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Lesson Objectives

- Define community as the term is used in ecology.
- Describe predation and its effects on population size and evolution.
- Explain why interspecific competition leads to extinction or greater specialization.
- Compare and contrast mutualism, commensalism, and parasitism.
- Outline primary and secondary succession, and define climax community.

Vocabulary

- climax community
- commensalism
- ecological succession
- host
- interspecific competition
- intraspecific competition
- keystone species
- limiting factor
- mutualism
- parasite
- parasitism
- pioneer species
- predation
- predator
- prey
- primary succession
- secondary succession
- specialization

Introduction

Biomes as different as deserts and wetlands share something very important. All biomes have populations of interacting species. Species also interact in the same basic ways in all biomes. For example, all biomes have some species that prey on others for food. The focus of study of species interactions is the community.

What Is a Community?

A community is the biotic part of an ecosystem. It consists of all the populations of all the species in the same area. It also includes their interactions. Species interactions in communities are important factors in natural selection.
They help shape the evolution of the interacting species. There are three major types of community interactions: predation, competition, and symbiosis.

**Predation**

_Predation_ is a relationship in which members of one species (the **predator**) consume members of another species (the **prey**). The lionesses and zebra in **Figure 1.1** are classic examples of predators and prey. In addition to the lionesses, there is another predator in this figure. Can you spot it? The other predator is the zebra. Like the lionesses, it consumes prey species, in this case species of grass. However, unlike the lionesses, the zebra does not kill its prey. Predator-prey relationships such as these account for most energy transfers in food chains and food webs.

**Predation and Population**

A predator-prey relationship tends to keep the populations of both species in balance. This is shown by the graph in **Figure 1.2**. As the prey population increases, there is more food for predators. So, after a slight lag, the predator population increases as well. As the number of predators increases, more prey are captured. As a result, the prey population starts to decrease. What happens to the predator population then?
In the predator-prey example, one factor limits the growth of the other factor. As the prey population decreases, the predator population begins to decrease as well. The prey population is a limiting factor. A **limiting factor** limits the growth or development of an organism, population, or process.

**Keystone Species**

Some predator species are known as keystone species. A **keystone species** is one that plays an especially important role in its community. Major changes in the numbers of a keystone species affect the populations of many other species in the community. For example, some sea star species are keystone species in coral reef communities. The sea stars prey on mussels and sea urchins, which have no other natural predators. If sea stars were removed from a coral reef community, mussel and sea urchin populations would have explosive growth. This, in turn, would drive out most other species. In the end, the coral reef community would be destroyed.

**Adaptations to Predation**

Both predators and prey have adaptations to predation that evolve through natural selection. Predator adaptations help them capture prey. Prey adaptations help them avoid predators. A common adaptation in both predator and prey is camouflage. Several examples are shown in **Figure 1.3**. Camouflage in prey helps them hide from predators. Camouflage in predators helps them sneak up on prey.

![Camouflage in Predator and Prey Species](image)

**FIGURE 1.3**

Camouflage in Predator and Prey Species. Can you see the crab in the photo on the left? It is camouflaged with the sand. The preying mantis in the middle photo looks just like the dead leaves in the background. Can you tell where one zebra ends and another one begins? This may confuse a predator and give the zebras a chance to run away.

**Competition**

Competition is a relationship between organisms that strive for the same resources in the same place. The resources might be food, water, or space. There are two different types of competition:

1. **Intraspecific competition** occurs between members of the same species. For example, two male birds of the same species might compete for mates in the same area. This type of competition is a basic factor in natural
selection. It leads to the evolution of better adaptations within a species.

2. **Interspecific competition** occurs between members of different species. For example, predators of different species might compete for the same prey.

**Interspecific Competition and Extinction**

Interspecific competition often leads to extinction. The species that is less well adapted may get fewer of the resources that both species need. As a result, members of that species are less likely to survive, and the species may go extinct.

**Interspecific Competition and Specialization**

Instead of extinction, interspecific competition may lead to greater specialization. **Specialization** occurs when competing species evolve different adaptations. For example, they may evolve adaptations that allow them to use different food sources. **Figure 1.4** describes an example.

**Specialization in Anole Lizards**

Many species of anole lizards prey on insects in tropical rainforests. Competition among them has led to the evolution of specializations. Some anoles prey on insects on the forest floor. Others prey on insects in trees. This allows the different species of anoles to live in the same area without competing.

**FIGURE 1.4**

Specialization in Anole Lizards. Specialization lets different species of anole lizards live in the same area without competing.

**Ground Anole**

**Tree Anole**

**Symbiotic Relationships**

Symbiosis is a close relationship between two species in which at least one species benefits. For the other species, the relationship may be positive, negative, or neutral. There are three basic types of symbiosis: mutualism, commensalism, and parasitism.
Mutualism

Mutualism is a symbiotic relationship in which both species benefit. An example of mutualism involves goby fish and shrimp (see Figure 1.5). The nearly blind shrimp and the fish spend most of their time together. The shrimp maintains a burrow in the sand in which both the fish and shrimp live. When a predator comes near, the fish touches the shrimp with its tail as a warning. Then, both fish and shrimp retreat to the burrow until the predator is gone. From their relationship, the shrimp gets a warning of approaching danger. The fish gets a safe retreat and a place to lay its eggs.

Commensalism

Commensalism is a symbiotic relationship in which one species benefits while the other species is not affected. One species typically uses the other for a purpose other than food. For example, mites attach themselves to larger flying insects to get a “free ride.” Hermit crabs use the shells of dead snails for homes.

Parasitism

Parasitism is a symbiotic relationship in which one species (the parasite) benefits while the other species (the host) is harmed. Many species of animals are parasites, at least during some stage of their life. Most species are also hosts to one or more parasites.

Some parasites live on the surface of their host. Others live inside their host. They may enter the host through a break in the skin or in food or water. For example, roundworms are parasites of mammals, including humans, cats, and dogs (see Figure 1.6). The worms produce huge numbers of eggs, which are passed in the host’s feces to the environment. Other individuals may be infected by swallowing the eggs in contaminated food or water.

Some parasites kill their host, but most do not. It’s easy to see why. If a parasite kills its host, the parasite is also likely to die. Instead, parasites usually cause relatively minor damage to their host.
Ecological Succession

Communities are not usually static. The numbers and types of species that live in them generally change through time. This is called ecological succession. Important cases of succession are primary and secondary succession.

Primary Succession

Primary succession occurs in an area that has never before been colonized. Generally, the area is nothing but bare rock. This type of environment may come about when

- lava flows from a volcano and hardens into rock.
- a glacier retreats and leaves behind bare rock.
- a landslide uncovers an area of bare rock.

The first species to colonize a disturbed area such as this are called pioneer species (see Figure 1.7). They change the environment and pave the way for other species to come into the area. Pioneer species are likely to include bacteria and lichens that can live on bare rock. Along with wind and water, they help weather the rock and form soil. Once soil begins to form, plants can move in. At first, the plants include grasses and other species that can grow in thin, poor soil. As more plants grow and die, organic matter is added to the soil. This improves the soil and helps it hold water. The improved soil allows shrubs and trees to move into the area.

Secondary Succession

Secondary succession occurs in a formerly inhabited area that was disturbed. The disturbance could be a fire, flood, or human action such as farming. This type of succession is faster because the soil is already in place. In this case, the pioneer species are plants such as grasses, birch trees, and fireweed. Organic matter from the pioneer species improves the soil. This lets other plants move into the area. An example of this type of succession is shown in Figure 1.8.

Climax Communities

Many early ecologists thought that a community always goes through the same series of stages during succession. They also assumed that succession always ends with a final stable stage. They called this stage the climax com-
Community. Today, most ecologists no longer hold these views. They believe that continued change is normal in most ecosystems. They think that most communities are disturbed too often to become climax communities.

**Lesson Summary**

- A community is the biotic part of an ecosystem. It consists of all the populations of all the species that live in the same area. It also includes their interactions.
- Predation is a relationship in which members of one species (the predator) consume members of another species (the prey). A predator-prey relationship keeps the populations of both species in balance.
- Competition is a relationship between organisms that strive for the same resources in the same place. Intraspecific competition occurs between members of the same species. It improves the species’ adaptations. Interspecific competition occurs between members of different species. It may lead to one species going extinct or both becoming more specialized.
- Symbiosis is a close relationship between two species in which at least one species benefits. Mutualism is a symbiotic relationship in which both species benefit. Commensalism is a symbiotic relationship in which one species benefits while the other species is not affected. Parasitism is a symbiotic relationship in which one
species (the parasite) benefits while the other species (the host) is harmed.

- Ecological succession is the process in which a community changes through time. Primary succession occurs in an area that has never before been colonized. Secondary succession occurs in a formerly inhabited area that was disturbed.

### Lesson Review Questions

#### Recall

1. List the three major types of community interactions.
2. Describe the relationship between a predator population and the population of its prey.
3. What is a keystone species? Give an example.
4. Define mutualism and commensalism.
5. What is a climax community?
6. Summarize how ideas about ecological succession and climax communities have changed.

#### Apply Concepts

7. In 1980, a massive volcanic eruption of Mount St. Helen’s in Washington State covered a large area with lava and ash. By 2010, plants were growing in the area, including some small trees. What type of ecological succession had occurred? How do you know? Describe how living things colonized the bare rock.

#### Think Critically

8. Compare and contrast the evolutionary effects of intraspecific and interspecific competition.
9. Explain why most parasites do not kill their host. Why is it in their own best interest to keep their host alive?

### Points to Consider

Communities consist of populations of different species. The size and growth of populations in a community are influenced by species interactions. For example, predator-prey relationships control the growth of both predator and prey populations.

- How might populations grow without these influences? What other factors do you think might affect population growth?
- What factors do you think may have affected the growth of the human population?

### References

2. Hana Zavadska. [CK-12 Foundation](http://www.ck12.org) . CC BY-NC 3.0