THE SCIENCE OF TEACHING SCIENCE:
BIODIVERSITY

Lesson Objectives:

Students will learn how biodiversity varies in natural wetland ecosystems and how biodiversity can affect the health of wildlife. Learning will take place within the classroom and through an active-learning experience at Roberson Museum and Science Center.

Students will be able to define biodiversity and distinguish between communities with higher biodiversity compared to those with lower biodiversity.

Students will be able to identify the different kinds of biodiversity that can be found in the local wetlands and the importance of having and maintaining biodiversity.

Students will gather information about the habitat, adaptations, and biological interactions of several wetland species and compile the information into a species info sheet.

Students will be able to collect and graph scientific data.

Targeted NYS Standards:

Science – Independent Relationships and Ecosystems

Measurement and Data – Represent and Interpret Data

Reading Informational Text – Key Ideas and Details and Integration of Knowledge and Ideas

Writing – Research to Build and Present Knowledge

Speaking and Listening – Comprehension and Collaboration

Kyra D. Ricci
Department of Biological Sciences, Binghamton University, Binghamton, NY 13905
http://jhua13.wixsite.com/jhua

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BINGHAMTON UNIVERSITY
State University of New York

imagine. explore. ROBERSON Museum and Science Center

NSF

CLASSROOM ACTIVITY

Estimated time 40 minutes

Lesson Objectives

Students will learn how biodiversity varies in natural wetland ecosystems and how biodiversity can affect the health of wildlife. Learning for this session will take place within the classroom.

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Students will be able to identify the different kinds of biodiversity that can be found in the local wetlands and the importance of having and maintaining biodiversity.

Students will gather information about the habitat, adaptations, and biological interactions of several wetland species and compile the information into a species info sheet.

Required Materials

- *Amphibian Adventures: Beyond the Vernal Pool* by Nora Hines, Christina Jacob, Apurva Singh, Kathleen Lu, Emma Glembocki, and the Hua Lab.
- Animal info sheets
- Link to online survey and assessment.

Vocabulary

- Adaptation
- Amphibian
- Biodiversity
- Ecosystem
- Parasite
- Predators
- Habitat
- Wetland

Procedure

Before introducing the topic for the day and after completing the lesson, have students complete the provided survey.

Part I: Graphic Novel

Next, read chapters 1-3 of *Amphibian Adventures: Beyond the Vernal Pool* and give students the animal information sheets to fill out as they follow along. Use the book as a guide, pausing to teach concepts at the following points:

- *Cover page:* explain **amphibian.**
- *Chapter 1, Pg. 4*. Introduce that we will learn about an amphibian called the Wood Frog. We are going to learn about where they live, what they eat, and special ‘adaptations’ that they have. Explain **adaptation.**
- *Pg 7*. Ask if students can point out an **adaptation** of the Wood Frog. Clarify that hibernating and freezing is one adaptation of wood frogs.
- *Pg 8-9.* Note that February and March are passing, and the Wood Frog is still frozen!
- *Pg 10.* Ask if students can find anything that the wood frogs like to eat. Note that Wood frogs are eating insects and spiders. Instruct students to fill this out on their animal info sheet.
- *Pg 11, top.* Wood Frog mentions the ‘vernal pool.’ Explain that this is where Wood Frog lives – this is their habitat. Explain **habitat**.

- *Pg 11, bottom.* Explain **predator**.

- *Pg 14-15.* This is a map of different ecosystems - explain **ecosystem**. Note that the different labels are different ecosystems. The ecosystems by bodies of water are called wetlands - explain **wetland** why they are important. This is actually a map of a Nature Preserve in Binghamton!

- *Pg 16.* Read the Wood Frog journal entry and make sure all of the info is filled out on student info sheets. You may ask students to imitate what they think a Wood Frog sound might be.

- *Chapter 2, Pg 16.* Note that it looks like Wood Frog is going to make a friend, and that students should look out for more info on this frog as we continue.

- *Pg 25.* Note that we found a predator of the Wood Frog and the Green Frog (the heron – described in detail later in the book). Instruct students to fill this out on their info sheets.

- *Pg 29*. Read the Green Frog journal entry and make sure all of the info is filled out on the info sheets. One **adaptation** is jumping into the water when a **predator** is nearby.

- *Chapter 3, Pg 34.* Note that it looks like Wood Frog and Green Frog are going to meet another friend, and that students should look out for more info on this frog as we continue. This time, let students identify the info and write it down on their own as you read with less direction from you.

- *Pg 35*. Note night vision as another **adaptation** of Wood Frog and Green Frog.

- Pg 44. Note that we have met another **predator**. It looks like this Racoon might eat our heroes!

- *Pg 49*. Before you reveal the next page with the journal entry, check if students were able to fill out info on the Spotted Salamander.

- *Pg 50.* Flip to reveal the Spotted Salamander journal entry and make sure all of the info is filled out on student info sheets.

Finish the chapter and set the graphic novel aside for now. You can mention that students will get a chance to read more about our friends Wood Frog and Green Frog and their adventures later.

Part II: Biodiversity Discussion

Next, switch to teacher-directed instruction.

- Begin by discussing that we met a lot of different animals, which all contribute to what we call **biodiversity**. Explain that ‘bio’ means life and ‘diversity’ means different kinds of things, so scientists use this word to describe the variety of life on earth. Explain to students that lots of different kinds of animals together **is** biodiversity, while lots of one kind of animal is **not** biodiversity.

- Describe the importance of **biodiversity**. Different kinds of animals have different **adaptations** and

different roles in their habitat. It may be helpful to relate different animal roles to different human jobs. Would it be good to have a town that is only full of doctors? Or is it better to have a town that has some doctors, some teachers, and some store owners? Like having different jobs, it is important to have lots of **biodiversity** in an **ecosystem** to make sure that all of the different jobs are being done so the ecosystem can run smoothly.

- Next, discuss the **predators** that Wood Frog and Green Frog encountered. Are predators bad or good? If there is student misconception that predators are bad, guide students to understand that in terms of the **ecosystem**, having a predator isn't a bad thing – they actually have a very important job to keep the whole ecosystem healthy.

Note for teachers: This next part is quite a bit of a shift from the previous discussions – however, it is a critical preview to our field trip activities, so it is important that the students understand! Try to maintain the connection from our previous discussions to this new topic.

- Switch gears and describe another reason why **biodiversity** is important: explain that having lots of different kinds of animals can actually protect the habitat from **parasites**. A **parasite** is something that causes disease. If a parasite enters the habitat, having lots of biodiversity can help to slow the spread of disease. It might be helpful to consider a familiar analogy of disease like the flu or COVID-19. First consider when you get sick, can you make your friends or family sick? How about your pets? Diseases don't make everything sick – there are some diseases that would make Wood Frog sick but would not make Green Frog sick, in the same way a disease might make you sick but would not make your pet sick. So, when there are lots of different animals around, it can be harder for a disease to spread.

After instruction has concluded, ask students to complete survey again.

Part III: Individual Student Work

- As an in-class assignment or as homework, allow the students to have time to read through the rest of the graphic novel and fill in the info sheets about the remaining animals. You can allow students to do this individually, in pairs, or in small groups.

Teacher's notes

Adaptation: An adaptation is the change or the process of change of a feature or behavior that helps an animal survive in their environment. A few examples include an animal's ability to hibernate during the winter and specialized warning coloration.

Amphibian: Includes frogs, toads, newts and salamanders. Many amphibians begin as larvae within wetland ecosystems and metamorphose (transform) into a terrestrial adult stage. They are often important indicators of a healthy ecosystem.

Biodiversity: The variety of life on earth. Biodiversity is indicated by the number of different species of plants and animals. Having lots of one species is not biodiversity, but having lots of different species is biodiversity.

Ecosystem: A system of living organisms interacting with each other and the non-living parts of their environment. For example, Wood Frogs and Green Frogs (living organisms) interacting with each other and burrowing into the soil (non-living part of the environment) during hibernation.

Parasite: A parasite is an organism that lives in or on another organism (the host) and benefits by deriving nutrients at the host's expense. Parasites can cause disease in their hosts, but this is not always the case. Parasites are not a bad thing – in fact, they are very important for the natural functioning of an ecosystem.

Habitat: The area or natural environment in which an organism or population normally lives.

Predators: An animal that survives by eating another animal. A lion is an example of a predator. Predators are not a bad thing – in fact, they are very important for the natural functioning of an ecosystem.

Species: A group of similar organisms that are able to reproduce with one another. For example, humans are a species, and so are Wood Frogs. Frogs in general are not a species, because frogs are a large group of lots of different kinds of frog species.

Variation: The differences within or between a group of organisms (usually referring to form, function, or behavior). Variation can be found 'among species', referring to the differences between one species and the other. For example, there is variation in coloration, habitat, and other characteristics between Wood Frogs and Green Frogs. Variation can also be found 'within species', referring to the differences between individuals from the same species. For example, one person may have a relatively strong immune system, while another person may have a relatively weak immune system, even though they are both members of the same species.

Wetland: An area that is saturated with water either permanently or seasonally (ephemeral pond). Wetlands are important because they are home to diverse organisms, prevent flooding, and slow the spread of pollution

ROBERSON MUSEUM ACTIVITY

Estimated time Half school day

Lesson Objective

Students will learn how biodiversity varies in natural wetland ecosystems and how biodiversity can affect the health of wildlife. Learning for this session will take place through an active-learning experience at Roberson Museum and Science Center.

Students will be able to collect and graph scientific data.

Required Materials

- 4 medium kiddie pools
- Fake (rubber) frogs of different colors
- Large dip nets
- Small tubs for holding animals
- Survey

Vocabulary

- Adaptation
- Amphibian
- Biodiversity
- Ecosystem
- Species
- Parasite
- Predators
- Habitat
- Wetland
- Variation

Directions for activity

Before and after the activities, ask students to complete the provided survey.

1. Before the start of the field trip, research staff will sample live animals from a wetland site at the Binghamton University Nature Preserve and transport them to Roberson.
2. Upon arrival, research staff will provide students with a lesson on specific species identification of tadpoles and other common invertebrates that are found at Binghamton Nature Preserve.
3. Students will help researchers to collect real data by identifying real, live animals collected by the researchers. They will first vote individually on the species identification, and then work together in groups to confirm ID.
4. Once species identity has been decided, students will break up into groups to count how many of each species was present in the sample. Students will then graph the identity and number of species that they found on an interactive graph. Since this procedure will be followed by multiple groups gathering data from different collection sites, students will be given digital access to a map and graphs of all of the data collected by the different groups. Teachers can optionally present this compiled data to the students during class time.
5. Additionally, research staff will create “ponds” filled with fake animals. Students will then practice “sampling” by dip netting into the “ponds” created by the researchers. The fake ponds will have different levels of “biodiversity” (different colors of frogs) which have different amounts of “parasites” (colored dots). Students will practice recording and reporting data on biodiversity and disease.
6. Students will have the opportunity to interact with Roberson’s Nature Trek exhibit.