3.2 Communities

Key Terms
community
dominant species
keystone species
captive breeding
ecosystem engineer
succession

Observing and recording data about the number of species on Earth is an important way for scientists to measure biodiversity. However, ecologists also measure biodiversity at the more complex level of communities. A **community** is all the populations of the different species that interact in a specific area or ecosystem. The fish, corals, and sponges in **Figure 3.6** are all part of the community on this coral reef. Recall, from Chapter 2, that there are many types of relationships among organisms in a community, such as symbiosis, competition, and predation. Because species depend on these interactions, it is important to preserve the biodiversity of communities in order to protect the individual species in that community. As you read further, you will see that the removal of certain species from a community or ecosystem can have serious consequences for the community as a whole.

community all the populations of the different species that interact in a specific area or ecosystem

Important Species in a Community

Certain species can have a greater impact on a community or ecosystem. This can be because they have a high population number or they perform a critical ecosystem service. Sometimes their impact can be seen through food chain interactions. Other times, the species may change the environment physically. Three types of species that affect communities are dominant species, keystone species and ecosystem engineers.

Figure 3.6 Many populations, including different types of fish, corals, and sponges, make up this community.

dominant species species that are so abundant that they have the biggest biomass of any community member

keystone species a species that can greatly affect population numbers and the health of an ecosystem

Dominant Species

Dominant species are so abundant that they have the biggest biomass of any community member. *Biomass* is the total mass of living organisms in an area. In terrestrial ecosystems, dominant species are always primary producers because consumer biomass is always less than producer biomass.

The removal of a dominant species can result in a decrease in biodiversity within an ecosystem. For example, the American chestnut was a dominant tree in eastern North American forests in the early 1900s. By 1950, all American chestnut trees had been killed as a result of a fungus that had been accidentally introduced. Although no birds or mammals were affected by the loss of the chestnuts in the forests, seven species of insects that relied on the trees as a food source became extinct.

Keystone Species

It is easy to see why abundant, dominant species can be very important in a community. However, much less common keystone species can be equally important. A **keystone species** is one that can greatly affect population numbers and the health of an ecosystem. Keystone species are generally not abundant, and they can be plants or animals.

Sea Otters

One example of a keystone species is the sea otter. Sea otters are keystone predators in British Columbia's coastal kelp forests. As shown in **Figure 3.7**, sea otters eat sea urchins, which feed on kelp. During the 20th century, sea otter populations were greatly reduced as otters were trapped for their fur. As their numbers declined, the number of sea urchins increased. More sea urchins began eating the kelp, so the kelp biomass decreased. When this happened, the fish that depend on kelp forests as a habitat also declined in number, as shown in **Figure 3.7**. When sea otters were re-introduced, the kelp forests recovered. Sea otters are a keystone species because they keep the number of sea urchins in check, allowing the kelp to survive.

Sense of Value

The keystone is the brick at the top of an arch. The word *keystone* is used figuratively to refer to the central element of a system. The term *keystone species* is used in this sense, as an organism that provides stability to an ecosystem.

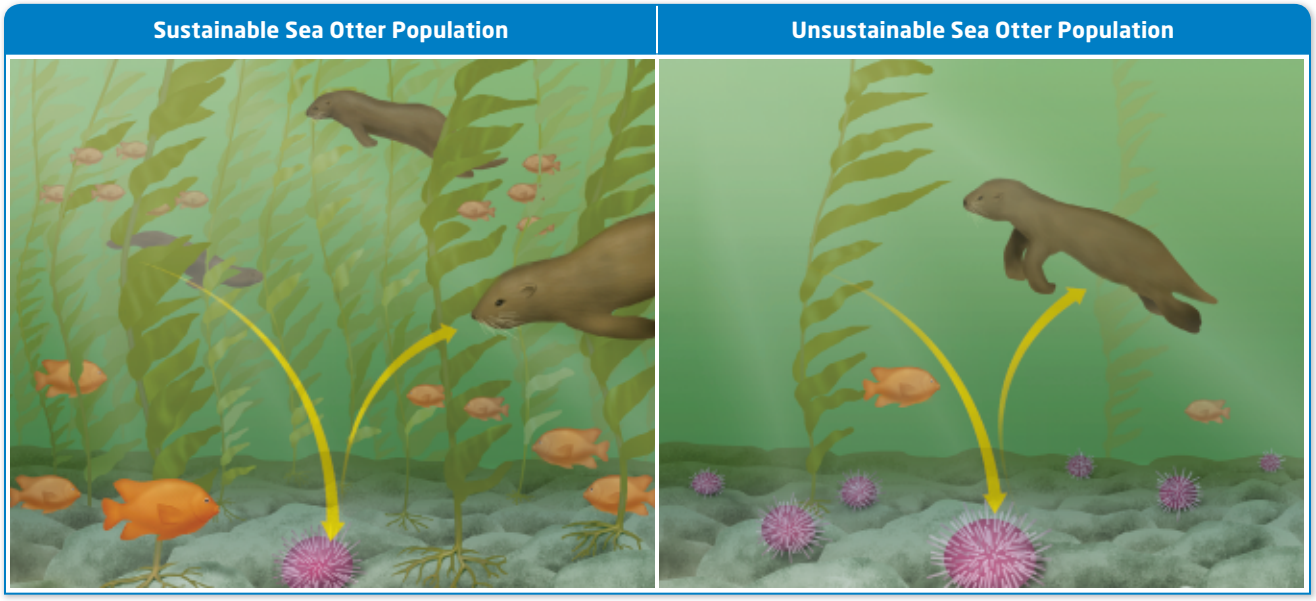

Figure 3.7 When the population of sea otters declines, the number of sea urchins increases, leading to a decrease in kelp biomass.

Prairie Dogs and Black-footed Ferrets

Another example of a keystone species is the prairie dog, shown in **Figure 3.8**. Prairie dogs build burrows in huge colonies, known as "dog towns." As European settlement spread across the western grasslands of North America, prairie dogs were once thought of as pests, especially because they consumed crops and interfered with ranching. Through poison, trapping, and guns, prairie dog populations were drastically reduced in Canada and the United States. The wild prairie ecosystems suffered when populations of this keystone species were reduced. In places where the prairie dog has persisted, ecologists have discovered that dog towns are important for increasing plant diversity, turning over tonnes of soil, increasing the nitrogen content of the soil, and allowing deeper water penetration of the soil.

Figure 3.8 Prairie dogs live in large colonies in networks of underground tunnels.

Another feature of dog towns that make prairie dogs a keystone species is that many species use the burrow system they establish. Black-footed ferrets are predators that use these burrows, and they eat prairie dogs. As the dog towns disappeared, so did the ferret. The last black-footed ferret in Canada was seen in 1937. The species survived longer in the United States, but it was thought to be completely extinct by 1979. However, in the early 1980s, a small American population was found. When that population dropped to only 18 individuals, wildlife managers captured them.

captive breeding
the breeding of rare or endangered wildlife in controlled settings to increase the population size

Captive Breeding Since 1992, the Toronto Zoo has been one of the facilities involved in the black-footed ferret **captive breeding** program, designed to bring these animals back from the brink of extinction. Hundreds of young ferrets have been born in the captive breeding program at the Toronto Zoo. Most, like the ferret shown in **Figure 3.9**, have been released back into the wild, following a program that trains them to capture wild prey and to avoid the natural risks they may encounter in the wild.

Figure 3.9 This wildlife biologist is releasing a ferret into the wild.

So far, the release sites have been in the United States, where the natural population of black-footed ferrets is now in the hundreds. The current plan to re-introduce the species to Canada involves re-establishing a stable population of prairie dogs too, so that the ferrets' ecosystem will be sustainable. The planned release site is Saskatchewan's Grasslands National Park, where a self-sustaining prairie dog population now occupies a large area of protected wild prairie.

Learning Check

1. Why is it important to protect communities in order to protect particular species?
2. Use **Figure 3.7** to help you define *keystone species* and give an example of a keystone species.
3. What is the purpose of a captive breeding program?
4. Why must the prairie dog population be stable for the black-footed ferret population to survive?

ecosystem engineer a species that causes such dramatic changes to landscapes that it creates a new ecosystem

succession the series of changes in an ecosystem that occurs over time, following a disturbance

Ecosystem Engineers

Beavers, like the one in **Figure 3.10**, are examples of ecosystem engineers. **Ecosystem engineers** are species that cause such dramatic changes to landscapes that they create a new ecosystem. In a matter of a few weeks, beavers can convert a small stream in a forest into an aquatic ecosystem that suits their needs perfectly. By building dams across streams and creeks, they create ponds that provide them with safety and a food supply of aquatic plants. Their tree-cutting activities also make small clearings in the forest. Many species of fish, birds, amphibians, and insects benefit from a beaver-pond ecosystem. What was once moving water becomes a calm refuge for juvenile fish, migrating birds, and aquatic insects. The beaverpond basket-tail dragonfly, shown in **Figure 3.10**, is one of many animals that benefit from beavers creating ponds. Their larvae live underwater and the adults hunt insects above the pond's surface.

Succession

By building a dam, a beaver's actions commonly kick start a succession of different ecosystems. **Succession** is the series of changes in an ecosystem that occurs over time, following a disturbance. In the case of a beaver pond, the area changes from forest to a flooded forest, and then to sunny pond, and ultimately to an abandoned pond that becomes a beaver meadow.

Each of these stages is ideal for different species. Even the final stage, the beaver meadow, provides important habitat in otherwise forested ecosystems. Beaver meadows are used by wolf packs.

Figure 3.10 The beaver is the best-known example of an ecosystem engineer. The clearings and ponds it creates support organisms, such as the beaverpond basket-tail dragonfly.

Section 3.2 Review

Section Summary

- Species live in communities where relationships among different species are very important.
- Dominant species are very common primary producers.
- Keystone species are especially significant in maintaining an ecosystem through their relationships with other species.
- Ecosystem engineers alter a landscape in a way that makes it suitable for additional species.
- Succession is the series of changes in an ecosystem that occurs over time, following a disturbance.

Review Questions

K/U **1.** What is the relationship between the terms *community* and *population*?

K/U **2.** Compare and contrast *dominant species* and *keystone species* using a Venn diagram.

C **3.** Debate why the removal of a rare species from an ecosystem may not change the ecosystem very much, but the removal of the dominant species causes a drastic change.

A **4.** The beetle shown on the right lives in the desert in Mexico. The beetle chews on the stems of mesquite shrubs, forcing the shrubs to grow new branches every spring. The trees take up more nutrients from the soil to support the new growth. This means there are fewer nutrients for other plants, such as grasses. Partly due to the action of the beetle, the desert has changed from mostly grasses to mostly mesquite shrubs over the last 150 years. How would you classify this beetle in terms of its role in the ecosystem? Explain your answer.

This beetle chews on the stems of mesquite shrubs.

A **5.** A person with *charisma* attracts attention and admiration. People sometimes use *charismatic species* to help draw attention to an environmental problem. Explain why you would or would not choose the following as charismatic species in a campaign to protect the ecosystems in which they live.

a. polar bear **b.** fern **c.** blue whale **d.** earthworm

Do you think that charismatic species at risk deserve to get more attention than other species at risk? Justify your response.

K/U **6.** Explain succession in your own words.

K/U **7.** Look back at **Figure 3.10**. What do beaverpond basket-tail dragonflies and wolves have in common?

A **8.** Complete the following analogy: An ecosystem engineer is like a(n)….