Encyclopedia of Life
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Lesson: Interdependence in Ecosystems

Activity: Exploring Food Chains and Webs

Key Question

How is energy transferred among organisms in ecosystems? What is the relationship between food chains and food webs?

Objectives

- Students will **describe** how energy flows through food chains and food webs.
- Students will **build** and **examine** food chains and food webs.
- Students will **manipulate** ecological relationships using EOL Food Webs.

Grade: 9-12 Biology Time 60 minutes Location: Classroom

Materials

- Computer and Internet access
- EOL Species Cards: http://education.eol.org/species_cards (one set per group of 3-4 students)* *Any card deck with producers, consumers, and decomposers will work, especially those from specific habitats such as Rocky Intertidal Habitat or Urban Habitat
- Food chain images (attached)
- Rope
- Tape
- Index cards with organism names (or species cards)
- Sharpie
- Journals/notebooks
- Butcher block paper or chalkboard table
- Print-out arrows

Culminating Activity

Students practice building food chains and webs, explore interrelationships in the EOL Food Webs Tool, then model the flow of energy in food webs.

Preparation

- Choose a set of EOL Species Cards about habitats (Okaloosa County, FL Urban Habitat, New England Rocky Intertidal Habitat, etc.) These decks will have producers, consumers, and decomposers. Some decks have information about adaptations and energy sources (try Okaloosa County Biodiversity, New England Vernal Pools, New England Urban Habitats).
- Print enough decks so that each group of students can use one deck or a subset. Some decks have many cards. Making food webs with more than 8-10 species can be quite challenging, so try building food chains and webs with cards

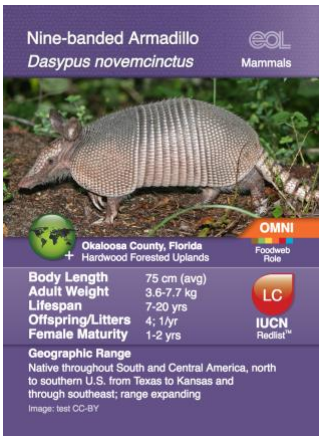
yourself first before using with students. You may want to give each group the same 8 species, or use different sets.

Directions

Engage: Elicit prior understanding by having students draw a food chain **(2 minutes)**
On the board, tape images of the following: sun, grass, insect, toad, hawk, fungi. Draw the diagram below with a blank for each image and an arrow between. Based on previous activity, ask a volunteer to place each image in order from how they think each organism obtains energy from another. Pool everyone's ideas, and explain that the class just created a **food chain**.

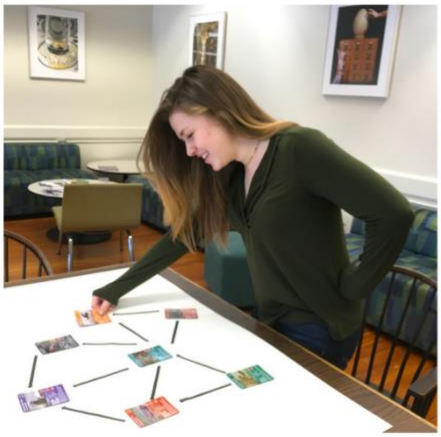
_____ → _____ → _____ → _____ → _____ → _____

Explore the species cards to create more food chains **(15 minutes)**
Put students into small groups (3-4 individuals). Provide one set or subset of cards to each group and have students work together to make at least five **different** food chains with at least three steps in each. As they create the chain, students should discuss why they think each organism belongs where it does. They should write down or draw their food chains.



Students can re-use cards. Explain to students that these cards have information about how the plant and animal obtain energy, and that students can use EOL or other resources to help research the trophic relationships of plants, animals, and fungi.

Explain how the food web works (5 minutes)
Food chains may seem simple, but ecosystems are complex and have many overlapping food chains called **food webs**. Food webs show the transfer of energy among all of the organisms in the habitat. The direction of arrows indicates the flow of energy from one organism to another. See the example below.



Create food web from food chains (20 minutes)
Have students practice making their own food webs with the species in their food chains. On a large piece of paper, students set out their cards in a random arrangement. Now, using the food chains students created previously, place arrows among the organisms. Then, work together to see if there are any other connections they could make. They should create a web similar to the New England forests habitat above.
Discuss: Are there any species with only one connection? Are there other species with lots of arrows? Why do they think this occurs? What do you think happens when one of the organisms with a lot of connections is removed from a web vs. one without many connections?

Elaborate: Food Web Interdependence **(15 minutes)**
Write the name of each organism from the habitat card deck on an index card - OR - pass out species cards to students. Ask students to form a circle and assign one organism to each student by taping the organism index card (or species card) to his or her shirt. The teacher should tape to his- or herself an index card labeled as "the sun." The teacher should hold one end of a rope to act as the sun.

Then, announce someone in the circle who obtains its energy from the sun and while continuing to hold the end, pass the rest of the rope to that individual. That individual will pass to another student, and so on until a food chain is formed. Once a chain is formed, the rope gets passed back to the sun and another is started. Continue forming overlapping chains until everyone receives the rope at least once, but individuals can be repeated. Students made their own food web! Ask everyone to take a step back and provide some tension in the web.

Now, demonstrate how organisms are interdependent in food webs. Have all students lean back a little to create tension in the food web. If one person lets go, the web will change. Explore the effects on the ecosystem when different individuals or groups let go or pull harder than others. How could this happen in real ecosystems? Ask students to think of examples. Here are a few examples for discussion:

- Wolves and bears in Yellowstone (see this amazing YouTube video on wolves)
- Sea otters, urchins, and kelp forests
- Decomposers
- Humans

Evaluation Project: Backyard Food Webs (3-5 day take-home assignment)

Provide students with the prompt: **What does a food web look like in your backyard?**
Students will spend time in their backyard or open space in their community and create a food web of at least **ten** organisms that they find. They can create a food web using any type of media: drawing, computer, or build model.

Students can use the following as resources for common urban/suburban species in various regions:

- Okaloosa County (Florida Panhandle) Urban Habitat Food Web
- New England Region Urban Habitat

Next Generation Science Standards

Performance Expectations

HS-LS2-1. Use mathematical and/or computational representations to support explanations of factors that affect carrying capacity of ecosystems at different scales
HS-LS2-2. Use mathematical representations to support and revise explanations based on evidence about factors affecting biodiversity and populations in ecosystems of different scales.
HS-LS2-3. Construct and revise an explanation based on evidence for the cycling of matter and flow of energy in aerobic and anaerobic conditions.
HS-LS2-4. Use mathematical representations to support claims for the cycling of matter and flow of energy among organisms in an ecosystem.
HS-ETS1-4. Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.

Science and Engineering Practices

- Asking Questions and Defining Problems
- Developing and Using Models
- Engaging in Argument from Evidence
- Constructing Explanations and Designing Solutions

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Appendix: Food Chain Images

Image Attribution:"The sun shines on everyone": leecullivan via Flickr CC BY-NC-ND; Bermudagrass (*Cynodon dactylon*): Leticia Soriano Flores CC-BY-NC; Differential Grasshopper (*Melanoplus differentialis*): Rob Curtis CC-BY-NC-SA; American Toad (*Anaxyrus americanus*): Matt Muir CC-BY-NC-SA; Red-tailed Hawk (*Buteo jamaicensis*): Dori via Wikimedia Commons CC-BY-SA; Ruby Bonnet (*Mycena viscidocruenta*): Arthur Chapman CC-BY-NC-SA