NATIONAL GEOGRAPHIC

RESOURCE LIBRARY I ACTIVITY : 1 HR

Introducing Biodiversity and BioBlitz

Students prepare for BioBlitz by defining biodiversity and examining the characteristics of various plants and animals as examples of taxonomic groupings. Students learn about the number of species identified globally in key taxa and use this information to make predictions about the biodiversity they may observe during their local BioBlitz.

GRADES

4 - 8

SUBJECTS

Biology, Ecology

CONTENTS

3 PDFs, 2 Links

OVERVIEW

Students prepare for BioBlitz by defining biodiversity and examining the characteristics of various plants and animals as examples of taxonomic groupings. Students learn about the number of species identified globally in key taxa and use this information to make predictions about the biodiversity they may observe during their local BioBlitz.

For the complete activity with media resources, visit:
http://www.nationalgeographic.org/activity/introducing-biodiversity-and-bioblitz/

Program

bioblitz

DIRECTIONS

1. Define *biodiversity*.

Tell students that they will explore the diversity of life and prepare for participation in a bioblitz.

Write the word *biodiversity* on the board, with "bio" in a different color than "diversity." Ask students to discuss this word in pairs and generate a definition in their own words (Possible response: "bio" means life, and "diversity" means different; *biodiversity* means the variety of life on Earth.) Explain that there is a great deal of diversity on Earth, and that diversity is all around them. Ask: *Why is biodiversity on Earth important?* Refer to the encyclopedic entry for biodiversity in the media carousel for examples of the value of biodiversity for all life.

Project the Biodiversity and BioBlitz presentation, and distribute a Biodiversity By The Numbers worksheet to each student. Have students use a pencil with this activity.

2. Explore biodiversity and biological classification.

Projecting slide 2, give students an opportunity to guess or estimate the numbers of species on Earth, writing their ideas on the board. Ask: *How many species do you think have been identified and given a scientific name?* (1.75 million) *How many species do scientists estimate there are on Earth?* (possibly 7 million). After students share ideas, reveal the scientific estimates on slide 3. Next, students will observe photos of different organisms to determine some of the characteristics, or traits, that make different species unique.

With slides 4, 5, and 6, explain that, even with all this biodiversity in the world, we know that some organisms are more closely related than other organisms. Tell students they are going to play a game of "which one does not belong." Each slide will include three organisms. Two are closely related, while the third organism is in a different class. Guide students through each slide to see if they can identify the organism that does not belong with the other two. For each slide, elicit explanations from two or more students to the prompts: *How could you tell? What characteristics helped you decide?* Prompt students to explain the characteristics that

may be shared by the two organisms in the same class, which are not shared by the third organism. At the end of the slides, emphasize that special characteristics of organisms allow us to group them into similar types of organisms.

3. Introduce taxon groups.

On slide 7, introduce or review different taxa (singular: taxon), or groups, of organisms organized in a system called biological classification. Explain that this term refers to the organization of organisms into groups based on their characteristics. Ask: *What taxon do snakes, alligators, and turtles belong to?* (reptiles) Tell students that reptiles, mammals, amphibians, and birds are all classes of a larger group called vertebrates. Vertebrates, or organisms with a backbone, and invertebrates, or organisms without a backbone, comprise the kingdom Animalia. Plants, fungi, and other kingdoms are organized in similar ways.

Moving to slide 8, show the photo of an organism from a taxon. Prompt students to make observations:

- *What are some characteristics you can see that differentiate this organism from others?* (Possible response: vertebrate/invertebrate; type of outer layers such as scales, hair/fur, feathers, skin, exoskeleton; appendages and body parts)
- *What taxon do you believe this organism belongs to*? Point out to students that the names are on the worksheet.

Explain to students that the next slide reveals several defining characteristics of each taxon. Note for students that, while these are common characteristics, there are always exceptions within each taxon. For example, a few mammals lay eggs, and one sea turtle is semi-warm-blooded. Some plants do not contain chlorophyll to make them green, and some fungi are not made of hyphae tubes. So, most members of each taxon will have all of these physical characteristics.

Moving through the slides, have students write or sketch two or three defining characteristics of each taxon. Have them include an example of a local organism from each taxon grouping on their worksheet.

4. Have students estimate biodiversity for various taxa.

Divide students into pairs or small groups of three and have them spend approximately five minutes to estimate the number of species they believe belong within each taxon, by writing the numbers from the Approximate Number of Species box with each taxon. After groups finish, ask a few to share their estimates for each taxon and their reasoning. Reveal the approximate number of species for each taxon. Talk about the numbers, and discuss any surprises they see.

5. Explain that a bioblitz is one way of documenting biodiversity.

Make sure students understand that biodiversity is not a term that is reserved for tropical rainforests. There is incredible diversity from the bottom of the ocean to their backyards, in extreme environments such as the geysers in Yellowstone National Park, and even in urban environments. Explain to students that the class will engage in a bioblitz—a short, intensive study of the biodiversity of an area. Participants will document findings and share what they found through an online observation platform called iNaturalist.org.

6. Show students the iNaturalist tutorial.

Project the iNaturalist website (the about section), and show students the Observe Nature with iNaturalist video. Browse the map and observations for your local area. Under "Species," students will see the various taxa groupings on iNaturalist.

Explain that at their bioblitz, students may have an opportunity to use iNaturalist to record observations using tablets or other mobile devices. They will also work with their team to identify what they see using biological classification, including the taxon groupings from the

slideshow. Bioblitz participants also upload and share observations with other bioblitz participants as well as the broader iNaturalist community.

7. Have students reflect and predict.

Have students spend five minutes responding to the following prompts in writing:

- *Why is biodiversity important?*
- *What taxa do you expect to find with the most biodiversity in your park? Support your response with information using your worksheet to help you answer this question.*
- *What part of the bioblitz experience are you wondering about, and why?*

Collect students' written responses as they leave class and keep them for students to refer to after BioBlitz.

Tip

Check with your local BioBlitz coordinators to find out if students can bring mobile devices to help with recording observations using iNaturalist.

Tip

Expose students to National Geographic photographer Joel Sartore's Photo Ark project to see more examples of biodiversity. Have students discuss the possible motivations behind the project. Ask: Why care about biodiversity?

Tip

If students plan to bring mobile devices, have them load and sign in to the iNaturalist app before the day of BioBlitz. In the app's settings, there is a step-by-step tutorial for how to upload an observation.

Modification

If time allows, have students use iNaturalist to look up local observations to inform hypotheses before matching numbers to taxon groups.

Informal Assessment

Review students' written responses from Step 6 to evaluate their understanding of the concept of biodiversity and predictions about local biodiversity.

Extending the Learning

- Use biodiversity hotspot maps to hypothesize what taxa students will observe the most and least during BioBlitz. Ask: What relationships between biodiversity and geography can you find in these maps? Have students review the Global or USA maps and construct a written or verbal geographic analysis based on their study.
- Conduct a practice survey of living things located around the school grounds. Ask students to make observations and record the number of different species. Return to the classroom and synthesize all of the data. Discuss students' questions about the process of conducting the survey, for example, any questions they had during the process and also what they learned.

OBJECTIVES

Subjects & Disciplines

Biology

- Ecology

Learning Objectives

Students will:

- Differentiate characteristics among taxa of organisms
- Explain the purpose of a bioblitz and why biodiversity matters
- Record and share observations

Teaching Approach

- Learning-for-use

Teaching Methods

- Discussions
- Multimedia instruction
- Visual instruction
- Writing

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Learning and Innovation Skills
    - Creativity and Innovation
    - Critical Thinking and Problem Solving

National Standards, Principles, and Practices

NATIONAL GEOGRAPHY STANDARDS

• **Standard 8:**
The characteristics and spatial distribution of ecosystems and biomes on Earth's surface

NEXT GENERATION SCIENCE STANDARDS

• **Crosscutting Concept 4:**
Systems and system models
• **Crosscutting Concept 7:**
Stability and change
• **MS. Ecosystems: Interactions, Energy, and Dynamics:**
MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.
• **MS-LS2: Ecosystems: Interactions, Energy, and Dynamics:**
MS-LS2-1: Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem

• **Science and Engineering Practice 3:**
Planning and carrying out investigations

Preparation

What You'll Need

MATERIALS YOU PROVIDE

- Pencils

REQUIRED TECHNOLOGY

- Internet Access: Required
- Tech Setup: 1 computer per classroom, 1 computer per small group, Projector, Speakers

PHYSICAL SPACE

- Classroom

OTHER NOTES

This activity uses the taxa that are core to the iNaturalist observation platform, as national parks will use this platform for documenting organisms at their bioblitzes. The major taxa of iNaturalist include: plants, fungi, mollusks, arachnids, insects, reptiles, amphibians, birds, mammals, and ray-finned fishes (bony fishes). iNaturalist also refers to two additional kingdoms: protozoans and chromista. Protozoans are unicellular organisms that cannot be seen with the naked eye. Chromista refers to a subset of algae that occurs in aquatic systems. Because these groups will not be easily observed across all parks, they are not included in this activity.

RESOURCES PROVIDED: WEBSITES

- iNaturalist
- biodiversity

RESOURCES PROVIDED: HANDOUTS & WORKSHEETS

- Biodiversity By The Numbers Answer Key
- Biodiversity and BioBlitz

- Biodiversity By The Numbers

BACKGROUND & VOCABULARY

Background Information

There is an incredible amount of biodiversity, or variety of life, on Earth. Scientists have already discovered and named over 1.75 million species and estimate there may be as many as four times this number undiscovered. For centuries, scientists have been attempting to organize and classify this incredible diversity of life using a classification system called taxonomy.

Scientists use taxonomic hierarchy as a way to organize and classify organisms based on their characteristics and genetic relationships. At the top of the taxonomic hierarchy, highly diverse organisms belong to one of the three basic domains of life: archaea (primitive bacteria), bacteria, and eukarya (all other organisms). Next, the eukarya domain is separated into many kingdoms of life: plantae, animalia, fungi, protista, and chromista. Within each kingdom, organisms are separated further into the following hierarchies: phylum, class, order, family, genus, and species.

Species that share the same genus are more closely related than species that share the same phylum. For example, wolves and tree frogs are both members of the chordate phylum (vertebrates). Wolves and coyotes are both members of the canis genus. Therefore, wolves and coyotes are much more closely related than wolves and tree frogs. In this way, biological classification using taxonomic hierarchies is a tool to visualize the evolutionary relationships between the millions of diverse species on Earth. Taxonomists, or biologists specializing in biological classification, are constantly discovering new information that becomes part of this dynamic taxonomic system.

A taxon is a unit of individuals at any level of taxonomic rank. Taxa is its plural form. Taxa can include high levels of taxonomic rank, like plant, animal, fungi, protist, and chromista kingdoms. Taxa can represent lower levels of rank as well, such as orders of insects: e.g.,

butterflies, beetles, grasshoppers, flies, and dragonflies.

Prior Knowledge

["Students should have some knowledge of the differences between plants, vertebrates, and invertebrates."]

Recommended Prior Activities

- None

Vocabulary

Term	Part of Speech	Definition
bioblitz	*noun*	a field study in which groups of scientists and citizens study and inventory all the different kinds of living organisms within a given area.
biodiversity	*noun*	all the different kinds of living organisms within a given area.
classification	*noun*	grouping based on physical and genetic characteristics.
invertebrate	*noun*	animal without a spine.
species	*noun*	group of similar organisms that can reproduce with each other.
taxonomic group	*noun*	things, such as organisms or ideas, organized by their relationship to each other.
taxonomy	*noun*	study of the identification, classification, and naming of organisms.
vertebrate	*noun*	organism with a backbone or spine.

For Further Exploration

Websites

- Joel Sartore: The Photo Ark Introduction
- Instituto de Pesquisas Ecológicas: Biodiversity Mapping
- World Wildlife Fund: Why does biodiversity matter?
- Encyclopedia of Life: What is Biological Classification?
- Joel Sartore Photo Ark
- Encyclopedia of Life—Fungi

- Encyclopedia of Life: Mammals
- Encyclopedia of Life: Birds
- Encyclopedia of Life: Amphibians
- Encyclopedia of Life: Fishes
- Encyclopedia of Life: Reptiles
- Encyclopedia of Life: Invertebrates
- Encyclopedia of Life: Crustaceans
- Encyclopedia of Life: Mollusks
- Encyclopedia of Life: Insects
- Encyclopedia of Life: Spiders
- Encyclopedia of Life: Worms
- Encyclopedia of Life: Plants