

WHAT IS AN ECOSYSTEM?



Overview

In this lesson, students will learn what an ecosystem is and how the components of the ecosystem interact.

Note: There are two parts to this lesson. Each part will take approximately one class period. Part 1 can be done independently. Vocabulary and concepts learned in Part 1 are needed to complete Part 2.

Objectives

On successful completion of this lesson, students will be able to:

- identify examples of living and nonliving things; and
- organize a simple food chain.

Alaska Standards

Alaska Science Standards / Grade Level Expectations

[4,5] SA1.1 The student demonstrates an understanding of the processes of science by describing, measuring, classifying, making generalizations, inferring, and communicating.

[4,5] SA1.2 The student demonstrates an understanding of the processes of science by using quantitative and qualitative observations: observing, describing, measuring, and collecting data from explorations and using this information to classify, predict, and communicate.

[4,5] SA2.1 The student demonstrates an understanding of the attitudes and approaches to scientific inquiry by supporting the student's own ideas with observations and peer reviews.

[4,5] SA3.1 The student demonstrates an understanding that interactions with the environment provide an opportunity for understanding scientific concepts by identifying the local limiting factors (e.g., weather, human influence, species interactions) that determine which plants and/or animals survive.

[4,5] SC3.1 The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and transformation of matter and energy by identifying examples of living and non-living things and the relationship between them, and by diagramming how matter and energy are transferred between them.

[4,5] SC3.2 The student demonstrates an understanding that all organisms are linked to each other and their physical environments through the transfer and



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transformation of matter and energy by identifying and organizing a simple food chain of familiar plants and animals, diagramming how energy flows through it, describing the effects of removing one link, and tracing the source of energy back to the sun.

Alaska Cultural Standards

- [A] Culturally knowledgeable students are well grounded in the culture heritage and traditions of their community. Students who meet this cultural standard are able to:
- [A.4] practice their traditional responsibilities to the surrounding environment.
- [B] Culturally knowledgeable students are able to build on the knowledge and skills of the local cultural community as a foundation from which to achieve personal and academic success throughout life. Students who meet this cultural standard are able to:
- [B.2] make effective use of the knowledge, skills, and ways to knowing from their own cultural traditions to learn about the larger world in which they live.
- [D] Culturally knowledgeable students are able to engage effectively in learning activities that are based on traditional ways of knowing and learning. Students who meet this cultural standard are able to:
- [D.1] acquire in-depth knowledge through active participation and meaningful interaction with Elders.
- [E] Culturally knowledgeable students demonstrate an awareness and appreciation of the relationships and processes of interaction of all elements in the world around them. Students who meet this cultural standard are able to:
- [E.2] understand the ecology and geography of the bioregion they inhabit.

Bering Strait School District Scope & Sequence

4th grade sequence #3: Ecosystems

5th grade sequence #4: Ecosystems

Materials

Part 1

- *Dory Story*, by Jerry Pallotta, ISBN # 0-88106-075-5
- Chart paper, Smart Board, or chalkboard



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- Colored markers for chart paper, Smart Board markers, or chalk for chalkboard
- Pictures of animals from the book
- Prepared ovals for food chain
- Science journals or writing paper

Part 2

- Hand lenses
- Science journals or writing paper

Activity Preparations

Part 1

1. Pre-read the book *Dory Story*.
2. Make labels for producer, consumer, decomposer, predator, prey.
3. Create pictures of the biotic organisms depicted in the book.
4. Make ovals for the food chain.

Part 2

1. Select a nearby ecosystem where you can take the class to visit
2. Invite an elder to accompany your class to the selected plot and ask the elder to share with the class changes that have occurred in that ecosystem during the elder's lifetime.

Whole Picture

An ecosystem is a community of living (biotic) and nonliving (abiotic) things that interact in the same environment. Biotic organisms include things like plants, animals, microbes, and people; abiotic components include things like rocks, minerals, and water. Ecosystems can be vast, like the tundra or the ocean, or they can be small, like a classroom terrarium. In either case, each component of the ecosystem depends on the others for survival. When one part is disrupted, it can throw the entire system out of balance.

Alaska boasts a wide array of different ecosystems. On the western coast, “an impressive variety of animals and fish appears and disappears as part of an annual cycle on which the Yup’ik [and Iñupiaq] people focus both thought and deed” (Fienup-Riordan, 1994, p. 14). Further inland, people depend on the ecosystems that include rivers and tributaries, as well as the tundra, where large subsistence animals like caribou and muskox can be found.

Alaska Native people have long been aware of the fine balance in the various ecosystems



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they call home. In many communities, spiritual practices helped to maintain the balance, and ensure that future years would bring continued hunting success. One such example is the Yup'ik Bladder Festival, where seal bladders were sent back to their watery world, in order to “help insure the rebirth of the yuit, or ‘persons,’ of the animals” and ensure continued abundance of the seals the following season (Fienup-Riordan, 1994, p.256). In many Iñupiaq communities ceremonies included giving a whale, walrus, or seal a sip of fresh water once it was brought on land. The practice was meant to show the harvested animal that the people were respectful; in this way, the animal spirit could go back to others of its kind and encourage them to give themselves for harvest, as well.

However, as the climate changes, people are witnessing disturbances in the fine ecosystem balance. Many elders and culture bearers blame the changes happening in the ecosystem on poor human practices. Paul John, from Toksook Bay gave the example of disappearing fish and marine mammals as the result of “wasteful practices, noting that when people throw unwanted fish back in the water, food resources will be harmed” (Fienup-Riordan and Rearden, 2012, p.38). Further, Paul Tunuchuk from Chefnak explained that “the adage ‘The world is changing following its people’ captures the Yup'ik view that environmental change is directly related not just to human action — over fishing, burning of fossil fuels — but to human interaction. ... [Elders] encourage young people to pay attention to qanruyutet [the wisdom and teachings of the elders], believing that if their values improve, correct actions will follow” (Fienup-Riordan and Rearden, 2012, p.42).

Nevertheless, many arctic ecosystems are in danger. Especially along the coast, once stable habitats are eroding, and animal behavior and plant timing are changing unpredictably and are disturbing other components of the system. One such example can be seen in changes to sea ice. “As ice conditions change, so does the presence of seals that make it their home ... According to John Eric from Chefnak not only are bearded seals and spotted seals becoming scarce, but beluga whales are also rarely seen and the ringed seals that were once plentiful around bays have moved farther down into the ocean” (Fienup-Riordan and Rearden, 2012, p. 306-307). Similarly, people on St. Lawrence Island “have long reported a delay in fall sea ice formation, which now commonly occurs in early December — instead of late October or November as in the ‘old days.’ ... In recent years, solid ice is often broken by leads, ice cracks, and patches of open water, even in the middle of winter” (Krupnik and Jolly, 2002, p.166).

The changes in ice patterns, which affect the abundance of marine mammals, also affect the people who depend on them for subsistence. Hunters need stable ice to haul out the animal and take it back to their village before it spoils. The lack of ice causes great trouble for hunters as well as for local villagers who depend on their hunters’ success.

Ecosystem changes are being witnessed not only on the sea, but also along the coast and further inland. Kenneth Kingeekuk, the former Vice President of the Savoonga Tribal



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Council, explained: “We’ve lost a lot of coastline. We’ve lost a lot of lakes and ponds where migratory birds lay their eggs in the summertime”(Kingeekuk, 2010). The loss of these lakes and ponds means that the birds will necessarily find somewhere new to raise their young. In turn, the loss of birds will mean an eventual change in the rest of the habitat, for each living organism fulfills a specific niche in an ecosystem. In other words, all the elements of an ecosystem are intricately tied, and the loss of one can disrupt the entire system.

Ecosystem change seems to be amplified in the Arctic. This is especially concerning for people whose lives and livelihoods are so closely intertwined with the environment. As changes continue to happen, elders and culture bearers emphasize the importance of learning traditional skills like observation, which will be needed if people are to adapt and understand the changes resulting from climate change.

Vocabulary

abiotic	nonliving component of an ecosystem (for example, water and sunlight)
biotic	living components of the environment that are alive, or were alive
consumer	a living organism that eats plants or other animals
dead	formerly a living organism that no longer reacts or interacts with other components of the ecosystem
decomposer	an organism that breaks down dead plants and animals, returning nutrients to the soil
ecosystem	the interactions and relationships of all living and non-living things in a specified area
food chain	a model that shows one-to-one links between producers and consumers
niche	role that an organism has in an ecosystem
predator	a living animal that hunts, kills and eats another animal
prey	a living animal that is hunted, killed, and eaten by another animal
producer	a plant that changes the sun’s radiant energy into chemical energy

Activity Procedure

Part 1

1. Read the book *Dory Story*. Briefly ask the students what they thought about the ending of the book. Ask what skill or scientific process the boy was using as



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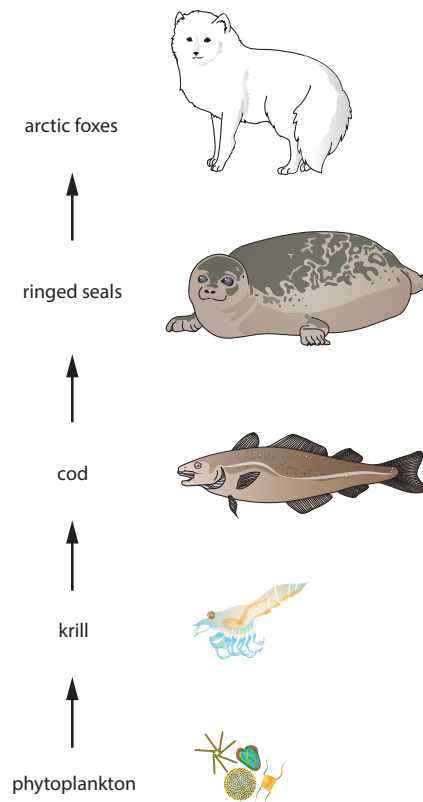
he explored the sea. If observation has not been provided, introduce the word observation and explain how observation is an important scientific process. Also make note that it is an important traditional skill that the elders and culture bearers use.

2. Define the words biotic and abiotic. Have students brainstorm a list of all the components in the story that were biotic or abiotic. Record their answers on the board or piece of chart paper. Ask if students think dead things are biotic or abiotic.

Biotic	Abiotic

3. Explain to the students that the book was about an ecosystem and the relationships and interactions of the components in that area. Explain that an ecosystem has a defined boundary and can be small or large.
4. Introduce and define the words consumer, producer, and decomposer. Using the list of biotic organisms have students, as a group, classify which are producers, consumers, and decomposers.
5. Ask: What is the relationship between producers, consumers, and decomposers?
6. Introduce the terms food chain, predator, and prey. Ask: What is the relationship between predator and prey? Using the class list, as a group, have students create a food chain, identifying those organisms that are predators and/or prey. Have them label their producers and consumers as predators and/or prey.

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7. Ask:

- What would happen if one of your producers was missing?
- What would happen if one of the abiotic elements changed?
- What are some of the relationships that exist among the components of an ecosystem?
- How do the biotic organisms compete with each other?
- What does a healthy ecosystem need?
- Why do we need decomposers?
- What are some characteristics of biotic organisms?
- What are some of the abiotic components of an ecosystem?

8. Writing Activity: Post the following questions for students to answer in their science journals or a separate piece of paper.

- What is one example of an abiotic component in an ecosystem?
- What are three of the life processes that biotic components in an ecosystem do?



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- What is the relationship between producers, consumers, and decomposers?
- What is the relationship between predators and prey?
- What is an ecosystem?

Part 2

1. Briefly review with the students what an ecosystem is. Ask for examples of local ecosystems and provide appropriate feedback on their responses.
2. Explain to the students that they will be going outside to observe a local ecosystem. Introduce the elder who will be accompanying the class to help them learn about how the area has changed. Pass out hand lenses, and have students take writing implements and their science journals (or worksheets) with them.
3. Take the students outside to the local ecosystem. Explain that they will use the science process skill and traditional cultural skill of observation to learn about a local ecosystem.
4. Have the students observe the ecosystem (e.g. large grassland, whole tree, seashore). Encourage them to use the hand lenses to observe the smaller components of the ecosystem. Have them record the biotic and abiotic components of the ecosystem. As the students are recording observations, have the elder describe what the area was like in an earlier time and changes that have occurred over time.
5. After the elder has finished talking, ask them to write down one or two things that have changed in the ecosystem that the elder had observed. Discuss with the class the biotic and abiotic components of the local ecosystem
6. Return to the classroom and review the definition of producers, consumers, decomposers, predators, and prey.
7. Ask:
 - What type of components did you find in the local ecosystem?
 - Did the type of components vary from location to location?
 - Have you noticed if any patterns emerged in the ecosystem?
 - What do you think will happen to the dead things?
 - How do the components of the local ecosystem interact with each other?
 - Were there signs of predators or prey?
8. Ask the students to create a simple food chain from the biotic components of the local environment. Have them label the producers, consumers, decomposers, predators, and prey.



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Extension Activities

- Research the difference between a real and artificial ecosystem in order to build an artificial ecosystem (i.e., a fish aquarium, Bottle biology, a garden).
- Create a food web from the biotic organisms from your ecosystem.
- Interview an Elder about how climate has changed and the effect it has had on local ecosystems.
- Create solutions to problems encountered in an ecosystem. (Examples follow)

You are a biologist with an emergency situation regarding the local caribou herd. The caribou are dying and you need to find out why. As you investigate, you discover that the local lichen has developed a brown mold. What could be the cause of this? What other problems could exist if this isn't fixed? How will you solve it? (Hint: Start by creating a food chain and labeling it)

You have decided to build a greenhouse in your backyard because food is too costly to have shipped in. You know it gets very dark and cold in the winter. Create an ecosystem to help you grow food. What problems do you need to solve? What are the biotic and abiotic factors that you need to consider?

Answers

Part 1

1. **Observation**
2. **Biotic** – boy, seabirds, Grandpa, Mom, Dad, shrimp, plankton, sand lances, sand eels, mackerels, bluefish, tuna, killer whales, humpback whale, harbor seals, seaweed, krill.
Abiotic – water, bay, sun, rock, shore, dark, dory, temperature (i.e. cold water).
Dead things are biotic because they were once living.
3. **Teacher explanation**
4. **Producers** – plankton, seaweed
Consumers - seabirds, shrimp, sand lances, sand eels, mackerels, bluefish, tuna, killer whales, humpback whale, harbor seals, krill
Decomposers – none
5. A producer makes its own food from sunlight, air, and soil. A consumer cannot make its own food and gets its food by eating other animals or plants. A decomposer cannot make its own food and must rely on dead plants and animals to survive.



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6. **Predators** - seabirds, shrimp, sand lances, sand eels, mackerels, bluefish, tuna, killer whales, humpback whale, harbor seals, krill

Prey – plankton, seabirds, shrimp, sand lances, sand eels, mackerels, bluefish, tuna, humpback whale, harbor seals, krill

7. **Discussion:**

- Consumers who feed on that organism would begin to die which could then impact all the other organisms, which could then begin to die; answers may vary as to details
- The ecosystem would begin to change; answer may vary as to details
- Organisms rely on each other for survival; biotic organisms rely on abiotic components in an ecosystem; answers may vary in details
- Answers vary
- Biotic (producers, consumers, and decomposers) and abiotic (land, water, temperature, sun) components
- To replenish the nutrients that organisms need to live; to decompose dead organisms
- Living, reproducing, growing, moving, eating, breathing - answers may vary in detail
- Land, water, climate, temperature, sun, energy

8. **Writing Activity:**

- Answers vary
- Live, reproduce, grow, move, breathe, eat – answers will vary
- A producer makes its own food from sunlight, air, and soil. A consumer cannot make its own food and gets its food by eating other animals or plants. A decomposer cannot make its own food and must rely on dead plants and animals to survive.
- A predator is an animal that hunts other animals for food. Prey is an animal that is hunted and eaten for food. An animal that is prey does not depend upon a predator to live, but a predator depends upon its prey to live.
- An ecosystem is the interaction and relationship of all living and non-living things in a specified area.

Part 2

1. Answers vary
4. Answers vary
5. Answers vary



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7. Answers vary
 - Answers vary
 - Answers vary
 - Decompose, rot, become nutrients, or return to the soil
 - Answers vary
 - Answers vary
8. Food chains will vary and be dependent upon the ecosystem visited.

References

- Fienup-Riordan, Ann, and Alice Rearden. (2012) *Ellavut: Our Yup'ik World and Weather. Continuity and Change on the Bering Sea Coast*. Seattle and London: University of Washington Press.
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- Kinggeekuk, Kenneth. (2010). "Overview of Impacts from Savoonga." *Stories About Adaptation and Subsistence: Native Voices from the Frontlines of Climate Change*. Aksik. Accessed from: <http://aksik.org/content/2010-overview-impacts>.
- Krupnik, Igor, and Daynna Jolly. (2002). *The Earth is Faster Now: Indigenous Observations of Arctic Environmental Change*. Arctic Research Consortium of the United States and Smithsonian Institution Presses.



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Ovals for Food Chain

The page contains eight empty ovals arranged in two columns and four rows. These ovals are intended for students to draw a food chain within them.