Curriculum Overview

*Butterfly: Survive and Thrive* connects the lifecycle of butterflies to their natural habitat. Through a series of hands-on, minds-on activities students will not only prepare for a trip to the Desert Botanical Garden, but will expose them to a variety of butterfly conservation strategies. A concluding research-based activity brings together all their butterfly knowledge in a cohesive argument.

Learning Objectives

*Upon completion of this curriculum, students will be able to...*

- Construct a habitat based on a plant or animal’s required needs
- Observe a habitat and identify potential threats
- Explain the relationship between butterflies and plants, and how they are impacted by disaster
- Research a specific butterfly species and analyze their findings in order to formulate a conservation strategy and justify their argument

Pre-Field Trip

Explain to the students that they will be visiting the Desert Botanical Garden where they will have the opportunity to seek wild butterflies during different stages of their lifecycle as well as witnessing multiple lifecycle stages of captive butterflies. By using their senses and making careful observations, they will identify the changing threats and resources of butterflies during the different stages of their lifecycle. The following activities can be used to introduce and/or review the lifecycle and habitat of butterflies and prepare students for their field trip. These activities can be used individually or in conjunction as a mini-unit.

Classroom Bulletin Board

- *Students identify elements of a desert habitat and create a desert habitat scene on a bulletin board in the classroom.*

Clear a bulletin board in your classroom. Explain to students that they are going to collaborate as a class to turn the blank board into a desert habitat. Guide them in brainstorming elements needed for a habitat (food, safe shelter, space to raise their young, water, etc). *You may need to have them brainstorm animals that live in a desert.*
In small groups, have them brainstorm what in the desert may fulfill those needs. For example, the first group may identify mesquite seed pods as a food, while a second group may identify nectar as a food. Have these small groups create their habitat elements and add them to the bulletin board making a complete desert scene.

**Option:** Have the students gather natural objects from their home or schoolyard to add to the board.

Once all the groups have added to the board, read/evaluate this new “text” as a class. Are there any duplicates or elements that can play more than one role? Saguaro is a great example because they provide fruit to eat, boots/shelter for birds to raise their young, and shelter for a variety of animals. Examine the board for any missing elements. How many of these habitat elements do they see in their neighborhood, or how do they change in an urban environment?

**Option:** Use this board as a way to introduce or review “biotic” and “abiotic”, or the interrelationship of producers, consumer, and decomposers.

*Keep this desert habitat up until after the field trip; it can be used for the post activity as well.*

**Resources Game**

- **Students identify how changes to the environment affect the habitat and population of butterflies.**

Make sure you have adequate space to play this game; basketball courts would be ideal. Divide the students into two groups: one half will be monarch butterflies, and the other half will be the resources, and the allotted space will be their habitat.

Review what basic resources monarchs need in their habitat (milkweed for shelter and to lay eggs on, puddles to drink water and gather minerals, and flowers for nectar/food). Explain that each resource will have a different hand signal associated with it.

- Puddles for water and minerals – hands covering mouth
- Nectar flowers for food – hands covering stomach
- Milkweed for shelter and place to lay eggs – hands covering head

Send the monarchs to one end of the court/room, and resources to the other. Have each group stand with their backs to the other group. Each person makes a signal for the resource that they represent, or that they (as a monarch) need. Explain that on the count of three each student will turn around and the monarchs will walk over and partner up with the matching resource. They cannot change their resource once they turn around. Just like in nature, the resources do not move. Remind them that they should only find one matching resource, and the resource should only have one monarch (pairs or individuals, not groups).

After they have found their pair, the monarchs that found a resource should take their resource back to their starting place, while monarchs who did not find a matching resource, and resources who did not get utilized by a monarch stay put.

Spend a minute or two debriefing after the first pairing. Did the monarchs feel there was competition for resources? What would change that? What would happen to monarchs in the wild
who were looking for (insert unused resource here) when there was none to be found? Would it be sustainable for there to be (insert extra resource here)? What would happen in nature?

Reset the students with the successful pairs all being butterflies, and any unmatched students as resources. Let them play a few rounds until they start to observe patterns and develop strategies. Once they are comfortable, a natural disaster occurs. While the groups are facing away from each other, explain to the resources that one of the below habitat threats occurred.

- Fire – all the plants were burned, so no resources can be shelter or food
- Heat wave – flowers bloomed early, and there is no nectar available, so no resources can be food
- Drought – little or no rain, so no resources can be puddles/water
- Habitat loss – a road was built through a field of milkweed, so no resources can be shelter/place for eggs

Have the monarchs turn around and let them try to form as many pairs as possible. Ask the students what happened to the butterfly population? What do they think happens in nature when disaster strikes? How come the butterflies don’t go extinct?

**Option: Discuss “plasticity” and “adaptation” if appropriate.**

Continue the game and make more observations about habitat loss and resource availability.

**Sound map**

- Students will create a sound map to identify elements in their school yard habitat and evaluate if it is a good habitat for butterflies.

Students will work individually to create their own sound map of an outdoor area. Have the students sit quietly outside and close their eyes with a pencil and paper. When they hear a sound they should make a mark on their paper where they heard the noise. For instance, if it is a distant sound to the right, they should mark the far right corner of their paper. Feel free to include any or all of the variations listed below.

- Color code natural v man-made objects
- Use differently shaped marks to note different sounds
- Use different pencil weights for the volume of sound
- Sketch the object that might have produced the noise

Depending on the environment, this may take between 5-30 minutes. They do not have to mark the entire page, but it should provide an overview of the area.

When complete, have the students draw conclusions from their sound maps. Does this habitat have lots of man-made elements or is it mostly nature? What natural elements did they hear? Where there areas of the map that had more/less noise and why?

Review the lifecycle of a butterfly (egg, caterpillar, chrysalis, adult). Ask the students to think about butterflies (at each stage of the lifecycle) and what butterflies need in a habitat. Did they hear anything that would make a good habitat? Did they hear any threats? Would it be a good habitat for one stage of the lifecycle and not another? Have students form an argument as to if this area would be a good habitat, why or why not. They should use their sound map to support their argument.
Option: This could easily be adapted into two journaling assignments.

Option: This could be adapted to be a scent map. Butterflies often food and places to lay their eggs using chemosensory in addition to vision.

Post-Field Trip

Build a Butterfly

- The students will research and model a butterfly, and discuss how its appearance relates to its habitat (can be a math based activity).

After seeing butterflies during different stages of their lifecycle and in different habitats, have each student or groups of students select one of the butterflies they are likely to see from the list in the Appendix. Have them research what the butterfly looks like: color, shape, size, symmetry, etc. Ask the students to create the butterfly species they selected. This could be out of paper, paint, found objects, etc. The more challenging materials, the more problem solving and engineering required to build their butterfly. You can assess how well they observed the butterflies and their anatomy while they are building.

*Feel free to ask an art teacher to help

Option: Include math into this lesson by using graph paper and/or creating their butterfly to scale.

Once they have created their butterflies, have them share their butterfly with the class. Once everyone has presented, compare the butterflies and look for patterns. Are all the butterflies symmetrical? Why might that be? Do the butterflies have similar colors or mimicry? How would this adaptation help them to thrive in the desert environment? Are they all a similar size? Why might that be? They don’t need to have all the answers, the point is to think critically about adaptations and form and function. If there are ideas that the students can’t answer, ask them to think of how they could find the answer (experiments or places to research).

Option: If the classroom bulletin board was completed, have them post their completed butterflies on the board.

Research-Based Conservation Strategy

- The students will conduct research on a specific butterfly and use that information to construct a conservation strategy for their species.

*If the students completed Build a Butterfly, you may consider having them continue to work with the same species and/or groups. Have the student(s) conduct research to identify the following information.

- Does it have a host plant? If so, what is it?
- Does it have particular nectar plants? If so, what are they?
- What is its geographic range?
- Where does it like to take shelter? Does this change throughout its lifecycle, how so?
- What are its natural predators? Does this change throughout its lifecycle, how so?
- Is the population thriving? Why or why not?
Extension Questions:

- Is it often affected by parasitic wasps, describe?
- What natural disasters is it vulnerable to? (This may be something they need to infer)
- Does it have any adaptations (mimicry, smooth chrysalis, etc.)?

Once the students have gathered this information, have them summarize the three biggest threats to their butterfly, and then conclude what three actions could be taken to conserve their species. This presentation could be made with a variety of technology such as PowerPoint, Prezi, posting to a blog, or infographic. This technology also provides the other students the opportunity to post and collaborate.

As the students are presenting, have the rest of the class tally which host plants the butterflies require, which nectar plants are preferred, and which conservation strategies are the most frequent. Once this information is compiled, challenge the students to identify one to two conservation strategies as a class and a suggested planting list to share with their school, families, community, etc. Don't forget to challenge your students to be better butterfly stewards by implementing some of their conservation strategies.

**Option:** If the classroom bulletin board was completed, have the students add specific host and nectar plants.

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**Share your work:**

Please share your class’ conservation strategies and planting lists with the Desert Botanical Garden. You can share photos and lists by emailing formaled@dbg.org, be sure to include your school name and grade level!
Butterflies of Central Arizona

- Painted Lady (Vanessa cardui)
- Empress Leilia (Asterocampa leilia)
- Arizona Sister (Adelpha eulalia)
- American Snout (Libytheana carinenta)
- Monarch (Danaus plexippus)
- Queen (Danaus gilippus)
- Gulf Fritillary (Agraulis vanillae)
- Marine Blue (Leptotes marina)
- Gray Hairstreak (Strymon melinus)
- Sleepy Orange (Eurema nicippe)
- Cloudless Sulphur (Phoebis sennae)
- Checkered White (Pontia protodice)
- Giant Swallowtail (Papilio cresphontes)
- Pipevine Swallowtail (Battus philenor)
- Fiery Skipper (Hylephila phyleus)
- Orange Sulphur (Colias eurytheme)
- Mourning Cloak (Nymphalis antiopa)
- Bordered Patch (Chlosyne lacinia)
- Elada Checkerspot (Texola elada)
- Variable Checkerspot (Euphydryas chalcedona)
- Western Pygmy-Blue (Brephidium exilis)
- Mormon Metalmark (Apodemia mormo)
- Arizona Powdered Skipper (Systasea zampa)
- Funereal Duskywing (Erynnis funeralis)
- White Checkered-Skipper (Pyrgus albescens)
- Black Swallowtail (Papilio polyxenes)
- Desert Orangetip (Anthocharis cethura)
- Two-tailed Swallowtail (Papilio multicaudata)
- Large Orange Sulphur (Phoebis agarithe)
- Dainty Sulphur (Nathalis iole)
Butterfly Resources

Arizonensis - [http://www.arizonensis.org/sonoran/fieldguide/arthropoda/lepidoptera.html](http://www.arizonensis.org/sonoran/fieldguide/arthropoda/lepidoptera.html)
  Information on specific species in the Sonoran Desert

Butterflies and Moths of North America – [www.butterfliesandmoths.org/species_search](http://www.butterfliesandmoths.org/species_search)
  General information about butterfly species

Butterflies of America – [www.butterfliesofamerica.com](http://www.butterfliesofamerica.com)
  Images of adult butterflies and some basic habitat information

Butterflies of Southeastern Arizona – [www.nitro.biosci.arizona.edu/zeeb/butterflies/seazlist.html](http://www.nitro.biosci.arizona.edu/zeeb/butterflies/seazlist.html)
  Images of butterflies

  Lots of links to butterfly related organizations

  Information specific to monarchs including tagging, waystations, and milkweeds

Monarch Joint Venture – [http://monarchjointventure.org](http://monarchjointventure.org)
  Information on monarchs and monarch conservation

  Species specific information and planting guides

World Wildlife Fund – [www.worldwildlife.org/species](http://www.worldwildlife.org/species)
  Search by species for information

The Xerces Society – [www.xerces.org](http://www.xerces.org)
  Information on invertebrate conservation, including butterflies
Standards

Arizona State Science Standards

Classroom Bulletin Board
Third – 2.2.1, 2.2.2, 4.3.3
Fourth – 2.2.2, 4.3.1
Fifth – N/A

Resources Game
Third – 1.3.2, 2.2.1, 2.2.2, 3.1.2, 4.3.3, 4.3.4, 4.3.5, 4.4.3
Fourth – 1.3.2, 2.2.2, 3.1.2, 4.3.1, 4.3.3
Fifth – 1.3.1, 3.1.1

Sound Map
Third – 2.2.1, 2.2.2, 4.3.3
Fourth – 2.2.2, 4.3.1
Fifth – N/A

Build a Butterfly
Third – 4.4.1
Fourth – 4.4.2
Fifth – N/A

Research-Based Conservation Strategy
Third – 1.1.4, 1.2.5, 1.3.1, 1.3.2, 1.4.3, 1.4.4, 3.1.2, 4.3.3, 4.3.4, 4.3.5, 4.4.3
Fourth – 1.1.3, 1.2.5, 1.3.1, 1.3.2, 1.4.3, 1.4.4, 3.1.1, 3.1.2, 4.3.1, 4.3.4
Fifth – 1.2.5, 1.3.1, 1.3.2, 1.4.3, 1.4.4, 3.1.1, 3.1.2, 3.1.3