Quick Lab

How do abiotic factors affect different plant species?

Materials presoaked rye and rice seeds, sand, potting soil, 4 paper cups

Procedure

1. Use a pencil to punch three holes in the bottom of each cup. Fill 2 cups with equal amounts of sand and 2 cups with the same amount of potting soil.
2. Plant 5 rice seeds in one sand-filled cup and 5 rice seeds in one soil-filled cup. Plant 5 rye seeds in each of the other 2 cups. Label each cup with the type of seeds and soil it contains.
3. Place all the cups in a warm, sunny location. Each day for 2 weeks, water the cups equally and record your observations of any plant growth. **CAUTION:** *Wash your hands well with soap and warm water after handling plants or soil.*

Analyze and Conclude

1. **Analyzing Data** In which medium did the rice grow best—sand or soil? Which was the better medium for the growth of rye?
2. **Inferring** Soil retains more water than sand, providing a moister environment. What can you infer from your observations about the kind of environment that favors the growth of rice? The growth of rye?
3. **Drawing Conclusions** Which would compete more successfully in a dry environment—rye or rice? In a moist environment?

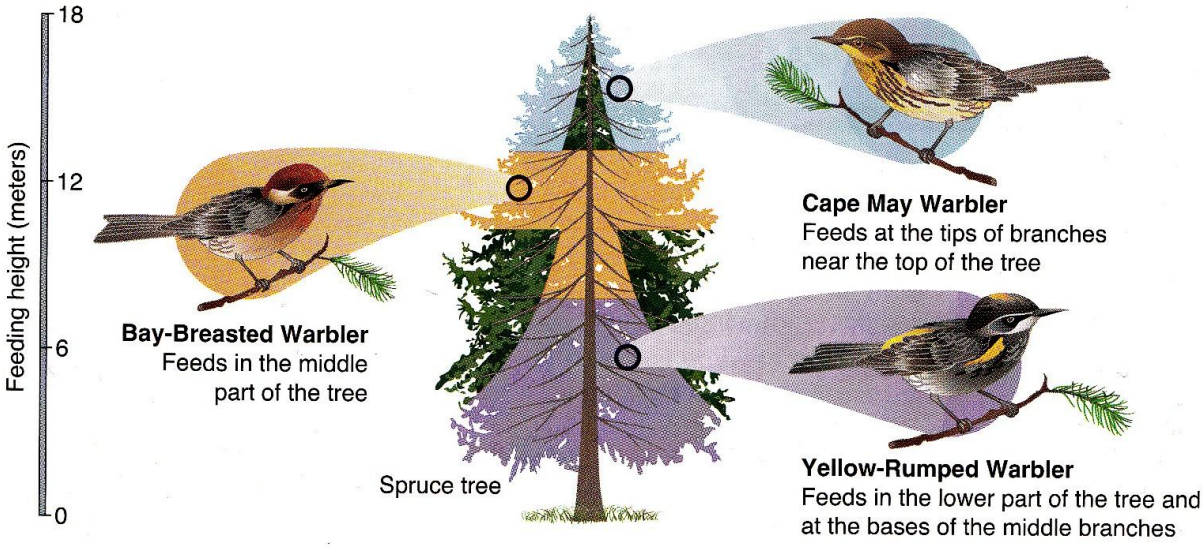
The Niche

An organism's habitat is its address, its niche is its occupation. A **niche** (NITCH) is the full range of physical and biological conditions in which an organism lives and the way in which the organism uses those conditions. For instance, part of the description of an organism's niche includes its place in the food web. Another part of the description might include the range of temperatures that the organism needs to survive. The combination of biotic and abiotic factors in an ecosystem often determines the number of different niches in that ecosystem.

A niche includes the type of food the organism eats, how it obtains this food, and which other species use the organism as food. For example, a mature bullfrog catches insects, worms, spiders, small fish, or even mice. Predators such as herons, raccoons, and snakes prey on bullfrogs.

The physical conditions that the bullfrog requires to survive are part of its niche. As amphibians, bullfrogs spend their lives near the water of ponds, lakes, and slow-moving streams. A bullfrog's body temperature varies with that of the surrounding water and air. As winter approaches, bullfrogs burrow into the mud of pond or stream bottoms to hibernate.

The bullfrog's niche also includes when and how it reproduces. Female bullfrogs lay their eggs in water during the summer months of the year. The young frogs, called tadpoles, live in the water until their legs and lungs develop.



▲ **Figure 4–5** Each of these warbler species has a different niche in its spruce tree habitat. By feeding in different areas of the tree, the birds avoid competing with one another for food. **Inferring** *What would happen if two of the warbler species occupied the same niche?*

As you will see, no two species can share the same niche in the same habitat. However, different species can occupy niches that are very similar. For instance, the three species of North American warblers shown in **Figure 4–5** live in the same spruce trees but feed at different elevations and in different parts of those trees. The species are similar, yet each warbler has a different niche within the forest.

CHECKPOINT *What is a niche?*

Quick Lab

How does biological magnification occur?

Materials paper cups (3 small, 1 medium, and 1 large); 1-L beaker; sand; 12 beads; masking tape

Procedure

1. Use a pencil to punch five holes in the bottom of each paper cup. Place tape over the outsides of the holes. The small cups represent grasshoppers, the medium-sized cup represents an insect-eating lizard, and the large cup represents a hawk.
2. Half-fill each small cup with sand and 4 beads. The sand represents food. The beads represent a chlorinated pesticide.
3. Hold each small cup over a beaker to catch the sand and remove the tape. The sand that flows out of the cup represents digested food. Record the number of beads in each cup.
4. To model the effects of biological magnification on the lizard, empty the contents of the three small cups into the medium-sized cup. Repeat step 3 with the medium-sized cup.
5. With two classmates, empty the three medium-sized cups into a large cup to model a hawk eating the lizard. Repeat step 3 with the large cup.

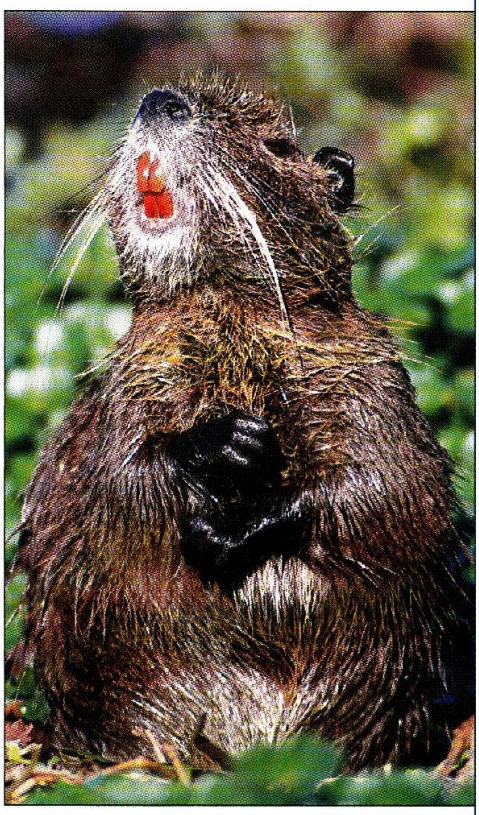
Analyze and Conclude

1. **Inferring** Which animals accumulated the most pesticide?
2. **Predicting** Which level of the food chain is most affected by biological magnification?

ntroduced Species

ne of the most important threats to biodiversity today comes om an unexpected source: apparently harmless plants and nimals that humans transport around the world either acci-ntally or intentionally. Introduced into new habitats, these rganisms often become **invasive species** that reproduce pidly. Invasive species increase their populations because eir new habitat lacks the parasites and predators that control eir population "back home."

Hundreds of invasive species, including the one in **gure 6–17**, are already causing ecological problems in the nited States. Zebra mussels, an aquatic pest, were imported om Europe during the 1980s. They spread through the Great akes and several major rivers. These mussels reproduce and ow so quickly that they cause major ecological changes and re driving several native species close to extinction. There are lso many examples on land. One European weed, the leafy purge, now infests millions of hectares of grasslands across the orthern Great Plains, where it displaces native plants.



▶ **Figure 6–17** **Human activity can reduce biodiversity by introducing foreign species to new environments.** Native to South America, nutrias have become pests in coastal areas of the southeastern United States. These furry rodents eat water plants that protect fragile shorelines from erosion. This destroys the habitats of species native to those ecosystems.