Lesson 2

Interactions in Ecosystems

MS-LS2-2, 4, 5

Ecosystems are made up of different groups of organisms. The organisms interact with one another and their physical environment in a number of different ways. These interactions can determine whether an organism will thrive in its environment.

Levels of Ecological Organization

Ecosystems can be divided into a number of levels. The smallest level is the individual. An individual is a single animal, plant, or other organism. All the individuals of a single species in a certain area make up a **population.** All the populations in an area make up a **community.** A community and the nonliving parts of its environment make up an **ecosystem.**

A population is made up of all the members of a species in a given area.

A community is made up of all the populations in a given area.

An ecosystem is all the living and nonliving things in an area

Which of these is an example of a community?

A a rainbow trout

B all the rainbow trout in a stream

C the water, rocks, and organisms in a stream

D all the rainbow trout, other fish, and insects in a stream

A single organism is an individual. So, choice A is incorrect. All the members of a single species in an area make up a population. So, choice B is incorrect. The living and nonliving things in an area make up an ecosystem. So, choice C is incorrect. A community is all the living things in an area. So, choice D is correct.

Relationships Among Organisms

Scientists can describe organisms in an ecosystem based on their relationships to one another. These relationships may be harmful, competitive, or beneficial. In some cases, organisms have developed dependent relationships. In such cases, one kind of organism might not be able to survive without the presence of another kind of organism. There are three main types of relationships between organisms:

- predator-prey
- competition
- symbiosis

In a predator-prey relationship, one kind of organism hunts and eats another kind of organism. The organism that hunts is the **predator.** The organism that is hunted is the **prey.** For example, if a dolphin hunts a fish, the dolphin is the predator and the fish is the prey. The terms *predator* and *prey* are most commonly used to refer to animals. However, it is also correct to say that herbivores are predators of plants. For example, cows are predators of grass.

Typically, predators have adaptations that help them find and capture prey. Prey have adaptations that help them hide or escape from their predators. Camouflage is an adaptation of many predators and prey. A tiger's stripes help the tiger blend in with grasses as it stalks a deer. A stick bug avoids predators by blending in with tree branches and twigs. Some prey live in herds. Large groups give each individual a better chance of avoiding a predator.

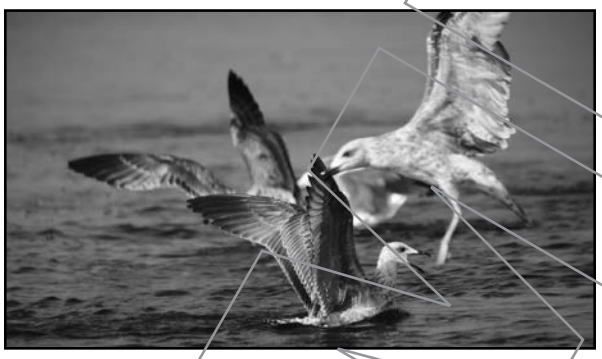
If a resource in an environment is scarce, organisms will compete for it. **Competition** is the struggle between organisms for the same limited resource. For example, if there are few moths in a forest ecosystem, bats will compete with other bats to eat the moths. Bats will also compete with other species that eat moths, such as spiders and frogs.

A predator is an organism that hunts and eats other organisms.

Prey are organisms that are hunted and eaten by a predator.

Competition involves the struggle of two or more organisms for the same resource.

If a species cannot successfully compete for resources, it may become extinct, or vanish forever.



Competition may be between individuals of a species or between species.

When competition occurs over a resource, there is often a winner and a loser. The winning organism competes better than the losing organism. It meets its needs and survives. The losing organism must find a different resource to meet its needs or it will not survive. In parts of North America, wolves and coyotes often compete for deer and rabbits. Wolves usually dominate the best hunting areas, which forces coyotes to adapt by hunting smaller animals or living closer to humans. This competition influences where and how both animals live.

Competition can occur over any resource, not just food. Bats might compete for living space in a cave. If water is scarce, frogs might compete over it for a place to lay their eggs. Forest fires, floods, droughts, and pollution can all affect the resources for which organisms compete.

A third important kind of relationship is symbiosis. **Symbiosis** is a very close relationship between two different kinds of organisms in which at least one organism benefits. There are three main kinds of symbiosis: **mutualism, commensalism,** and **parasitism.** The table on the next page describes these three kinds of symbiosis.

TYPES OF SYMBIOSIS

Type of Symbiosis	Description	Example
mutualism	Both organisms benefit.	Small birds eat insects from the backs of rhinoceroses. The birds get food, and the rhinoceroses get biting insects removed from their skin.
commensalism	One organism benefits, and the other is neither helped nor harmed.	Shrimp live in the poisonous tentacles of sea anemones. The tentacles protect the shrimp from predators. The shrimp do not harm or help the anemones.
parasitism	One organism benefits, and the other is harmed.	Flatworms live in the intestines of mammals. The worms absorb nutrients from the mammals. The worms get shelter and food. The mammals are harmed because the worms take nutrients from their bodies.

Symbiosis is a close relationship between members of two different species.

Mutualism is a symbiotic relationship in which both organisms benefit.

Commensalism is a symbiotic relationship in which one organism benefits but the other is neither benefited nor harmed.

Parasitism is a symbiotic relationship in which one organism benefits and the other is harmed.

Describe *one* example of mutualism involving an insect and a plant.

Many plants depend on insects for pollination. For example, honeybees carry pollen from one apple tree to another as they feed. The bee benefits because it gets food from the tree's flowers. The tree benefits because the bee helps its eggs get fertilized by the sperm contained in pollen.

Many symbiotic relationships involve bacteria. In fact, most plants and animals rely on bacteria in one way or another. For example, all plants need nitrogen to grow and repair their bodies. Nitrogen is the most common gas in the atmosphere. However, plants cannot use nitrogen gas from the atmosphere directly. Instead, bacteria that live in the soil take in nitrogen gas. They convert the nitrogen gas into compounds that contain nitrogen. The plants can use these compounds as a source of nitrogen.

Animals get the nitrogen they need by eating plants. Without the soil bacteria, plants and animals would not have enough nitrogen to survive. Soil bacteria and plants have a mutualistic relationship. The plants benefit because they get useful nutrients. The bacteria benefit because the plant roots give them a place to live.

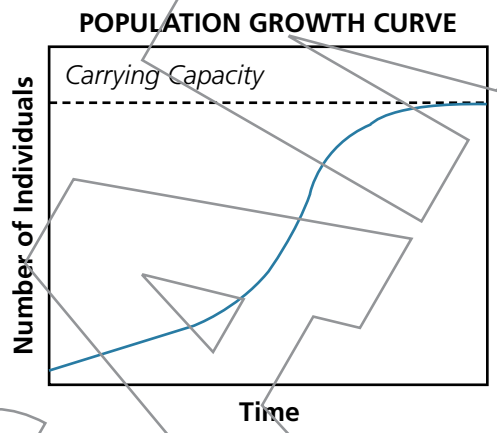
Many animals also rely more directly on bacteria. For example, there are more bacteria cells living in your intestines than there are human body cells in your whole body. The bacteria in your intestines help you digest your food. The beneficial bacteria in your intestines also compete with other, harmful bacteria. In general, the beneficial bacteria are more successful than the harmful bacteria. So, the bacteria in your intestines help protect you from getting sick. Similar beneficial bacteria in the intestines of other mammals help them digest their food, too.

Carrying Capacity

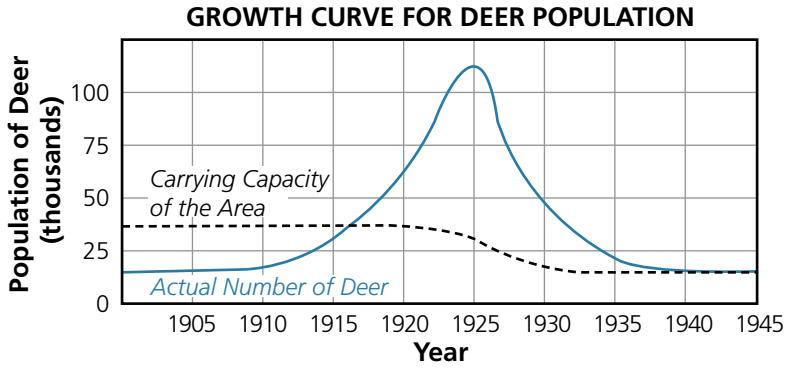
Although the environment provides resources for organisms, it cannot support an unlimited number of them. For example, bats eat insects in a forest ecosystem. There are only a certain number of insects available to be eaten. Therefore, only a certain number of bats can survive on the food that is available.

Populations generally grow at a high rate when many resources are available. As resources become less available, this growth rate slows. The largest number of individuals in a population that an ecosystem can support at a certain time is called its **carrying capacity.** The carrying capacity of an ecosystem limits the size of a population. The graph below shows the pattern of population growth in an ecosystem that reaches its carrying capacity.

The carrying capacity of an environment is the largest number of organisms of a given species that the ecosystem can support.



If a population grows past the carrying capacity of its ecosystem, the ecosystem will not sustain the population for long. Eventually, the size of the population will drop back to the carrying capacity. The graph below shows what happens over time to a population of deer that exceeds the carrying capacity of its environment.



The carrying capacity of an ecosystem does not always remain the same. If conditions change in an ecosystem, so will the carrying capacity. For example, if the number of moths in a forest ecosystem falls, the amount of food available to bats will decrease. Therefore, the carrying capacity of the environment for bats will decrease. Without enough food, the number of bats will drop to meet the new carrying capacity.

Suppose humans introduce a new flower to the ecosystem that provides food for moths. Explain what will most likely happen to the carrying capacity of the ecosystem for bats.

If the moths have a new source of food, their population will probably increase. An increased moth population can support a larger bat population. Therefore, the carrying capacity for bats will probably increase.

It's Your Turn

Please read each question carefully. For each multiple-choice question, circle the letter of the correct response.

1 A population of groundhogs lives in a field. Which of these events would most likely cause the population of groundhogs to stop increasing?

- **A** an increase in food supply
- **B** a decrease in competition
- **C** an increase in predator population
- **D** a decrease in disease rates

2 Cleaner fish live in many coral reef ecosystems. The cleaner fish swim into the mouths of larger fish. The cleaner fish eat scraps of food from between the larger fish's teeth. This helps prevent the larger fish's teeth from decaying. In this relationship,

- **A** neither organism benefits
- **B** both organisms benefit
- **C** the cleaner fish benefit, and the larger fish are harmed
- **D** the larger fish benefit, and the cleaner fish are harmed

3 Which bacterium is essential to the survival of another living thing?

- **A** Lactobacillus bacteria that change milk into yogurt
- **B** Staphylococcus bacteria that cause skin infections in people
- **C** Escherichia coli bacteria that scientists use in genetic research
- **D** Ruminococcus bacteria that help horses digest grass

This is an open-ended question. Write your answers on the lines.

4 Identify the type of symbiosis in question 3. Make a claim supporting your answer.

Type of Symbiosis _____

Claim _____

Use the information below to answer questions 5 and 6.

FROG POPULATIONS IN A POND ECOSYSTEM

Year	Pond Water Level (m)	Frog Population Count
1	1.5	120
2	1.2	110
3	0.8	75
4	0.5	40

5 Every spring, frogs lay their eggs in the water and tadpoles grow into adult frogs. Over the past few years, a drought has caused the water level in the pond to drop. Based on the data, which of these describes the effect of a drought on the frog population?

A The drought causes the frogs to find a new habitat on drier land.

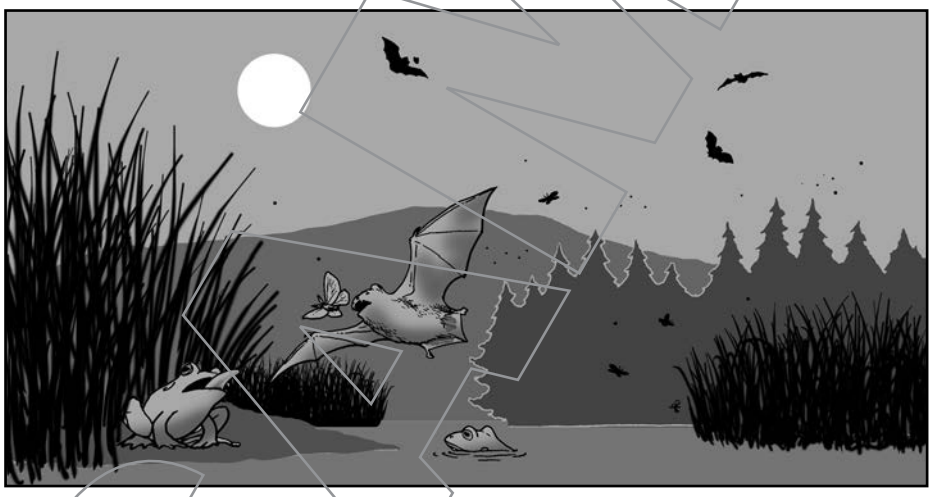
B The drought causes the water to become clear, making it hard for the frogs to survive.

C The frog population increases because the water level drops, creating more space for frogs to live.

D The frog population decreases because the water level drops, reducing habitat for frogs and tadpoles.

This is an open-ended question. Write your answers on the lines.

6 The diagram shows an example of an ecosystem.



Make a prediction about the growth of the bat population if this image was taken during year 1 of the drought. Make a claim to support your answer.

Prediction _____

Claim _____