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Climate Change

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Animals and Climate Change (approx. 1 hour)

Objective: Students will learn how animals are uniquely adapted for their environment, and the potential detrimental effect that changing environments can have on an organism.

Materials

- Slideshow of example organisms side by side with their habitat (easy matches: a whale with an ocean image; a polar bear with a tundra landscape; a camel with a desert; etc.)
- Art supplies: coloured construction paper, googly eyes, patterned paper (scales, etc.), markers, pens, etc.
- Large poster-sized images of five major biomes: arctic tundra, ocean, jungle, desert, meadow
- Cutouts of weather-related symbols that illustrate a changing environment: a sun, a snowflake, a raincloud, etc.

Introduction (10-15 minutes)

Instructor will discuss different organisms in different biomes or habitats; why do certain organisms look the way that they do? Students will brainstorm different features that each organism has that help it live in its particular environment, such as fish having fins and gills for living in water, while a leopard or a zebra has different patterns to allow it to be camouflaged in a meadow. Students will discuss what might happen if you put an organism that is well-adapted to one area in another habitat; such as a penguin in a jungle or a lion in the ocean.

Activity (30 minutes)

Students will use the art supplies to draw their own animals for whatever habitat they pick. They will be asked to give their particular animal a useful adaptation for the biome that it lives in. Students can draw any animal they choose, or they can invent an entirely new one; the key point is that the student draws an adaptation that will help their organism live in their chosen biome. Once all the students have drawn their organism, the instructor will change some of the biomes using the weather-related symbols – desert might get a raincloud, arctic tundra might get a sun, etc.

Discussion (15 minutes)

Students will discuss how their organisms were originally adapted to their environments, and what might happen to their organisms now. Instructor-led discussion on how this reflects what is happening today with climate change. What kind of impact might climate change have on some well-known organisms?

Make Your Own Fossil (approx. 1 hour)

Objective: Students will learn about basic concepts of fossilization, and how scientists prepare and use fossils to learn about ancient ecosystems.

Materials

- Copal pieces (available from Amazon: https://www.amazon.com/Govinda-Mayan-Copal-Gold-Black-Incense/dp/B00TWVN2LC/ref=sr_1_4?crid=3HM247G44N1AM&keywords=copal+resin&qid=1560799379&s=home-garden&sprefix=copal%2Cgarden%2C119&sr=1-4)
- Sandpaper in a couple different grades (medium or coarse and fine)

Introduction (10-15 minutes)

What is a fossil? Instructor will discuss how an organism is preserved by fossilization, some different major types of fossilization (mineralization, impression fossils, casts/moulds, etc.). Students will discuss what potential information we can gain from a fossil. What did this animal look like? Building on the prior lesson, what might we be able to infer from a fossil about the kind of environment it lived in? Instructor-led discussion on changing fossils and environments over time – what can we learn, using fossils, about extinction?

Activity (20-25 minutes)

Each student will select a piece of copal and polish it themselves. They first will use a coarser-grained sandpaper, then a fine-grained sandpaper. Once they are done, the copal will resemble amber. Some pieces may have insects in them, though these are rarer; these can be highlighted to the other students.

Discussion (15 minutes)

Students will discuss how and why a scientist might prepare a fossil like they have just done. What might get preserved in amber? Why might amber be a really useful fossil to study? Some pieces may have insects inside – instructor-led discussion on why insects are a good resource to understand not only past insects but ecosystems in general.

Nature Walks (approx. 2 hours)

Objective: Students will gain an understanding of the biodiversity that surrounds them, the skills necessary for being a good naturalist, and an appreciation for and scientific curiosity about nature.

Materials

- iNaturalist app downloaded onto class iPads or phones
- Notebooks for students and writing utensils (pens, pencils, erasers, etc.)
- (for younger grades) Toilet paper tubes stapled together like binoculars
- Biodiversity scavenger hunt paper (see if you can spot at least one bird, butterfly, fly, beetle, flower, etc.)

Introduction (10-15 minutes)

Students will be instructed on basic field safety and the fundamentals of how to observe nature. What is biodiversity? How do we observe this in our own parks and green spaces? Students will discuss how to view nature respectfully and at a distance. Instructor will demonstrate iNaturalist and illustrate some of the local diversity in the area. Students will discuss the biodiversity scavenger hunt and brainstorm some of the animals and plants that they might be able to find in their park. What are some roles that common animals in the park play in the ecosystem?

Activity (1.5 hours)

Students will conduct the biodiversity scavenger hunt in a local natural area. As they progress through the park, they will mark off the animals and plants that they see on their scavenger hunt, and sketch the organisms that they see. Older students will make more detailed notes: what sort of organism do they see? How is it interacting with its environment? What are the conditions in the park? As organisms are recorded, students will make notes of their sightings on iNaturalist.

Discussion (15 minutes)

Instructor-led discussion on the diversity that they saw in the park: what groups were the most diverse? Which did they see fewest of? Did they see any evidence of human activity that was hurting the animals or plants (i.e. evident pollution, animals eating garbage, etc.)? Considering iNaturalist, why might it be important to record what we see? What does that tell us about diversity, especially in different areas and over time?

Helping Native Pollinators (approx. 2.5 hours)

Objective: Students will learn about pollination, why it is so important to humans and the ecosystem at large, and their own native pollinators and the threats they face.

Materials

- Wood planks (size contingent on how large you want the bee house)
- Wood blocks (at least 6" long, ideally a little longer)
- Paper straws
- Hammer/nails
- Handheld drill and drill bits of different sizes (pollinators range in size)

Introduction (15 minutes)

Instructor will discuss some common pollinators; students generally assume that the only pollinators are honeybees and butterflies, but mason bees, leafcutter bees, many different wasps, flies, and moths also pollinate plants. Discuss why pollination is important: why does the ecosystem need pollinators? What are some common foods that the students like that are dependent on pollinators? What are some ways that we can encourage pollinator diversity in our neighbourhoods? Highlight some ways that our current urban areas are set up to highly discourage native pollinators; lawns are analogous to deserts for pollinators, pesticides can inadvertently harm pollinators.

Activity (2 hours)

Students, with the guidance of instructor for more construction-heavy aspects, will build their own bee houses in groups. There are several different possible designs, but they all must have in common a house structure with all sides except the front covered (including the back), a sloping roof that extends over the front of the house, and several paper tubes or holes in a block of wood that serve as the bee nests.

Discussion (15 minutes)

Students will discuss how the bee house will help conserve pollinator diversity; what are some other ways that we can encourage it? Discuss planting native vegetation around the bee house, etc. What are factors that threaten diversity? What can we do as communities, not just individuals, to slow the decline?

References for building bee houses

<https://colinpurrrington.com/2018/06/mason-bee-hotel/>
<https://baynature.org/article/backyard-boarding-house/>
<https://www.foxleas.com/make-a-bee-hotel.asp>
<http://extensionpublications.unl.edu/assets/pdf/g2256.pdf>

References for local pollinator diversity

https://www.amazon.com/gp/product/0691160775/ref=oh_aui_detailpage_o01_s00?ie=UTF8&psc=1

Note: Building a bee hotel is a more difficult project, and the hotel must be managed over time to ensure that fungi and parasites don't build up in the hotel. While students love this project, it is more suitable for older grades, and especially grades where some of the supervision and management of the hotel can be delegated to groups of students.

Migration of the Monarchs

Objective: Students will learn about monarch butterflies and more broadly, insect ecosystem services, migration, and conservation.

Materials

- Monarch board game on a posterboard large enough for several students to gather around
- Plastic butterflies, one for each student (available on Amazon)
- Dice (6 sided, students use one per roll)

Introduction (10-15 minutes)

Instructor will discuss the fundamentals of monarch butterflies and their migration; students will brainstorm some possible reasons why monarch butterflies migrate and what potential threats they might face doing so. Instructor-led discussion on why monarch butterflies in North America are threatened today. Students will discuss why it matters that monarch butterflies are threatened, including a broader discussion on the importance of pollinators to ecosystems and humans.

Activity (30-40 minutes)

Students will play the monarch butterfly migration board game. Each student gets one butterfly token; the objective of the game is to complete one successful “round”, or migration. The student will roll a die and move the number of spaces indicated by the die. If a student lands on a square with a label, they follow the instructions on that square. If a student rolls more than the number of spaces required to reach the final square, they have still completed the game; their monarch butterfly has successfully completed the full migration cycle.

Discussion (15 minutes)

Students will discuss the number of threats faced by their monarch butterfly during the game. What were some non-human threats? What threats were specifically caused by human activity? Students will discuss possible ways that they can mitigate these threats, including planting native flora for monarch food, and helping conserve natural spaces for monarchs.

References for monarch butterflies and conservation

<https://www.monarchwatch.org/tagmig/>

<https://news.nationalgeographic.com/2017/10/monarch-butterfly-migration/>

https://www.fs.fed.us/wildflowers/pollinators/Monarch_Butterfly/index.shtml