



Learning Activity:

**It's a Matter of Energy: Arctic Food Webs**

<b>Activity Type</b>	Modeling
<b>Focus Area</b>	Science, Visual Art
<b>Time Required</b>	45–60 minutes

**Overview**

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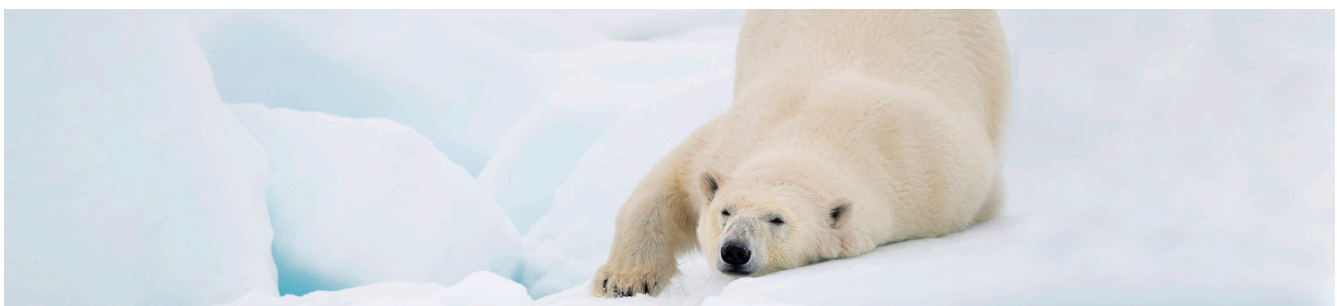
The Arctic contains a variety of rich ecosystems, each housing intricate transfers of matter and energy among its members. In this activity, students will learn about some of the producers, consumers, and decomposers that are a part of the terrestrial, marine, and freshwater ecosystems of the Arctic, and then they will create food web models to visually represent the relationships that form between species through the movement of energy (food). At the conclusion of this activity, students will be able to answer the key question: *How do Arctic species depend on one another to keep energy flowing through the ecosystem?* When reflecting on the interdependence represented in their models, learners will explain how energy connects organisms and how outside factors, such as climate change, can disrupt these processes.

**Objectives**

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**After completing the activity, learners will be able to**

- understand that there are a variety of ecosystems found throughout the Arctic, each with its own rich biodiversity
- explain, using visual representations, the transfer of energy between producers and consumers in an Arctic ecosystem and how matter is recycled
- describe how energy connects members of the Arctic and how outside intrusions such as human activities or invasive species can upset this connectivity



*Polar bear stretching on an ice floe, Svalbard, Norway*



## Standards

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### Next Generation Science

- 5-LS2-1 Ecosystems: Interactions, Energy, and Dynamics
  - Develop a model to describe the movement of matter among plants, animals, decomposers, and the environment.

## Materials Needed

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- One container (e.g., a lunch bag or an empty tissue box) per participant or group
- Coloring utensils
- Tape or glue
- Large paper (e.g., butcher paper, posters, or large easel Post-its®; one per participant or group)
- Pre-cut slips of paper from the terrestrial, marine, and freshwater ecosystem handouts (included)
- Copies of the student handout (included)
- Optional: string, scissors, construction paper
- *Educator's Resource Guide* (for reference)

## Vocabulary

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- **Biodiversity:** all the different kinds of life found in one area, including animals, plants, fungi, bacteria, and genetic material
- **Consumer:** a plant or animal that obtains food by preying on other living things or eating particles of organic matter
- **Decomposer:** an organism (such as a bacterium or fungus) that feeds on and breaks down dead plant or animal matter
- **Ecosystem:** the living (e.g., humans, polar bears, fish) and nonliving (e.g., air, ice, water) components of an area that interact with each other in an interconnected way
- **Energy:** the capacity for doing work; a basic unit in nature that is transferred between parts of a system and results in a physical change
- **Interdependence:** the reliance that all living things have on each other in order to survive
- **Matter:** the substance that physical objects are made of
- **Photosynthesis:** the process by which plants make chemical (food) energy from water, carbon dioxide, and light



- **Producer:** a living thing (such as a green plant) that makes its food from nonliving things (such as carbon dioxide and nitrogen) and may be a food source for other organisms
- **Scavenger:** an organism that usually feeds on dead or decaying matter
- **Tundra:** a treeless plain of the Arctic region that has a permanently frozen layer below the surface of its soil

## Activity Procedure

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### Part 1: Teacher Preparation

- Participants will create an energy model of three ecosystems within the Arctic (terrestrial, marine, and freshwater). Depending on the size of your group, determine if students will work individually or in teams and, based on the amount of time you have, choose whether you'd like to have each student or group create three separate diagrams of each of the ecosystems or be assigned one ecosystem.
- Cut apart the various ecosystem squares from the handouts. Separate each ecosystem's squares into its own container, making sure that the squares are well mixed.

### Part 2: Introductory Discussion

- Begin by posing the following warm-up question to learners: *When thinking about the Arctic region, what species come to mind?*
  - Encourage participants to share their thoughts and create a word cloud.
- Explain to students that although the Arctic is known for being a very cold place, it's filled with life. There is rich biodiversity on land, in the ocean, and in rivers and lakes.
  - Reflect on the word cloud; see if students can contribute more species, now organizing their answers based on where the species are found (on land, in the ocean, or in rivers and lakes).



*A school of salmon swims close to shore in Lake Iliamna in Pedro Bay, Alaska.*



- Within land, ocean, and freshwater ecosystems, all of the organisms depend on each other to survive through their intertwining relationships inside the food web. Have the included vocabulary terms displayed for reference and review the roles of producers, consumers, scavengers, and decomposers in a food web.
  - Have learners reflect on their word cloud answers one last time and challenge them to add more species, this time considering their roles within food webs.
  - Ask learners to think about these Arctic species and their respective roles, and then ask, *How do these organisms get the energy they need to survive?*

At the completion of this activity, students should be able to answer the key question.

**KEY QUESTION:** How do Arctic species depend on one another to keep energy flowing through the ecosystem?

### Part 3: Activity

- Distribute the following to each individual or group: one large piece of paper, coloring utensils, tape or glue, and the container of mixed-up squares from their assigned ecosystem(s). If available, you can also supply several sheets of construction paper, a pair of scissors, and string, to encourage creativity.
- Introduce the activity by explaining to learners that they will use the distributed materials to create a food web model that demonstrates the flow of energy among the Arctic species in their ecosystem.
  - Encourage participants to be creative with the use of the materials. There isn't one correct way to build their model; you can recommend that they use the large paper as their display canvas. Remind them that the goal is to visually represent the flow of energy between the producers and consumers.
- Once participants finish their displays, ask, *What's missing?* Take a few moments to have students share ideas of what they believe would make their models more complete.
  - Guide them by discussing what processes need to take place for the energy to flow throughout the food web. *Producers get energy by making their own food, but what do they need in order to do that? What happens when the top consumers or predators die; does the energy just disappear?*
- Using the materials available, learners should now add other components to their models that are needed to complete the cycle of matter. This could include sun, gases, water, soil, nutrients, scavengers, and decomposers. Encourage students to be creative in incorporating these important pieces of the ecosystem (e.g., by coloring them in, cutting out construction paper, using the string), making sure that movement through the cycle is represented on the visual display.



- Once the food web models are complete, have learners share their final products, noting which Arctic ecosystem their model represents and explaining the roles of each included component in the transfer of energy and matter.
- As a conclusion to the activity, have learners submit written answers to the following challenge question.
  - Consider the impacts climate change is having on the Arctic, for example, sea ice habitat is melting, invasive species are arriving in search of cooler temperatures, and species migration and breeding patterns are changing. *Select one effect of climate change and describe some of the impacts it may have on one of the food webs modeled in the activity.* For example, the Atlantic cod is a temperate species of fish that is moving into the Arctic as a result of climate change. How would this change affect other members of the marine Arctic food web?

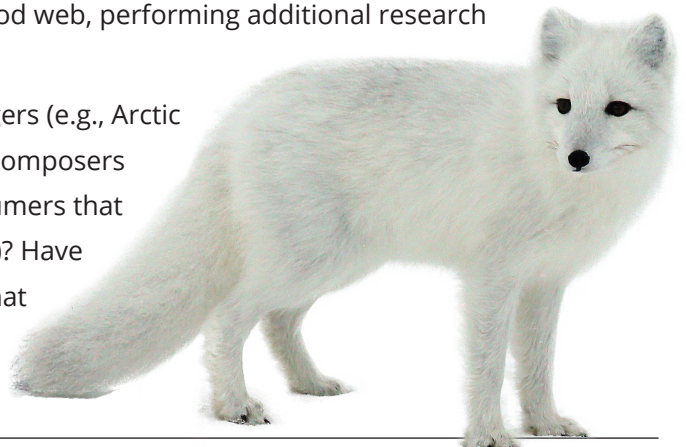
#### Part 4: Reflection and Assessment

- To tie the activity back to the key question, discuss the following with students.
  - Each producer, consumer, and decomposer has a role in keeping the energy flowing through an ecosystem. *What would happen if even one of these members on your food web were to no longer exist? What kind of effects would it have?*
  - Many people in the Arctic have a close connection to nature, as they rely on it not just for food but also for their livelihood. People are members of every Arctic ecosystem. *What role do humans play in these food webs? How would their lives be affected if anything were to change within their food webs?*
- As a follow-up assignment, have learners answer the post-activity questions on the (included) student handout individually or as part of a group discussion.

#### Extended Learning Options

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- Have learners look for consistencies across each food web, performing additional research as needed.
  - Are there any consumers that are also scavengers (e.g., Arctic fox)? Are there any producers that are also decomposers (e.g., lichen)? Are there any producers or consumers that appear on multiple food webs (e.g., polar bear)? Have students explain and determine if they think that these organisms are affected more or less by changes disrupting the transfer of energy.





- If you have a large group, you can choose to make one large mural display for your room or hallway that represents energy throughout all of the Arctic's ecosystems.
- For a fun way to assess student comprehension on this topic and others associated with the Arctic, check out the Wild Classroom Kahoot! Collection [Habitat spotlight: the Arctic](#).

## Additional Resources

You can use the information found at the following links to enhance your discussion with the class, or you may want to share some links directly with learners if you determine that they are grade-level appropriate.

- **Webpage:** [WWF Places—Arctic](#)
- **Webpage:** [Arctic Regions](#)
- **Web story:** [Why the Arctic National Wildlife Refuge needs more permanent protection](#)

For more fun classroom activities with a focus on wild species and conservation, visit [wildclassroom.org](http://wildclassroom.org).



*CarolAnn Hester holds smoked salmon in the doorway of her smokehouse in Naknek, Alaska. She practices subsistence fishing, catches salmon herself, and prepares the fish in a variety of ways for winter.*

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WILD CLASSROOM

# ARCTIC

## Terrestrial Ecosystem (tundra, boreal forest, mountains)

Cut out each member of the Arctic terrestrial ecosystem and shuffle them before using in the activity.



Shrub



Moss



Grass



Lichen



Mosquito/Insect



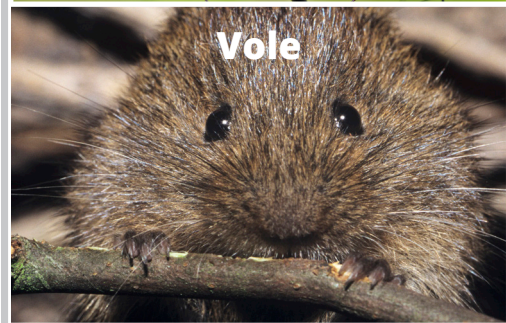
Reindeer



Caribou



Lemming



Vole



Ground squirrel



Musk ox



Arctic fox



Arctic wolf



Person



Snowy owl



Polar bear

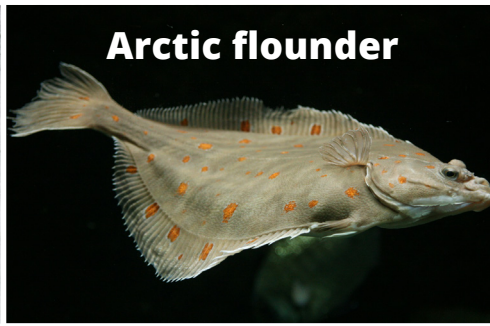


WILD CLASSROOM

# ARCTIC

## Marine Ecosystem (ocean, seas)

Cut out each member of the Arctic marine ecosystem and shuffle them before using in the activity.





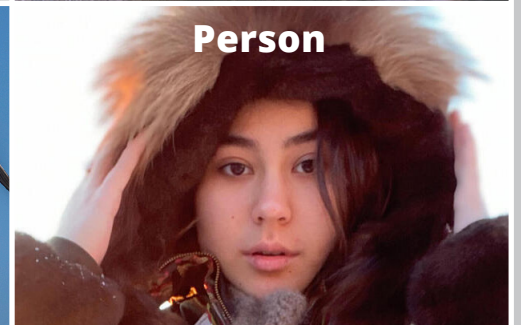
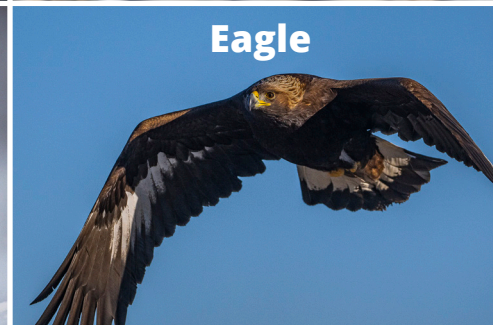
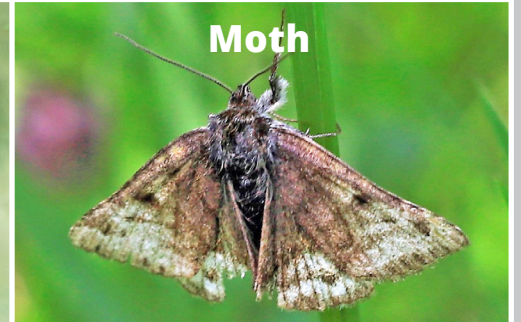


WILD CLASSROOM

# ARCTIC

## Freshwater Ecosystem (rivers, lakes, wetlands)

Cut out each member of the Arctic freshwater ecosystem and shuffle them before using in the activity.





WILD CLASSROOM

ARCTIC

## It's a Matter of Energy: Arctic Food Webs Student Handout

After completing your Arctic food web models, answer the following post-activity questions.

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- How do producers get energy?
  
  
  
  
  
  
  
  
  
  
  
  
  
- How do producers pass energy to consumers?
  
  
  
  
  
  
  
  
  
  
  
  
  
- Explain the role of decomposers.
  
  
  
  
  
  
  
  
  
  
  
  
  
- What other factors (including nonliving things) are needed to keep the cycle going?
  
  
  
  
  
  
  
  
  
  
  
  
  
- Provide three examples of how members in your ecosystem need each other.
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- Name one thing you learned about Arctic biodiversity by participating in this activity.