

# Matter and Energy in Ecosystems

Teacher Facilitation Guide | Science, Biology Grades 9-10

Essential Question	Learning Goals	Standards
<p>How do matter and energy cycle and flow through an ecosystem?</p>	<p>Students will be able to:</p> <ul style="list-style-type: none"> <li>compare and contrast food chains and food webs.</li> <li>create a model of matter and energy cycling and flowing through an ecosystem</li> </ul>	<p>NGSS HS-LS2-4 Ecosystems: Interactions, Energy, and Dynamics</p>

## Preparation

1. Make a copy of the [ALA: Matter and Energy in Ecosystems Google Slides](#).
2. Preview the activities, including all resources.
3. Take note of any changes you would like to make and edit as needed to accommodate your students' needs. Consider which activities lend themselves best to teacher facilitation, group **collaboration**, and/or independent practice and edit the slide deck as needed.
4. Review the learning artifact options and make a plan for which choices you will offer.
5. Make a list of must-dos before students begin this unit.
6. The facilitation notes that follow offer suggestions for how to best implement each activity in the slide deck, with active learning in mind.

### Learning Artifact Options

1. Written answers to reflection questions
2. Participation in a group discussion in response to reflection questions
3. A visual representation of their answers to the reflection questions

## Overview

This lesson can be completed individually or with a partner. It introduces students to the basic ideas of how energy and nutrients flow through ecosystems and then invites students to apply these ideas towards creating a model depicting the cycle and flow of energy and nutrients through an ecosystem. This lesson can be adjusted to go more deeply into the topic and/or be more specific and relevant for students in your class. The lesson can also be shortened (by having students complete Activities 2 and 3 only) if you just want to introduce students to food chains, food webs, and trophic levels.


### Jump to:

- Activity 1: [An Introduction \(Slides 2-3\)](#)
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- Activity 2: [Chains and Webs \(Slide 4-5\)](#)
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- Activity 3: [Trophic Levels \(Slides 6-7\)](#)
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- Activity 4: [Create a Model \(Slide 8\)](#)
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## Activity 1: An Introduction (Slides 2–3)

**Learning Goal:** Explain how nutrients and energy cycle and flow through an ecosystem.

### Slide 2

<p>Activity 1: An Introduction </p> <p><i>All living things need energy and nutrients to grow, reproduce, and carry out all the essential functions of life.</i> But where do these nutrients and energy come from?</p> <p>Conduct some research and in your science notebook, complete these tasks:</p> <ol style="list-style-type: none"><li>1. Describe how energy flows through an ecosystem.</li><li>2. Describe how nutrients flow through an ecosystem.</li><li>3. Compare and contrast how matter and energy flow through an ecosystem.</li><li>4. Define the key terms producer, consumer, and decomposer. Provide specific examples of each.</li></ol> <p>2</p>	<p>It is okay if students are off the mark here. The important thing is that they begin <b>establishing meaning</b> through their research and start to distinguish between the different roles of organisms in an ecosystem.</p> <p>Students can use <a href="#">this website</a> to <b>investigate</b> the Law of Conservation of Mass as it relates to the cycling of matter and the flow of energy in ecosystems.</p>
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### Slide 3

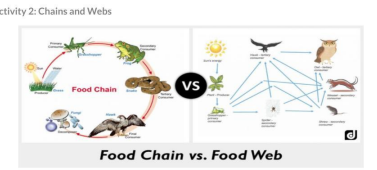
<p>Activity 1: An Introduction </p> <p>Consider this:</p> <ul style="list-style-type: none"><li>● Would life on Earth be different without decomposers? Why or why not?</li></ul> <p>Include an example to support your claim. Be ready to share!</p> <p>3</p>	<p> <b>ACTIVE LEARNING PRO-TIP</b></p> <p>As a way to practice CER (Claim-Evidence-Reasoning) statements, create a shared Google document or other virtual collaborative space. Then, ask students to record their thoughts regarding the role of decomposers in ecosystems (claim), an example (evidence), and a scientific principle/explanation that supports their thinking (reasoning).</p>
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## Activity 2: Chains and Webs (Slide 4-5)

**Learning Goal:** Compare and contrast food chains and food webs.

### Slide 4

Activity 2: Chains and Webs




**Food Chain vs. Food Web**

Compare and contrast a food chain vs. a food web. What are the similarities and what are the differences?

Ask students to examine these models of a food chain vs. a food web, and then, facilitate a discussion of the models using the questions below.

- Can you **identify patterns** to describe a food chain?
- What are some patterns of a food web?
- How is a food chain similar to a food web?
- What are the differences in the model?


 **TEACHER TALK**

*Describing the relationships between the organisms in an ecosystem is a bit more complex than "eat or be eaten." Let's take a more in-depth look at food chains and food webs.*

### Slide 5


Activity 2: Chains and Webs

Activity: Build Food Chains & Food Webs




Click on a living thing and drag it to the correct place. When you've completed the chain, a video will launch!

Conduct this activity together as a class, in order to address any misunderstandings students might have.

 **ACTIVE LEARNING PRO-TIP**

Students could **collaborate** with a partner or a small group and then report their overall results. Ask students to share if they have seen or experienced any of the living things in their own communities that are shown in the videos.

 **DIFFERENTIATE**

Additional Resources for Student Choice:


- [This video](#) (5:48) from the Amoeba Sisters can help students who might be struggling with vocabulary.

- For a more advanced example of a food web, this [video resource](#) (3:07) illustrates the complexity of the feeding relationships in an ecosystem using the model of the Everglades as an example.



## Activity 3: Trophic Levels (Slides 6–7)

**Student Goal:** Explore your own unconscious biases.

### Slide 6

<p>Activity 3: Trophic Levels </p> <p>A coyote gobbles up the matter that makes up the body of a rabbit. The energy flows from prey to predator.</p> <p>But the coyote does not receive 100% of the energy from the rabbit.</p> <p><b>Why not?</b></p> <p>First, write down and discuss your initial thoughts with a peer. Then, conduct your own research to discover why not.</p> <p>4</p>	<p><b>Check in with students</b> here to discuss their research and results.</p>
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### Slide 7

<p>Activity 3: Trophic Levels </p> <p>In your science notebook, answer and complete the following:</p> <ul style="list-style-type: none"> <li>• What is a trophic level?</li> <li>• Why is an ecosystem typically limited to only four or five trophic levels?</li> <li>• How is 90% of the energy at each trophic level used? Why does only 10% of the energy make it from one trophic level to the next?</li> <li>• Create and model an energy pyramid that depicts five trophic levels. Identify a specific organism for each level.</li> <li>• Suppose that 1500 kcal of energy are available at the producers' trophic level. Calculate and label how much energy is available at each of the other trophic levels.</li> </ul> <p>7</p>	<p><b>Check in with students</b> here, too, to discuss and review their responses. Students often struggle with the 10% rule for energy transfer from one trophic level to the next.</p> <p> <b>ACTIVE LEARNING PRO-TIP</b></p> <p>Help ensure students recognize that the 10% rule is what limits the number of trophic levels an ecosystem can support by using this <a href="#">10% modeling activity</a>.</p>
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## Activity 4: Create a Model (Slide 8-9)

**Student Goal:** Create a model of matter and energy cycling and flowing through an ecosystem.

### [Slide 8](#)

<div data-bbox="212 478 643 716"> <p>Activity 4: Create a Model </p> <p>Create your own model showing how matter and energy cycle and flow through an ecosystem.</p> <p>Complete <b>one</b> of two options:</p> <p>Option 1: <a href="#">Savanna Ecosystem</a></p> <p style="text-align: center;"><b>OR</b></p> <p>Option 2: <a href="#">Tropical Forest Ecosystem</a></p> <ul style="list-style-type: none"> <li>• Submit the food web and energy pyramid from parts 2 and 3.</li> <li>• Include the recycling of matter.</li> <li>• Include appropriate source citations in APA format where needed.</li> </ul> </div>	<p>This final activity can be tailored or changed entirely to fit the needs of students. Consider allowing students to work with a partner. Note, Part 1 of the HHMI activity is not relevant to what students will be doing in terms of creating a model. However, let your students know if you prefer they submit this part, too.</p> <p>Present students with the two options on slide 8. For guidance, see the educator materials for <a href="#">Option 1</a> and <a href="#">Option 2</a>. Note: You will need to print and provide the "cards" for students for this activity (or provide the link). For students completing the savanna ecosystem option, this optional video is available: <a href="#">The Guide: A Biologist in Gorongosa</a> (34:31).</p> <p>An additional option to offer students is the opportunity to complete an <a href="#">Owl Pellet Dissection Investigation</a>. An overview, teacher notes, and student worksheet are also available in this <a href="#">Owl Pellet Food Webs: A Model of Energy and Mass Transfer</a> resource from Carolina Biological, as are the <a href="#">owl pellets</a>.</p> <p> <b>DIFFERENTIATE</b></p> <p>Include a reflection after students complete the model.</p> <ul style="list-style-type: none"> <li>● What was the most interesting thing you learned from completing your artifact?</li> <li>● What was the most challenging part of completing your food web? Why?</li> <li>● Predict how ecological forces or disturbances may impact models and justify claims with evidence.</li> </ul>
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