

14.1 Habitat and Niche

VOCABULARY

habitat
ecological niche
competitive exclusion
ecological equivalent

KEY CONCEPT Every organism has a habitat and a niche.

MAIN IDEAS

- ▶ A habitat differs from a niche.
- ▶ Resource availability gives structure to a community.

☀️ Connect to Your World

The ways in which a zebra interacts with its environment and other organisms are only a small part of the ecology of the African plains. To understand what individuals, populations, and communities need to survive, ecologists study the interactions among species and between species and their environment. Why does a zebra fit so well into the African savannah?

▶ MAIN IDEA

A habitat differs from a niche.

On the vast plains of Africa, tall grasses grow among trees and shrubs, and small pools of water surrounded by thirsty animals dot the landscape. This challenging environment is the home of the African lion, shown in **FIGURE 1.1**. Here, lions stalk through tall grass to hunt zebras and antelope, find places to rest in the shade of trees, and never stray far from valuable pools of water. These are just a few of the environmental features that make up the lion's habitat. A **habitat** can be described as all of the biotic and abiotic factors in the area where an organism lives. These factors include all aspects of the environment, including the grass, the trees, and the watering holes.

FIGURE 1.1 A lion must hunt and kill its prey in order to survive on the African savannah. Its role as a top predator is part of the lion's niche.



Each species interacts with its environment in a different way. Within an ecosystem, each species has an ecological niche. An **ecological niche** (nihch) is composed of all of the physical, chemical, and biological factors that a species needs to survive, stay healthy, and reproduce.

You can think of a habitat as *where* a species lives and a niche as *how* it lives within its habitat. A niche includes

- **Food** The type of food a species eats, how a species competes with others for food, and where it fits in the food web are all part of its niche.
- **Abiotic conditions** A niche includes the range of conditions, such as air temperature and amount of water, that a species can tolerate.
- **Behavior** The time of day a species is active as well as where and when it reproduces are factors in the niche of a species.

Looking closely at all of these factors, we can see that while an antelope may use the tall grasses of the African plains as a food resource, a lion may use the same grasses as camouflage for hunting. A lion uses the antelope as a food resource and hunts primarily during low-light times like dawn or dusk. In order to avoid the intense heat of the savannah, lions often spend afternoons in the shade. These examples are only a few parts of the lion's ecological niche, but they help to give a picture of how a lion fits into the African savannah.

Connect What are some of the abiotic and biotic factors of your habitat?

▶ MAIN IDEA

Resource availability gives structure to a community.

You have learned that the ability of an individual to survive and reproduce is the driving force behind natural selection. A species needs resources such as food, water, and shelter to be successful in its habitat. The organism that is best suited to obtain these resources is most likely to survive and reproduce. But what if two species are competing over limited resources?

Competitive Exclusion

We have already seen that many species can share similar habitats and that they may use some of the same resources, as shown in **FIGURE 1.2**. But when two species use the same resources in the same ways, one species will always be better adapted to the environment. The principle of **competitive exclusion** states that when two species are competing for the same resources, one species will be better suited to the niche, and the other species will be pushed into another niche or become extinct.

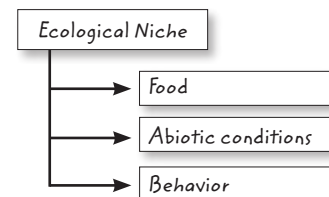
The North American gray squirrel was introduced to Great Britain in the late 1800s. The native European red squirrel was forced to compete with the newcomer for the same food resources, habitat, and space. In this case the gray squirrel was better adapted to the niche and pushed out its smaller competitor. Currently, the red squirrel population is declining due to competition with its larger, more aggressive cousin. But competitive exclusion can also result in other outcomes.

- **Niche partitioning** The two squirrel species could have naturally divided different resources based on competitive advantages. If one type of squirrel ate nuts from the tops of trees while others ate nuts from the ground, the niche would have been divided.
- **Evolutionary response** The two species of squirrel could have experienced divergent evolution. Selection for larger teeth might have allowed one type of squirrel to become better at cracking large nuts, while selection for smaller teeth might have allowed the other to eat small seeds.

READING TOOLBOX

TAKING NOTES

Define *ecological niche* by organizing your notes into a chart.



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FIGURE 1.2 Even though bees and butterflies both use these flowers for food, they occupy different niches. Many species with similar niches can coexist.

FIGURE 1.3 Ecological Equivalents

Ecological equivalents are two species that occupy similar niches in geographically separate areas.



The mantella frog (left) and the poison dart frog (right) have evolved similar defense mechanisms. The bright coloration of each is a warning to predators. Each frog secretes a highly poisonous toxin through its skin that makes it an unpleasant meal for a predator.

Synthesize Explain how natural selection resulted in the evolution of two similar frog species in two similar niches.

CONNECT TO

AMPHIBIANS

Amphibians were the first vertebrates to move out of the water and onto land. In **Vertebrate Diversity**, you will learn more about amphibians.

Ecological Equivalents

The competitive exclusion principle involves species competing for resources in the same community. In different communities, ecological equivalents occur in very similar niches. In mathematics, numbers that are equal are called equivalents. Similarly, **ecological equivalents** are species that occupy similar niches but live in different geographical regions. Pictured in **FIGURE 1.3**, the mantella frog of Madagascar and the poison dart frog of South America have much the same niche in similar habitats. They both have brightly colored skin that secretes a highly poisonous toxin to ward off predators. Both prey on similar insects and live in a similar habitat, but because they live in different regions of the world, they never compete for the same resources.

Apply Are these frogs experiencing competitive exclusion? Explain.



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PREMIUM CONTENT

CONNECT TO

EXOTIC SPECIES

- Considering the competitive exclusion principle, why may it be harmful to transport a species, such as a rabbit, to another habitat where it currently does not exist?

14.1 Formative Assessment

REVIEWING ► MAIN IDEAS

- What are the three parts of an organism's **ecological niche**?
- What does the principle of **competitive exclusion** say will happen when two species compete for the same resource?

CRITICAL THINKING

- Predict** If a group of mantella frogs were transported to the ecosystem of the poison dart frogs, what might happen to the two species' populations?
- Analyze** A bison and an elk live in the same **habitat** and feed on the same grasses. Does this mean that the competitive exclusion principle does not apply? Explain.