

FOOD WEB FOREST MUNCHERS

Subject: Science

Skills: Classification, Comparison, Discussion, Kinesthetic, Large group, Modeling, Simulation

Duration: 1-2 Class Periods

Setting: Outside or Large Open Area

Materials:

- timer or clock
- construction paper (4 colors) for tokens. Red (Top predator), blue (Secondary consumers), yellow (Primary consumers), and green (Producers)
- Food Web Game Cards copied and cut apart
- one envelope per student

Michigan Curriculum Framework Content Standards and Benchmarks:

- Science LEC- III.5 e-1:** Strand III. Using Scientific Life Science Knowledge, Standard 5. Ecosystems (LEC), Benchmark e-1. Identify familiar organisms as part of a food chain or food web and describe their feeding relationships within the web. (Key Concepts: Producer, consumer, predator, prey, decomposer, habitat, community. Real-world contexts: Food chains and food webs involving organisms, such as rabbits, birds, snakes, grasshopper, plants.)
- Science LEC- III.5 e-4:** Strand III. Using Scientific Life Science Knowledge, Standard 5. Ecosystems (LEC), Benchmark e-4. Describe positive and negative effects of humans on the environment. (Key concepts: Human effects on the environment-garbage, habitat destruction, land management, renewable and non-renewable resources. Real-world contexts: Household wastes, school wastes, waste water treatment, habitat destruction due to community growth, reforestation projects, establishing parks or other green spaces, recycling.)
- Science II.III.5.MS 1:** LEC Ecosystems, Standard III.5. Describe how materials cycle through an ecosystem. Benchmark MS 1. Describe common patterns of relationships among populations.
- Science II.III.5.MS 3: LEC Ecosystems,** Standard III.5. Describe how materials cycle through an ecosystem. Benchmark MS 3. Predict the effects of changes in one population in a food web on other populations.

Kent County Collaborative Core Curriculum (KC⁴):

- Science:** 3:3, 3:5
4:1, 4:2
5:1, 5:4

OVERVIEW

Students will use body movement, pantomime, and food tokens to simulate the feeding motions of forest and open land organisms and identify their interconnectedness in a food web.

OBJECTIVES

After participating in this activity, students will be able to:

- Diagram a food web.
- Compare a food web to a food chain and list similarities and differences.
- Discuss predator-prey and consumer-producer relationships using vocabulary words.
- Make predictions about the roles each link plays in the overall food web.
- Observe how the producers in a food web affect the consumers and top predators in the web.

BACKGROUND

Forests, open space, farmland and **green spaces** are all areas that provide habitat for Michigan plants and animals. An essential component of habitat is food, including the dynamics of food webs. In order to understand the consequences of habitat loss, it is important to understand food chains and food webs.

Plants use the energy from sunlight to grow, and in the process they provide both shelter and food for other organisms. Thus, natural areas tend to be the most abundant with organisms all the way up the **food chain**. For example, insects eat plants, and then toads eat the insects. Bears eat toads, and then people catch and eat bears. However, it is not always a simple food chain, and the reality ends up being a sometimes confusing **food web**, which this activity will attempt to demonstrate.

The beauty of the confusion behind a food web is that an organism can often feed on more than one organism. This is important because, if one organism is in low numbers or disappears, then the population of consumers is not necessarily lost—it can find other sources of food. This is the **balance**

of nature. It is important to remember that, if too many links of the food web are lost, then it will affect every other link and ultimately us as humans.

For simplicity of this game, organisms are assigned specific prey that they are allowed to consume. In reality, size of an organism is an important factor. For example, young snakes may in fact be prey to adult robins. Similarly, a small hawk that falls out of the nest could become food for a snake. There are endless examples of how the age or size of an organism could alter the structure of a food web. The end result of a food web is the transfer of energy and **bio-mass** produced by **producer organisms** to the **top consumers** or **predators**.

With every transfer of energy (consumption of food), there is some energy that is put into mass (animal growth), some used for daily activities (such as movement), and some returned to the ecosystem as waste. Therefore, it takes larger amounts of organisms at the lower end of a food web to support the fewer organisms at the top, since much of the energy produced goes to daily activities and waste. At times, organisms at the bottom or middle of the web may die before they are consumed. In this case, the energy and bio-mass are returned to the beginning of the web as nutrients for new plant growth.

PROCEDURE

1. Cut the appropriate colored construction paper into food tokens according to Table 1. Reproduce the **Food Web Game Cards** and cut them apart. Put one game card and the appropriate color and number of food tokens into each envelope.
2. Describe Michigan forest and open land habitat in terms of the plants and animals that live there. Have students discuss what they know about forests and open land. What lives there? Discuss the organisms. Find out how these areas may be important to the students (i.e. exploring, bird watching, collecting insects and toads, hunting, etc.) Introduce the terms **predator** and **prey**, as well as **producers** and **consumers**. With the students' help, build on their existing knowledge in order to come up with a usable but understandable definition of these terms. Also review the definition of a **food chain**.
3. Explain to the students that they are going to participate in an activity where they will see how **food webs** work by becoming forest and open land plants and animals.
4. Pass out one envelope to each student. Explain that their identity is a secret — they are not to tell others. Each envelope contains the identity of one organism that lives in a forest or open land. The only way others will know what they are is by their character movements and feeding behaviors. When they receive their envelopes, explain that organisms (students) need to eat to survive and that some

organisms (students) depend on others to survive. Some students will be predators and others will be prey. Some students will be both – they will need to eat other organisms but avoid being eaten themselves. Discuss this for a minute. Can there be more than one predator? Can predators eat predators? Build on previous knowledge regarding food chains to understand the concept of a food web.

5. Have the students open their envelopes. Inside, they will discover the animal/plant they will represent as well as game rules and instructions on acting out their character behavior and feeding motions. Remind them not to tell what they are. They have to indicate what organism they are by their character behavior. Emphasize that they are people pretending to be animals and that humans will not be able to move exactly like animals. Model and practice with the students the behavior of each organism. Identify them so the students recognize what each organism does. (It may be more productive to allow the students to improvise.)

Table 1. Numbers of Food Web Tokens
(for a group size of 28 students)

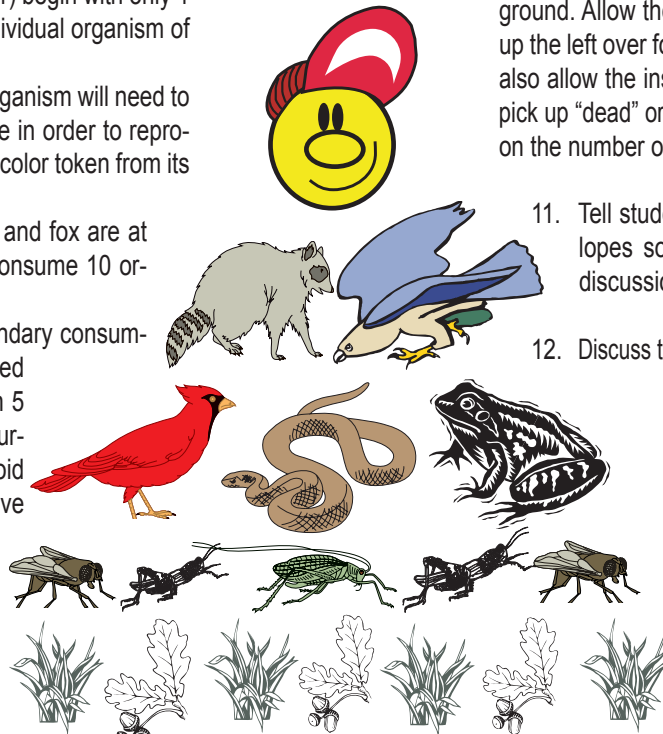
ORGANISMS	# STUDENT ACTORS	# OF TOKENS TO START	# OF TOKENS TO SURVIVE
Top Predators -- Red Tokens			
Person Hunting	1	1	10
Raccoon	1	1	10
Hawk	1	1	10
Fox	1	1	10
Badger	1	1	10
Secondary Consumers (may be predator or prey) -- Blue Tokens			
Robin	2	5	5
Snake	2	5	5
Toad	2	5	5
Primary Consumers (prey) -- Yellow Tokens			
Mice	4	5	1
Snails	3	5	1
Insects	5	5	1
Producers -- Green Tokens			
Plants	5	10	1

**If your group size is fewer than 28, remove one card from Top Predators, one from Secondary Consumers, one from Primary Consumers, one from Producers, one from Top Predators and so on, until you have the right number of cards for your group. If your group size is larger than 28, add one card to Producers, one to Primary Consumers, one to Secondary Consumers, one to Top Predators, one to Producers and so on, until you have the right number of cards for your group.

NOTE: If you think it will be too hard for the students to remember or identify organisms by acting out the behaviors, allow the students to attach their **Food Web Game Cards to their bodies with tape or safety pins for easier identification.**

6. Explain the rules:

- Each student represents an organism that is a producer or a consumer. Consumers will play the roles of predators, prey, or both.
- Each producer has 10 food tokens, representing 10 individual plants of the same species.
- Each primary consumer (insects, snails, and mice) starts with 5 food tokens, secondary consumers (snakes, toads, and robins) start with 5 food tokens, and top predators (human, raccoon, hawk, fox, and badger) begin with only 1 token. Each token represents an individual organism of the same species.
- During the first cycle or year, each organism will need to eat enough food to grow and survive in order to reproduce. Organisms can eat (take) any color token from its prey.
- The hunter, raccoon, hawk, badger, and fox are at the top of the food web and must consume 10 organisms to survive.
- Snakes, toads, and robins are secondary consumers or primary predators; they will need to consume and have in possession 5 organisms at the end of the year to survive. However, they must also avoid predation. If captured they must give up any one of their organisms (food tokens).
- Mice, insects, and snails need only to end the year with one organism to survive. However they must also eat enough to account for predation, or they will die, too.
- Plants without food tokens die and are directly returned to the soil as nutrients. In order to get food tokens, plants must wait until another organism dies (at the end of the cycle) and returns nutrients to the soil to be used for new plant growth.
- Any consumer that does not end the year with enough food tokens (any color) to survive will sit down and return what they do have to the ground for consumption by plants and other organisms that feed on decaying organisms. Plants are then allowed to run and pick up tokens from the consumers that did not survive. Record the results of each round of play.
- It is important that each organism continue to enact what it is. If an organism forgets what different pantomimes represent, then it is up to them to investigate if they want to survive. However, they will have to realize that food webs are not forgiving and a nosy little bird that investigates a hawk will become food for the hawk!



7. Establish a play area (inside a classroom or outside) and have all producers take their envelopes with them, spread themselves out on the playing field, and start pantomiming their character and feeding behaviors.
8. Tell the predators and consumers to begin to pantomime their respective feeding behaviors, capture their prey, and secure a food token from them, placing it in their envelope.
9. Call time when appropriate (after most top predators have got ten 10 food tokens).
10. Tell students to count their food tokens. If they do not have enough tokens to survive the cycle, they must sit down and spread out their remaining tokens on the ground. Allow the plant organisms to run and pick up the left over food tokens. (OPTIONAL: You may also allow the insects and snails-**decomposers**-to pick up "dead" organism food tokens. This depends on the number of leftover tokens.)
11. Tell students to hold onto their food envelopes so that they can participate in the discussions.
12. Discuss the results. Did every consumer fill up by getting their required number of food tokens during the cycle or year? If not, why not? (Some animals are more selective in feeding preferences and therefore may have a more difficult time finding food.) Talk about the different ways the animals are connected to each other and the producers. Be sure that the supporting roles of decomposers (snails, insects) does not get overlooked. Decomposers are responsible for breaking down dead organisms into nutrients usable by plants for growth.
13. Draw a food web based on the feeding interactions that took place during the game. Discuss how tokens got from the bottom of the web to the very top. (What organisms did the tokens go through?) Discuss how many plants and lower organisms it took to support the top of the food web. Practice making predictions about roles each link plays in this food web, for example, what would happen if all of the toads died off?
14. Review the definition of a food chain, and compare similarities and differences between food webs and food chains. What would happen if natural feeding relationships happened only in chains? (Top predators would surely die out if they only had one source of food and that food source died out.)

15. Discuss the effects that humans can have on food webs. For example:
 - What happens to a food web if habitat is destroyed due to community growth and development?
 - What might happen to a food web if an animal species is over-hunted, and its population is dying out?
16. OPTIONAL: Replay the simulation for a second round or year leaving the tokens distributed as they were after the first round. Tokens left over from organisms that died during the first year will be returned to the ground for consumption by organisms such as the plants and insects.
17. Summarize by emphasizing the importance of Michigan forests and open land. These areas provide food and habitat for a variety of different kinds of animals.

ASSESSMENT OPTIONS

1. On paper or the chalkboard, have students (as a group or individually) create a diagram of the food web they enacted using vocabulary words and their pictures.
2. Ask students to discuss how the lowest links reached the top links. How many lower link organisms did it take to support the top of the food web? Why?
3. Students should differentiate between a food web and food chain and list similarities and differences. Why might food webs be important? What would happen if natural feeding relationships happened only in chains?

Adaptations/Extensions

1. Identify specific organisms that play the roles of the generalized links (i.e. Garden or Pine Snake for snakes; dragonflies and walking sticks for insects). Build into discussion what might happen if one type of bug species is lost? Two bugs? Three bugs?
2. Try altering the Food Web by removing one or more organisms. Act this out to observe and record how the top organisms are affected.
3. Introduce pollution into the food web by putting a black dot on 1/3 of the tokens. Demonstrate how pollutants build up in top predators and “kill” organisms if more than 50% of their tokens have black dots.
4. If possible, visit a forest or open land area. Have students identify the organisms (or signs of organisms) they role- played.

Computer Extensions

1. AskERIC.org. Food Chain/ Food Web Lesson Plan. Oct. 1999. 18 May 2002. <<http://www.askeric.org/cgi-bin/printlessons.cgi/Virtual/Lessons/Science/Ecology/ECL0096.html>> A complete lesson plan for teachers.
2. EdHelper.com. Food Webs. 18 May 2002. <<http://www.iit.edu/~smile/bi9317.html>> Quick and fun teacher lesson plan on food webs.
3. PlanetPals.com. Foodchain. 18 May 2002. <<http://www.planetpals.com/foodchain.html>> Text and graphics for students to read/review food chains.

SOURCE

Adapted with permission from Project WILD Aquatic, “Marsh Munchers,” Western Regional Environmental Education Council, Inc. 1992. Pages 58-63. Worksheets developed by Anne Williamson, curriculum consultant for United Growth for Kent County, a grant project of Michigan State University Extension.

ADDITIONAL RESOURCES

Contacts:

- Center for Environmental Study
- Local Nature Center
- Michigan Alliance for Environmental and Outdoor Education
- Michigan Department of Natural Resources
- Project WILD at Michigan State University
- U.S. Forest Service

Additional Lessons:

- Project Learning Tree: Web of Life, 148-152.
- Project WILD: Owl Pellets, 144-145.
- WOW! The Wonders of Wetlands: Marsh Market, 109-111.

CONCEPTUAL FRAMEWORK REFERENCE

IIA1, IIA2, IIC1, IIC3, IIIC2, IVA

Food Web Game Cards (photocopy and cut apart)

Food Web Game Card

1. You are a **Person Hunting**. You walk forward pulling back on a bow and arrow and tag prey by poking it in the back.
2. Top predators start with 1 food token.
3. As a top predator, **humans eat anything**.
4. You must consume 10 organisms to survive. (Collect 10 food tokens.)
5. If you do not have 10 tokens by the end of the cycle (year), return any remaining tokens to the ground and sit down.

Food Web Game Card

1. You are a **Badger**. You crouch low and act ferocious by showing your teeth. Tag prey with two hands.
2. Top predators start with 1 food token.
3. As a top predator, **badgers eat snakes, toads, and mice**.
4. You must consume 10 organisms to survive. (Collect 10 food tokens.)
5. If you are captured by a human predator, you must give up 1 token. If you run out of tokens, you must sit down.
6. If you do not have 10 tokens by the end of the cycle (year), return any remaining tokens to the ground and sit down.

Food Web Game Card

1. You are a **Raccoon**. You walk forward washing hands and grasping prey.
2. Top predators start with 1 food token.
3. As a top predator, **raccoons eat toads, snakes, and plants (nuts and fruit)**.
4. You must consume 10 organisms to survive. (Collect 10 food tokens.)
5. If you are captured by a human predator, you must give up 1 token. If you run out of tokens, you must sit down.
6. If you do not have 10 tokens by the end of the cycle (year), return any remaining tokens to the ground and sit down.

Food Web Game Card

1. You are a **Hawk**. You walk around with arms fully extended and fly quickly with short range flapping motions. Nearing prey, arms become a beak and grasp prey.
2. Top predators start with 1 food token.
3. As a top predator, **hawks eat robins, snakes, toads, and mice**.
4. You must consume 10 organisms to survive. (Collect 10 food tokens.)
5. If you are captured by a human predator, you must give up 1 token. If you run out of tokens, you must sit down.
6. If you do not have 10 tokens by the end of the cycle (year), return any remaining tokens to the ground and sit down.

Food Web Game Card

1. You are a **Fox**. You walk around with your hands on your head and fingers in the air representing sharp ears. Nearing prey, arms become a mouth and grasp prey.
2. Top predators start with 1 food token.
3. As a top predator, **foxes eat toads, mice, and robins**.
4. You must consume 10 organisms to survive. (Collect 10 food tokens.)
5. If you are captured by a human predator, you must give up 1 token. If you run out of tokens, you must sit down.
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Food Web Game Cards (photocopy and cut apart)

Food Web Game Card

1. You are a **Robin**. You walk with your thumbs in your armpits and flap your elbows.
2. Secondary consumers start with 5 food tokens.
3. As a secondary consumer, **robins eat snails and insects**.
4. You must consume organisms to survive. (Collect food tokens.)
5. As a secondary consumer, you are also prey. If you are captured by a predator, you must give up 1 token. **You can be eaten by a fox, hawk, or human**. If you run out of tokens, you must sit down.
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Food Web Game Card

1. You are a **Snake**. You hold your hands together, point your fingers straight forward, and slither them back and forth. Tag prey by darting your hands out.
2. Secondary consumers start with 5 food tokens.
3. As a secondary consumer, **snakes eat toads, mice, and insects**.
4. You must consume organisms to survive. (Collect food tokens.)
5. As a secondary consumer, you are also prey. If you are captured by a predator, you must give up 1 token. **You can be eaten by a raccoon, hawk, badger, or human**. If you run out of tokens, you must sit down.
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Food Web Game Card

1. You are a **Toad**. You capture food with your tongue. Tag prey by curling arm back and forth like a toad tongue.
2. Secondary consumers start with 5 food tokens.
3. As a secondary consumer, **toads eat insects and snails**.
4. You must consume organisms to survive. (Collect food tokens.)
5. As a secondary consumer, you are also prey. If you are captured by a predator, you must give up 1 token. **You can be eaten by a raccoon, fox, hawk, badger, or human**. If you run out of tokens, you must sit down.
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Food Web Game Cards (photocopy and cut apart)

Food Web Game Card

1. You are a **Mouse**. You feed on nuts, fruit, and grass seeds. Wrinkle your nose up and down and pretend to nibble on seeds. Nearing food, arms become paws and grasp food.
2. Primary consumers start with 5 food tokens.
3. As a primary consumer, **mice eat plants (seeds, nuts, and fruit)**.
4. You must consume organisms to survive. (Collect food tokens.)
5. As a primary consumer, you are prey for other animals. If you are captured by a predator, you must give up 1 token. **You can be eaten by a hawk, fox, badger, snakes, or humans.** If you run out of tokens, you must sit down.

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Food Web Game Card

1. You are a **Snail**. You scrape plants and detritus (decaying stuff) with a special tongue. Show a scraping motion by holding your arm out and opening and closing your fist.
2. Primary consumers start with 5 food tokens.
3. As a primary consumer, **snails eat animals or plants that have died or live plants.**
4. You must consume organisms to survive. (Collect food tokens.)
5. As a primary consumer, you are prey for other animals. If you are captured by a predator, you must give up 1 token. **You can be eaten by robins, toads, or humans.** If you run out of tokens, you must sit down.
6. If you do not have 1 token by the end of the cycle (year), sit down.

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Food Web Game Cards (photocopy and cut apart)

Food Web Game Card

1. You are an **Insect**. Insects are scavengers of plant and animal debris. You make feeding motions by holding your thumbs on your cheeks and clapping.
2. Primary consumers start with 5 food tokens.
3. As a primary consumer, **insects eat live plants, other insects, and animals or plants that have died.**
4. You must consume organisms to survive. (Collect food tokens.)
5. As a primary consumer, you are prey for other animals. If you are captured by a predator, you must give up 1 token. **You can be eaten by robins, snakes, toads, other insects or humans.** If you run out of tokens, you must sit down.
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Food Web Game Cards (photocopy and cut apart)

Food Web Game Card

1. You are a **Plant**. Plants use sunlight, nutrients and water to grow. You stand in one place and wiggle hands over head like plants moving in the wind.
2. Producers start with 10 food tokens.
3. As a producer, **plants eat animals or plants that have died.**
4. You must consume organisms to survive. (Collect food tokens.)
5. As a producer, you are food for other animals. If you are eaten, you must give up 1 token. **You can be eaten by raccoons, mice, snails, insects or humans.** If you run out of tokens, you must sit down.
6. If you do not have 1 token by the end of the cycle (year), sit down.

Food Web Game Card

1. You are a **Plant**. Plants use sunlight, nutrients and water to grow. You stand in one place and wiggle hands over head like plants moving in the wind.
2. Producers start with 10 food tokens.
3. As a producer, **plants eat animals or plants that have died.**
4. You must consume organisms to survive. (Collect food tokens.)
5. As a producer, you are food for other animals. If you are eaten, you must give up 1 token. **You can be eaten by raccoons, mice, snails, insects or humans.** If you run out of tokens, you must sit down.
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