NATIONAL GEOGRAPHIC

RESOURCE LIBRARY I ACTIVITY : 50 MINS

No Species Lives in Isolation

Students watch a video that explores biodiversity in Patagonia. Based on this example, students then identify major groups of organisms in Indonesian forests. Using a model food web from a backyard ecosystem, the class builds a food web that shows the relationships between the Sumatran rhino and other species in its ecosystem.

GRADES

6, 7, 8

SUBJECTS

Biology, Ecology, Conservation

CONTENTS

3 PDFs, 1 Link, 1 Video, 1 Resource

OVERVIEW

Students watch a video that explores biodiversity in Patagonia. Based on this example, students then identify major groups of organisms in Indonesian forests. Using a model food web from a backyard ecosystem, the class builds a food web that shows the relationships between the Sumatran rhino and other species in its ecosystem.

For the complete activity with media resources, visit:
http://www.nationalgeographic.org/activity/no-species-lives-isolation/

In collaboration with

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learning that connects

DIRECTIONS

This activity is part of the Extinction Stinks! unit.

1. Introduce the concept of biodiversity by showing a video about the penguins of Patagonia.

- Ask students what they think the term "biodiversity" means.
    - Break down the word into its two parts: "bio," meaning life, and "diversity," meaning variety and difference.
    - Define biodiversity for students: "all the different kinds of living organisms within a certain area."
- Show the *Penguins of Patagonia* video (4:31) as an example of biodiversity in coastal Argentina.
    - In the video, Explorer Pablo Borboroglu defines biodiversity and uses it as one measurement of ecosystem resilience—how well the ecosystem can persist through disturbances. Have students listen for specific benefits of biodiversity that are identified in the video.
    - After watching the video, lead a discussion with students about the benefits of biodiversity they heard. List them on the board for future reference.

2. Use a model food web to demonstrate the importance of biodiversity in ecosystems.

- Review the definition of the term ecosystem from the *SOS—Saving Our Species* activity.
- Explain that within an ecosystem, organisms are categorized based on how they gain the energy they need.
    - Producers create their own food, often using energy from the sun. All plants, as well as some microorganisms like cyanobacteria, are producers.
    - Consumers eat producers or other consumers. Consumers are usually categorized by their typical diet: herbivores eat primarily plants, carnivores eat primarily meat, and omnivores eat a combination of plants, meat, and fungi.
    - Decomposers gain their energy from dead and decaying organisms.
- Display the *Who's in My Backyard?* food web infographic.
    - Ask students to predict what they think the arrows in the diagram represent.
    - Explain that arrows show how energy moves between species—the arrow points in the direction of energy flow from one organism to another.

- Explain to students that they will model a food web using organisms that live in the Sumatran rhino's ecosystem. Each student will receive a role for the activity of one organism or other factor that is a part of the food web.
- Display the *Vanishing Populations Map* used in *The Roots of Extinction* activity. Point out Way Kambas National Park, the ecosystem that is home to the organisms used in this model ecosystem. This is also the place where the Sumatran Rhino Rescue site is located.
- Distribute the *Way Kambas Food Web Cards* (one card to each student) with an organism typically found in Way Kambas National Park.

    - Have students organize themselves in a few ways to have some fun and get oriented with who is in the ecosystem. Some ideas include:

        - Line up by size (have them make their best guess!).
        - Organize into groups by producers, consumers, decomposers, and anything else.
        - Organize so every organism is standing next to another organism that it has a direct energy relationship with—either giving or receiving energy to each other.

- Then prompt students to follow the steps below to build a model of the relationships between species.

    - Distribute the pieces of yarn so that each student has at least three or four pieces.
    - Have students stand in a circle with their cards facing outwards.
    - Students should take several pieces of yarn and use them to connect to others in the circle from whom they receive energy. For some, this will be just one source and for others this can be many different sources.

        - Producers will all connect to the sun.
        - Consumers will connect to several examples of the organisms they eat as food.
        - Decomposers should connect to several organisms they might eat.

    - Once everyone has connected to the species they are related to, point out to students that there are many relationships within the ecosystem that overlap with each other.

3. Direct students to create food web models in pairs using a subset of species in the previous step, in order to reflect on food webs and biodiversity.

- Distribute the *Way Kambas Food Web Model* handout to students.

- Prompt students to complete Part A by creating a food web model using a subset of the organisms from Way Kambas National Park.

4. Model disruptions in an ecosystem using the physical model of species interactions.

- Have students retake their positions in the yarn-based model of the relationships between species, then use each of the *Way Kambas Food Web Disruption Cards* to introduce four different scenarios to the ecosystem. When each disruption happens, pause and prompt students to reflect on how that change would affect different species within the ecosystem using the questions printed on the card.
    - After disruptions #1 and #2, reset the food web before continuing with the next scenario.
    - After disruption #3, do not reset the ecosystem. Ask students to predict how an additional disruption might affect the ecosystem differently after already experiencing the impacts of this challenge. Then, complete disruption #4 with a reduced population of organisms in the ecosystem.
- After the disruptions are over, ask students to complete Part B of the *Way Kambas Food Web Model* handout and then consider how biodiversity affects the survival of the Sumatran rhino. Their ideas may include:
    - More species in an ecosystem allow for different sources of energy.
    - When species' numbers are depleted, the lower number of ecological relationships decreases an ecosystem's resilience after a disruptive event.
    - Biodiversity allows increased numbers of relationships between species, strengthening the resilience of the ecosystem.

5. Return to the class *Know & Need to Know* chart and add detail about students' knowledge of the value of biodiversity.

- Distribute the class *Know & Need to Know* chart from the *Saving Our Species—SOS* activity.
- Direct students to add new information they have learned about biodiversity through this activity. Examples may include:
    - Biodiversity is one measure of the health of an ecosystem supporting an endangered species.
    - Decreases in biodiversity might increase the risk of a species going endangered or extinct.

    - Species in an ecosystem affect each other even when they are not directly connected through an energy transfer.

- Students can also add new questions or ideas they have related to conserving endangered species while also protecting the needs of humans and other species.

Tip

Step 2: Please note that it is common practice in science to draw food webs with arrows pointing from organisms that provide energy toward the organisms that consume them.

Tip

Step 2: The *Way Kambas Food Web Cards* are organized to accommodate different sizes of student groups. The first 16 cards are intended to be the minimum for use, with up to 32 cards available, as needed.

Tip

Step 3: If you choose to have students draw their food web model in small groups, give each student a different colored marker. Tell students that all the colors being used should be equally visible in both words and diagrams to promote sharing work equitably.

Modification

Step 3: Students could use a web browser to find pictures of species for their food webs or type their responses to questions to reduce anxiety about or address challenges around creating their own visuals.

Informal Assessment

Use students' responses to the synthesis questions on the *Way Kambas Food Web Model* handout to assess their thinking about food webs and how ecosystem resilience can change with shifts in biodiversity.

Extending the Learning

Explore biodiversity in your schoolyard by holding a *BioBlitz* at your school. This activity engages learners in identifying as many species of living things that they can in your local ecosystem. BioBlitzes are a form of citizen science, where everyday people can collect data used by scientists to ask and answer questions on a large scale. Cataloguing what is present is engaging and helps scientists better understand the distribution and abundance of a variety of organisms in your local area, including species that may be threatened or endangered.

OBJECTIVES

Subjects & Disciplines

Biology

- Ecology

- Conservation

Learning Objectives

Students will:

- Define biodiversity and its value to ecosystems.
- Explore relationships between species in several ecosystems using a food web.
- Use a physical model to represent ecological connections between species.
- Apply systems thinking to the relationships between the Sumatran rhino and other species in its habitat.

Teaching Approach

- Project-based learning

Teaching Methods

- Brainstorming
- Discussions
- Multimedia instruction

Skills Summary

This activity targets the following skills:

- 21st Century Student Outcomes
  - Information, Media, and Technology Skills
    - Information, Communications, and Technology Literacy
    - Media Literacy
- 21st Century Themes
  - Environmental Literacy
  - Global Awareness
- Critical Thinking Skills
  - Analyzing
  - Applying
  - Understanding
- Science and Engineering Practices
  - Constructing explanations (for science) and designing solutions (for engineering)
  - Developing and using models
  - Engaging in argument from evidence
  - Obtaining, evaluating, and communicating information

National Standards, Principles, and Practices

COMMON CORE STATE STANDARDS FOR ENGLISH LANGUAGE ARTS & LITERACY

• **CCSS.ELA-LITERACY.SL.7.2:**
Analyze the main ideas and supporting details presented in diverse media and formats (e.g., visually, quantitatively, orally) and explain how the ideas clarify a topic, text, or issue under study.
• **CCSS.ELA-Literacy.WHST.6-8.1:**
Write arguments focused on discipline-specific content.

NEXT GENERATION SCIENCE STANDARDS

• **Crosscutting Concept 2:**
Cause and effect: Mechanism and prediction
• **Crosscutting Concept 5:**

Energy and matter: Flows, cycles, and conservation

• **Disciplinary Core Ideas LS2.A: Interdependent Relationships in Ecosystems:**

• **LS2.C: Ecosystem Dynamics, Functioning, and Resilience:**

When the environment changes in ways that affect a place’s physical characteristics, temperature, or availability of resources, some organisms survive and reproduce, others move to new locations, yet others move into the transformed environment, and some die. (secondary to 3-LS4-4)

• **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 2:**

Developing and using models

• **Science and Engineering Practice 6:**

Constructing explanations and designing solutions

• **Science and Engineering Practice 7:**

Engaging in argument from evidence

• **Science and Engineering Practice 8:**

Obtaining, evaluating, and communicating information

Preparation

What You'll Need

MATERIALS YOU PROVIDE

- String/yarn for food web activity. Note that the string will need to be cut prior to the activity into lengths of at least four feet, at least three per student.
- One printed copy of the *Way Kambas Food Web Cards*, cut out in advance
- One printed copy of the *Way Kambas Food Web Disruption Cards*, cut out in advance
- Printed copies of the *Way Kambas Food Web Model* handout for each student

REQUIRED TECHNOLOGY

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

PHYSICAL SPACE

- Classroom

GROUPING

- Large-group instruction

ACCESSIBILITY NOTES

Students with accommodations may need more scaffolding for the graphic organizer.

RESOURCES PROVIDED: WEBSITES

- National Geographic: Sumatran Rhino Rescue

RESOURCES PROVIDED: UNDEFINED

- The Penguins of Patagonia

RESOURCES PROVIDED: HANDOUTS & WORKSHEETS

- Way Kambas Food Web Cards
- Way Kambas Food Web Model
- Way Kambas Food Web Disruption Cards

RESOURCES PROVIDED: IMAGES

- Who's in My Backyard?

BACKGROUND & VOCABULARY

Background Information

Species interact in a variety of ways with the other species in their ecosystems. Biodiversity, the variety of living things in an area, tends to lead to healthy and resilient ecosystems, and losing one species can have cascading effects for many other species. Understanding the

complex relationships between species and how they impact each other is an important part of knowing how to support a species' survival.

Prior Knowledge

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Recommended Prior Activities

- The Roots of Extinction

Vocabulary

Term	Part of Speech	Definition
biodiversity	*noun*	all the different kinds of living organisms within a given area.
carnivore	*noun*	organism that eats meat.
consumer	*noun*	organism on the food chain that depends on autotrophs (producers) or other consumers for food, nutrition, and energy.
decomposer	*noun*	organism that breaks down dead organic material.
food web	*noun*	all related food chains in an ecosystem. Also called a food cycle.
herbivore	*noun*	organism that eats mainly plants and other producers.
omnivore	*noun*	organism that eats a variety of organisms, including plants, animals, and fungi.
producer	*noun*	organism on the food chain that can produce its own energy and nutrients. Also called an autotroph.