Encyclopedia of Life
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Food Webs: Interconnectedness of Organisms in Ecosystems

Activity 3: Exploring Food Chains and Webs

Key Questions

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 **model** the interrelationships of ecosystems.
- Students will **manipulate** ecological relationships using EOL Food Webs.

Grade: 6-8 Time 60 min. 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
- Large pieces of paper
- Cut-outs of arrows for building food webs (attached)
- Food chain images (attached)
- Rope
- Tape
- Index cards with organism names
- Sharpie
- Journals/notebooks
- Pencils

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 students with "rock-paper-scissors" activity that models a food chain (10 minutes)
In an open area, organize students in a circle. Explain that we will be playing a game of rock-paper-scissors, ecosystem edition! This activity models how energy flows from one organism to the next in a food chain. Students will represent energy moving through a food chain:
Grass → Grasshopper → Toad → Hawk.
They will play rock-paper-scissors against one another to "flow" from one trophic level to the next. Each trophic level is represented by these actions or signals:

- Grass: sit
- Grasshoppers: hop
- Toad: walk and stick out tongue
- Hawk: flap

All students start the food chain as grass, a primary producer. Students will find a partner and **sit** on the ground. All pairs of students begin to play rock-paper-scissors, best out of 3. The partner who lost the round will remain grass and find another grass to play against. The winner of this round "flows" to become a grasshopper, and **hops** around the room or field looking for other grasshoppers.

Two grasshoppers play rock-paper-scissors: the one in each pair who wins "flows" to the next trophic level, a toad (walks and sticks out tongue). The grasshopper that did not win remains a grasshopper and continues looking for other hopping grasshoppers to play against.

If a grass cannot find another grass to play against, the instructor can high-five that student and "flow" to the next level. Players continue to "flow" through the food chain until they become hawks, apex predators.

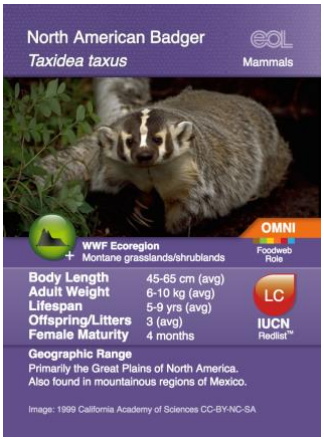
When two hawks play rock-paper-scissors against each other, the winner will "decompose" and the other student will remain a hawk. Anyone who "decomposes" dramatically calls "I'm decomposing!" while holding their hands over their head like a mushroom and slowly sink to the ground. Once a student "decomposes," that student should high five the instructor and can "reset" in same game as grass, begin a parallel game, or cheer on their classmates from the side.

It is important to remind students that decomposers do not *become* grass, but that the materials broken down by decomposers provide nutrients for primary producers.

Review concept of energy flow 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**.

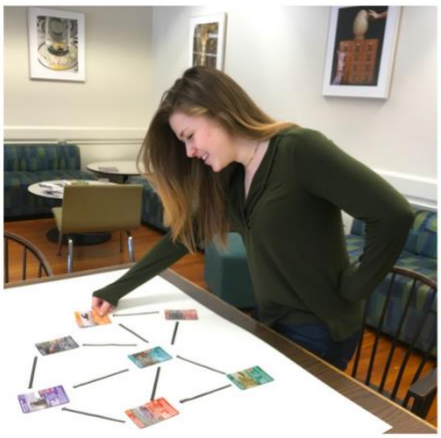
_____ → _____ → _____ → _____ → _____ → _____

Explore the species cards to create more food chains (10 minutes)
Put students into small groups (3-4 individuals). Give each group a large piece of paper and arrow cut-outs (attached). Provide one set of cards to each group and have students work together to make three **different** food chains with at least four 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*. Each group can present one food chain to the class. As each group presents, have one student draw their group's food chain on the board. After each group presents, highlight the organisms that are repeated among different food chains.

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?

Modeling Food Web Interactions (15 minutes)
Write the name of each organism from the food web on an index card, or use species cards. 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 is 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. 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 species in various regions:

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

Next Generation Science Standards

Performance Expectations

MS-LS1-6. Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
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.
MS-LS2-2. Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.
MS-LS2-3. Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.
MS-LS2-4. Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

Science and Engineering Practices

Asking Questions and Defining Problems
Developing and Using Models
Constructing Explanations and Designing Solutions

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

Appendix: Arrows
Provide 15-20 arrows per group