



Biodiversity's Bounty

Grades 7 - 12

Teacher Packet

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Biodiversity's Bounty

Academic Standards for Environment and Ecology

4.3. ENVIRONMENTAL HEALTH

- 4. 3. 7 C Explain biological diversity.
- 4. 3. 10 C Explain biological diversity as an indicator of a healthy environment.

4.6. ECOSYSTEMS AND THEIR INTERACTIONS

- 4. 6. 7 A Explain the flows of energy and matter from organism to organism within an ecosystem.
- 4. 6. 10 A Explain the biotic and abiotic components of an ecosystem and their interaction.
- 4. 6. 12 A Analyze the interdependence of an ecosystem.

4.7. THREATENED, ENDANGERED, AND EXTINCT SPECIES

- 4. 7. 7 A Describe diversity of plants and animals in biotic ecosystem.
- 4. 7. 10 A Explain the significance of diversity in ecosystems.
- 4. 7. 12 A Analyze biological diversity as it relates to the stability of an ecosystem.

4.9. HUMANS AND THE ENVIRONMENT

- 4. 9. 7 A Explain the role of environmental laws and regulations.



BACKGROUND INFORMATION

WHAT IS BIODIVERSITY?

Biodiversity is the variety of all life and ecosystems on Earth. This amazing variety provides us with vital resources such as oxygen, clean water, medicine, and food, as well as inspiration for literature and art. Biodiversity can be divided into three interrelated categories.

WHAT ARE THE THREE CATEGORIES OF BIODIVERSITY?

Species diversity is the variety of species on Earth, from the microscopic plankton in our rivers and oceans to the eighteen-foot giraffes of the African Savanna. Over 1.7 million species have been identified and named, and scientists think that there are millions more that have yet to be found in the interdependent web of life on Earth.

The diversity within a species or a population of a species is found in its vast gene pool. The variety of genes available to each individual from that gene pool enables adaptability to a variety of changes in the environment.

Earth's wide variety of ecosystems, where the diversity of life occurs, is another component of biodiversity. When deciding where to concentrate conservation resources, scientists consider ecosystem characteristics such as variety and uniqueness of species, uniqueness of geography, and environmental impacts such as water filtration or prevention of soil erosion.

THREATS TO BIODIVERSITY

One way to try to understand the wide array of threats to biodiversity is to study the group of interrelated concepts represented by the acronym "HIPPO."

"H" stands for Habitat Loss. A habitat provides all the necessities of life including access to food, water, shelter, and space. Without the proper habitat, species disappear.



“I” stands for Introduced Species. A species introduced to an area where it is not native may cause a decline in native species through direct predation, competition for resources, or impact on habitat.

“P” stands for Population Growth. The ever increasing human population, now over 6 billion, is connected to all other “HIPPO” components.

“P” stands for Pollution. Life can be either directly killed by pollution or indirectly killed by pollution’s effects on the habitat.

“O” stands for Over-Consumption. Using resources at a higher rate than the Earth can sustain affects all life. Whether directly using other living species or using resources in a way that affects their survival, people need to be smart about their rate of consumption by enacting the ideas represented in “REDUCE, REUSE, RECYCLE.”

CONSERVATION AT THE ZOO

Zoos undertake many efforts to protect species from extinction, including the Species Survival Plan or SSP. This plan is put into action by zoos accredited by the Association of Zoos and Aquariums to provide for the most diverse gene pool possible among the captive population of some endangered species. Participating institutions manage and exchange their animals and are careful to maintain as much genetic diversity as possible in order to have a viable population should the species become extinct in the wild. The Species Survival Plan also includes a variety of other cooperative conservation activities such as research, public education, reintroduction, and field projects.

As at other accredited zoos, our Education Department is committed to teaching about issues related to conservation of natural resources and biodiversity. The best thing anyone can do to combat the threats to biodiversity is to become educated on the subject, decide how to make a difference, and then share this knowledge with family, friends, and colleagues.



VOCABULARY

Adaptation: behavioral or physical change that improves a plant or animal's chance for survival in its habitat.

Biodiversity: the variety of species, their genetic make-up, and the natural communities in which they occur; biodiversity is important to sustain healthy ecological systems, to provide resources for recreational opportunities and other beneficial uses, and to ensure the long term welfare of ourselves and future generations; also known as biological diversity.

Bioregion: a land and water territory whose limits are defined not by political boundaries, but by the geographical limits of human communities and ecosystems.

Conservation: the wise use of natural resources in order to insure continued availability to future generations.

Ecosystem: a community of living organisms inhabiting and their interrelated physical and chemical environment; a group of natural communities where the complex interactions of living organisms with their environment sustain their life support systems.

Endangered: a species at risk of becoming extinct unless conservation measures enable the populations to increase.

Endemic Species: a species restricted to a locality or region.

Exotic Species: an organism that has been brought into an area where it does not usually occur.

Extirpation: loss of a local population of a species that still exists elsewhere.

Extinction: the complete, permanent loss of a species.

Genetic Diversity: the variation of genes within a species.

Habitat: the area where a species of animals, plants, fungi or micro-organisms exists and where it finds the nutrients, water, sunlight, shelter, living space, and other essentials for survival.

Keystone Species: a species that holds a critical position in its biome, without this species, the biome would cease to function properly.

Native Species: a species which occurs naturally in an area or habitat; also known as indigenous species.

Species: a type of organism that has a unique set of characteristics that distinguishes them from other organisms; the basic unit of biological classification.

Sustainability: the ability to keep in existence or maintain.

Threatened: an organism whose population is declining in numbers but has not yet become endangered.



SUGGESTED READING LIST

Biodiversity II: Understanding and Protecting Our Biological Resources by Marjorie L. Reaka-Kudla, Ed, 1996.

The Diversity of Life by Edward O. Wilson, 1992.

Making the Biodiversity-Sprawl Connection by Biodiversity Project, 2000.

Saving Nature's Legacy by Reed F. Noss, et al, 1994.

Windows on the Wild by World Wildlife Fund

Windows on the Wild-Biodiversity Basics: Pennsylvania Supplement by the Education Committee of the PA Biological Survey

Biodiversity! Our Living World: Your Life Depends On It! by Pennsylvania State University, 2001.

Endangered and Threatened Species of Pennsylvania by PA Wild Resources Conservation Fund

INTERNET RESOURCES:

American Zoo and Aquarium Association: www.aza.org

Association for Biodiversity Information: www.abi.org

Biodiversity Conservation Information System: www.biodiversity.org

Biological Resources Division of the Department of the Interior: www.nbs.gov

Biodiversity Web: www.biodiversity.nl

Department of Environmental Protection: www.dep.state.pa.us

Enature: www.enature.com

Endangered Species 2000: www.librarythinkquest.org/25014

Forest Conservation Portal: www.forests.org

U.S. Fish and Wildlife Service: www.fws.gov

National Park Service: www.nps.gov

National Wildlife Service: www.endangered.fws.gov

Second Nature: www.starfish.org

The Tree of Life: phylogeny.arizona.edu/tree/phylogeny.html

The Wild Ones Animal Index: www.thewildones.org

World Resource Institute: www.wri.org

World Wildlife Fund: www.wwf.org/windows



KNOW PENNSYLVANIA'S BIODIVERSITY

Pre-Visit Activity

Adapted from "Biodiversity IQ" from Windows On the Wild: Biodiversity Basics by World Wildlife Fund.

OBJECTIVES:

- TSW define biodiversity.
- TSW discuss facts and issues related to biodiversity.
- TSW explain why biodiversity is important.

MATERIALS:

- "Know Pennsylvania's Biodiversity" cards
- Answer sheets

PROCEDURES:

ANTICIPATORY SET:

Have students brainstorm on the definition of biodiversity.

DEVELOPMENT OF LESSON:

1. Divide students into 5 groups. Each member within a group should receive a copy of the same "Know Pennsylvania's Biodiversity" card. (all students in group #1 get a copy of card #1 etc.)
2. Allow students time to read and answer the questions in their group. Discussion is encouraged until all students in the group agree on the answers.
3. Pass out the corresponding answer sheet to each group's card number, and have students check and correct their responses.
4. Regroup students so that each new group has a representative from each of the 5 original groups.
5. Each student, who is now an expert on his or her original group's card, takes turns reading questions from that card to the new group. Continue until all of the questions are asked and answered.

SUMMARY:

Conduct a whole class discussion. Which questions caused the most difficulty? Which answers were the most surprising? Have the students now attempt again to define biodiversity. Discuss the reasons biodiversity is important, and have the students brainstorm ideas about what the world would be like with less biodiversity.



KNOW PENNSYLVANIA'S BIODIVERSITY

Card 1

CIRCLE ALL OF THE RESPONSES THAT YOU THINK ARE CORRECT.

1. Which of the following PA animals delivers a venomous bite?
 - a. Northern short-tailed shrew
 - b. Garter snake
 - c. Bobcat
 - d. King fisher

2. This is PA's best digging toad because of an adaptation on its hind feet.
 - a. Backhoe toad
 - b. American toad
 - c. Fowler's toad
 - d. Spadefoot toad

3. This plant, growing in PA woodlands, has a chemical used to fight some forms of cancer.
 - a. Honeysuckle
 - b. American Bittersweet
 - c. May apple
 - d. Crab apple

4. This PA animal's Native American name, "Wapiti," means an animal with a white rump.
 - a. Cottontail
 - b. Ermine
 - c. White-tailed deer
 - d. Elk

5. Which of these can be found in Pennsylvania?
 - a. A marsupial
 - b. A fish that can grow up to 7 feet in length
 - c. Ants that "herd" aphids for their milk
 - d. A hare that changes color from summer to winter



KNOW PENNSYLVANIA'S BIODIVERSITY

Card 2

CIRCLE ALL OF THE RESPONSES THAT YOU THINK ARE CORRECT.

6. This PA bird uses its saliva to help "glue" its nest of coarse sticks together.
 - a. Chimney swift
 - b. Night hawk
 - c. Bluebird
 - d. Wild turkey

7. This PA frog, with "raccoon" markings on its head, can jump away from an enemy and land facing it.
 - a. Leopard frog
 - b. Wood frog
 - c. Bull frog
 - d. Face-mask frog

8. This PA wetland mammal has a very keen sense of touch due to the tentacles on its nose.
 - a. White-footed mouse
 - b. Raccoon
 - c. Beaver
 - d. Star-nosed mole

9. Which of the following would be impossible without fungi?
 - a. Eating pizza topped with mushrooms
 - b. Baking bread
 - c. Living in a world free of dead organisms covering the ground
 - d. Putting blue cheese dressing on salad

10. What is the most common reason for a species to become endangered in Pennsylvania?
 - a. Habitat loss
 - b. Cold winters
 - c. Road kills
 - d. Too many predators



KNOW PENNSYLVANIA'S BIODIVERSITY

Card 3

CIRCLE ALL OF THE RESPONSES THAT YOU THINK ARE CORRECT.

11. Great numbers of mayflies in a stream could be an indication of what?
 - a. A serious pollution problem
 - b. Good water quality
 - c. Swimming should not be allowed
 - d. There is a hydroelectric dam somewhere upstream

12. This insect has been studied by the U.S Air Force due to its unique flying style.
 - a. Grasshopper
 - b. June bug
 - c. Dragonfly
 - d. Potato beetle

13. Which of the following would people have to do without if there were no bees?
 - a. Almonds
 - b. Honey
 - c. Apples
 - d. Pickles

14. This endangered species, also known as the swamp rattler, is one of only 3 venomous snakes in PA.
 - a. Garter snake
 - b. Eastern Massasauga
 - c. Black rat snake
 - d. Hognose snake

15. With many tiny white flowers first appearing near the top of the plant before the leaves unfurl, this blooming herb, threatened in PA, is the first you are likely to see in the early spring.
 - a. Spring violet
 - b. Harbinger of Spring
 - c. Spring crocus
 - d. Daisy



KNOW PENNSYLVANIA'S BIODIVERSITY

Card 4

CIRCLE ALL OF THE RESPONSES THAT YOU THINK ARE CORRECT.

16. How did "Ovenbirds" get their name?
- Their reddish-brown wings heat up to 212 degrees Fahrenheit when they fly.
 - The male's call sounds like "oven, oven, oven."
 - The female builds her nest on the ground in a shape resembling a Dutch oven.
 - American colonists used to value these birds as food.
17. Blackpoll Warblers are tiny birds that migrate between North and South America each year. Which of the following statements about them are true?
- They use the stars for navigation.
 - They ride on the wings of airplanes.
 - They don't really need to migrate.
 - If they burned gasoline instead of body fat for fuel, they would get 720,000 miles to the gallon.
18. This common PA plant, found in forested wetlands, gives off a unique smell when crushed or bruised. It is also a favorite food of Black Bears emerging from their winter dens.
- Plantain
 - Skunk cabbage
 - Wild grapes
 - Cattail
19. Toxins absorbed from the Orange Butterfly Weed make both adult butterflies and their caterpillars.....
- Orange in color
 - Very ill
 - Unable to fly or crawl
 - Distasteful to birds
20. As part of human osteoporosis and kidney disease research, scientists are studying the deep sleep habits of this animal.
- Bog turtle
 - Black bear
 - Northern saw-whet owl
 - Canada goose



KNOW PENNSYLVANIA'S BIODIVERSITY

Card 5

CIRCLE ALL OF THE RESPONSES THAT YOU THINK ARE CORRECT.

21. This PA plant is a source of late season nectar for hummingbirds during Fall migration. It also contains oil in its stems and roots that can be used to neutralize the rash-causing oil from poison ivy.
- Marigold
 - Fall Panicum
 - Jewell weed
 - Calamine plant
22. This PA mammal preys on porcupines and climbs trees well.
- Fisher
 - Bobcat
 - Coyote
 - Gray fox
23. What are some facts scientists have learned about “bug zappers?”
- Insects are attracted by the smoky smell of “bug zappers.”
 - “Bug zappers” are great for ridding summer nights of mosquitoes.
 - “Bug zappers” attract harmless insects that provide food for other animals and pollinate plants.
 - There are more than 4 million “bug zappers” being used in the United States.
24. Which definition best describes the word “Biodiversity?”
- The number of eggs a Queen bee can lay.
 - The variety of rock and rock formations on Earth.
 - The total number of trout in a stream.
 - The variety of all life on Earth.
25. This invasive plant, with no natural enemies in North America, causes dramatic disruption to the ecological balance of wetlands by spreading rapidly and replacing all native vegetation.
- Purple loosestrife
 - Trillium
 - Wild blue phlox
 - Golden ragwort



Card 1 Answers

1. a. Northern short-tailed shrew
2. d. Spadefoot toad
3. c. May apple
4. d. Elk
5. a.b.c.d. All should be circled

Card 2 Answers

6. a. Chimney swift
7. b. Wood frog
8. d. Star-nosed mole
9. a.b.c.d. All should be circled
10. a. Habitat loss

Card 3 Answers

11. b. Good water quality
12. c. Dragonfly
13. a.b.c.d. all should be circled
14. b. Eastern Massasauga
15. b. Harbinger of Spring

Card 4 Answers

16. c. Female builds nest on ground in a shape resembling a Dutch oven
17. a. Navigate by stars
d. Would get 720,000 miles per gallon
18. b. Skunk cabbage
19. d. Distasteful to birds
20. b. Black bear

Card 5 Answers

21. c. Jewell weed
22. a. Fisher
23. c. Attract harmless insects that provide food for other animals and help pollinate plants AND
d. There are more than 4 million "bug zappers" being used in the United States
24. d. The variety of all life on Earth
25. a. Purple loostrife



ZOO CHALLENGE

In-Zoo Activity

OBJECTIVES:

CHALLENGE I:

- TSW identify endangered animals at the zoo.
- TSW record observations about an endangered animal.
- TSW develop "I wonder" questions about the observed animal.

CHALLENGE II:

- TSW identify endangered animals at the zoo.
- TSW utilize information available at an animal's exhibit to write a commercial jingle about that animal.

MATERIALS:

- Teacher vocabulary list
- Zoo Challenge handout
- Paper and pencils

PROCEDURES:

ANTICIPATORY SET:

Review the vocabulary list with the students. Split the class into groups of 3-4 students per group (the zoo requires a one to ten ratio of chaperones to students). Distribute a copy of the Zoo Challenge handout to each group.

DEVELOPMENT OF LESSON:

The students can decide which Zoo Challenge they will focus on. The teacher has the option of having the students complete both of the challenges or assigning a different challenge to each group. You may want to assign a time limit to keep the groups focused on their task.

SUMMARY:

Have each group present their completed materials during a class period. Each group can exhibit their materials with background information on the Zoo Challenge they chose for their focus.



ZOO CHALLENGE

DIRECTIONS:

Your team must work together, making sure you budget your time. Make sure you read the challenge you are focusing on and provide the best information; be creative and thorough.

Challenge I

Fact: The staff at the Pittsburgh Zoo & PPG Aquarium is dedicated to conserving endangered species from around the world. The zoo is home to more than 18 different species of endangered animals and is dedicated to protecting and preserving the Earth's animal species and their precious habitats.

Fun: Find an endangered animal that best represents your group, and give your group a name. Sketch a picture of the animal that will become the cover of the journal that you will create. Take turns recording what the group notices about your animal. Record "I wonder" questions about the animal. If you need further evidence for your animal's behavior, then you can sketch a picture beside your question.

Examples:

I wonder if my animal is hungry.

I wonder what my animal is thinking right now.

I wonder if my animal is tired.

Brainstorm and record possible ways that you could test the answers.

Challenge II

Fact: Educating visitors on natural resource conservation is a very important mission of the Zoo. Some of the methods used to display conservation messages include signage, exhibit narration, tour programs, shows, and up-close animal experiences.

Fun: Pick an endangered animal. Write a brief commercial jingle about the conservation of that animal. It is okay to include facts about its size, lifestyle, behaviors, and adaptations (use the information found on that animal's graphics). Now set your jingle to the rhythm of a popular song.



DRAW BIODIVERSITY

Post-Visit Activity

OBJECTIVES:

- TSW discuss the concept of biodiversity.
- TSW create a visual image depicting the concept of biodiversity.
- TSW present their creations to the rest of the class.

MATERIALS:

Large sheets of paper, markers, colored pencils, crayons, etc.

PROCEDURE:

ANTICIPATORY SET:

Engage the students in a brief discussion of what biodiversity means to them.

DEVELOPMENT OF LESSON:

- Explain that the students will be creating illustrations depicting their interpretations of biodiversity.
- Divide the class into manageable groups (e.g. 3-5 students) and give each group ONE piece of paper, explaining that each group of students will work together to create an illustration.
- After allowing a brief time for each group to discuss their ideas, distribute the writing utensils.
- Students work together on the illustrations as time permits (determined by teacher)
- Each illustration is presented to the class by its creators.
- Illustrations are posted in the classroom.

SUMMARY:

Discuss as a class why particular depictions were chosen by the students. Why were particular life forms represented and others were not? Do we have any biases toward favorite forms of life on this planet? Do we only think about the relatively large or cute species? What was the representation of vertebrates vs. invertebrates? Were non-animal species included? Was interaction between species depicted? Was variety within a species depicted? Were there a variety of biomes (habitats and the living organisms that live there) illustrated? Why are there so many appropriate ways to illustrate the concept of biodiversity?

EXTENSIONS:

The students create three-dimensional representations of the concept of biodiversity using a variety of craft materials.



CREATE A SPECIES

OBJECTIVES:

- TSW discuss the concepts of adaptation and biodiversity.
- TSW create a new animal species with adaptations for survival in its habitat.

MATERIALS:

Paper, markers, colored pencils

PROCEDURE:

ANTICIPATORY SET:

1. Ask students to name various animal adaptations, and how each adaptation positively impacts survival.
2. Discuss the concept of different species with different behavioral and physical adaptations filling diverse niches in the large variety of ecosystems in the world.

DEVELOPMENT OF LESSON:

1. Explain that each student will create a new animal species with adaptations to survive in its habitat.
2. Distribute paper and writing utensils and have students create an animal and its habitat, making sure to focus on its adaptations.
3. Students should write the name of the new species.
4. Students present the creations to the class, explaining how the adaptations help the animal to survive.

SUMMARY:

Have students now discuss how the variety of adaptations they recognize in the diversity of animal life in the vicinity of the school and neighborhood enables so much life to flourish in these local habitats.

EXTENSIONS:

1. Students use glue, scissors, and construction paper, pipe cleaners, or any other craft materials to add a 3-D element to their creations.
2. Students create a new PLANT species after examining the diversity of plant life in the vicinity of the school and neighborhood.