protect biodiversity.**"

3. The teacher asks students to look at the pictures their classmates have. In consensus, they observe each sheet and explain whether or not the action represented allows the protection of biodiversity.
4. The teacher can ask the students to present a solution or alternatives to correct the actions represented in the sheets that do not allow to protect biodiversity.

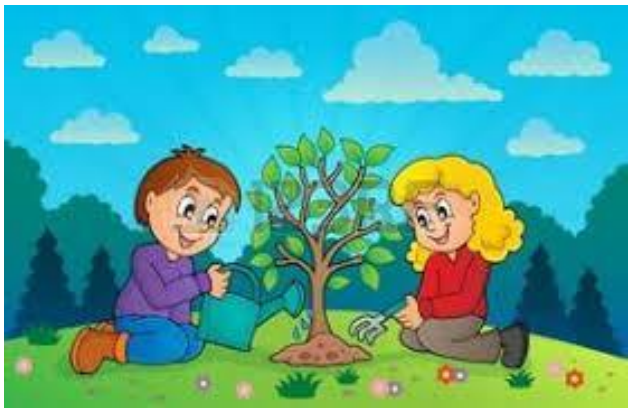
Information of the Host Plants with images of butterflies and their caterpillars

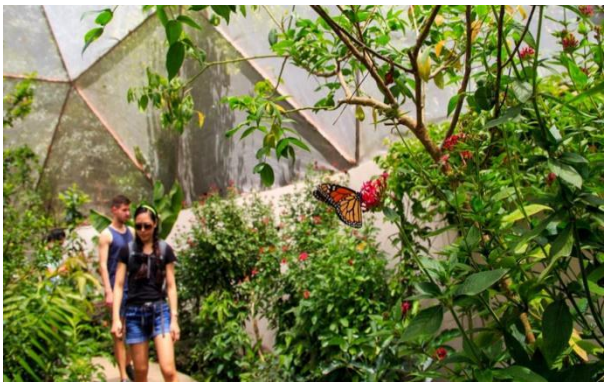
Host Plant	caterpillar	butterfly
Passiflora edulis (passion fruit) 		butterfly *Agraulis Vanillae*  Front  Back
Passiflora incarnata (Purple passionflower) 		butterfly *Heliconius charothonius* 
Asclepias curassavica  *Calotropis procera* 		butterfly *Danaus Plexippus* 

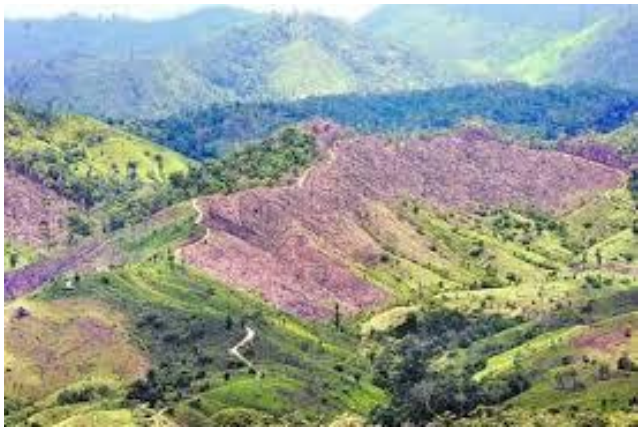
Host Plant	caterpillar	butterfly
Cassia occidentalis *(Coffee senna)*  *Cassia alata* *(Candle bush)* 		butterfly *Phoebis sennae* 
Blechum pyramidatum *(Browne's blecum)*  *Ruelia jussieuoides* 		butterfly *Siproeta stelenes* (Malachite) 

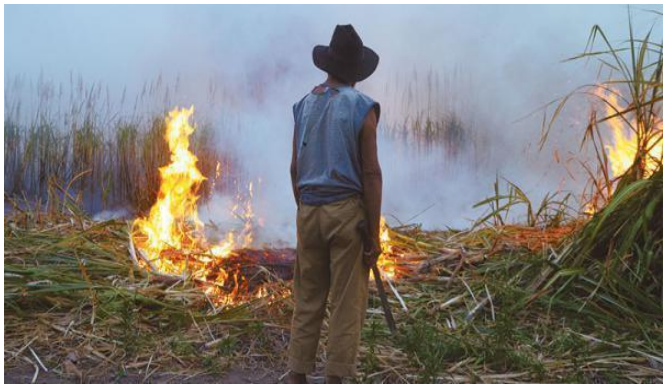
CLOSURE

Actions that allow or do not allow biodiversity to be protected.









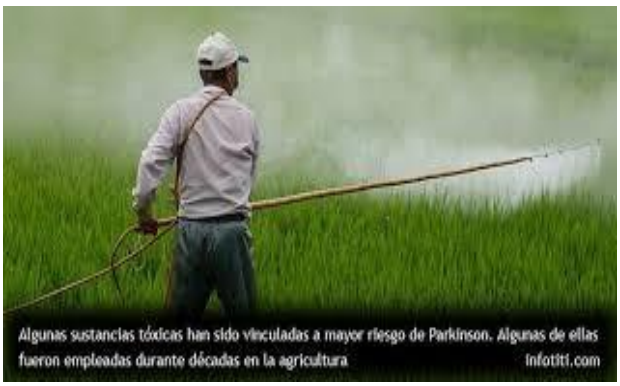

Algunas sustancias tóxicas han sido vinculadas a mayor riesgo de Parkinson. Algunas de ellas fueron empleadas durante décadas en la agricultura
infotiti.com

Image Credits

- ✓ http://www.learnaboutbutterflies.com/North%20America%20-%20Agraulis%20vanillae.htm
- ✓ Gulf Fritillary Agraulis vanillae larva 26 Jun 2016 Juragua © Tim Norriss
  http://www.butterfliesofcuba.com/agraulis-vanillae---gulf-fritillary.html
  http://www.uprutuado.edu/sites/default/files/documents/tecnologia-agricola/zebrabrocure.pdf
- ✓ Photos of caterpillars and monarch butterflies by students of the Julián E. Blanco Specialized Ballet School (School Butterfly Garden Project 2012-2017) directed by Prof. Minnuette Rodríguez Harrison.

Appendix

Guide to creating a school butterfly garden (ideas)

Worksheet #1: Plants for Butterflies
(Grades K-3)

Week #1: Plant observations (5 days)

Drawing of the plant and number of leaves	Measurement of plant height (cm)
Day #1	
Day #2	
Day #3	
Day #4	

Day #5	

Continuation:

Week #2: Plant observations (5 days)

Drawing of the plant and number of leaves	**Measurement of plant height (cm)**
Day #6	
Day #7	
Day #8	

Day #9	
Day #10	

Worksheet #1: Plants for Butterflies
(Grades 4-5)

Table #1: Observations of the plant for 10 days

Days of observations	Date of observation	quantity of leaves	flowers		height (cm)	other remarks
			Yes	No		
Day #1						
Day #2						
Day #3						
Day #4						
Day #5						
Day #6						
Day #7						
Day #8						
Day #9						
Day #10						

Worksheet #1: Plants for Butterflies
(Grades 4-5)

Working Group: _____ **Date:** _____

Host plant	Important information of the host plant
Scientific name: _____ **common name:** _____ **Photo or drawing of the host plant:**	_____ _____ _____ _____ _____ _____ _____ _____ _____ _____ _____

Photos or drawings of the Caterpillar and Butterfly that benefit from this plant	
caterpillar	**butterfly**

Action Plan for the care and monitoring of host plants (example)

1) Each working group using gloves, small shovels, and soil, will prepare the pot with the selected plant (it can be more than one depending on the availability of the resource).
2) The care of the plants will depend on which plant they are working on. Each group must have (as investigated), the information necessary to take care of the host plant.
3) Prepare a sheet to collect data related to plant growth. This data will be recorded in the data table and must include: number of leaves, flowers (whether it has or not), height (in cm), among others.
4) Leave the host plant for a period of 10 days, in an area that cannot be visited by any pollinator. This time will help ensure the availability of leaves or flowers. Similarly, we must monitor the presence of pests in the plant and find the right way to eliminate them.
5) After 10 days of monitoring plant growth, students will place the plants in a certain area of the schoolyard.
6) By observing (for 1 month), they will record the possible visit of pollinators. *They will continue with the care of the plants during this time of observation*.

✓ Students can prepare a calendar and write down the days selected for observation, what occurred, what they found, etc.