

# Plants Without Seeds

## Reading Preview

### Key Concept

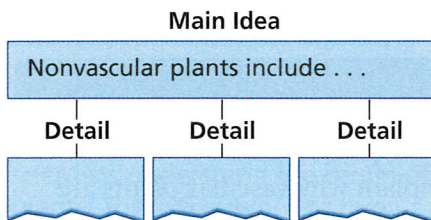
- What characteristics do the three groups of nonvascular plants share?
- What characteristics do the three groups of seedless vascular plants share?

### Key Terms

- rhizoid
- frond

## Target Reading Skill

**Identifying Main Ideas** As you read this section, write the main idea—the biggest or most important idea—in a graphic organizer like the one below. Then write three supporting details that give examples of the main idea.



Lab  
zone

## Discover Activity

### Will Mosses Absorb Water?

1. Place 20 mL of sand into a plastic graduated cylinder. Place 20 mL of peat moss into a second plastic graduated cylinder.
2. Predict what would happen if you were to pour 10 mL of water slowly into each graduated cylinder and then wait five minutes.
3. To test your prediction, add 10 mL of water slowly to the sand. Then add 10 mL of water to the moss. After five minutes, record your observations.

### Think It Over

**Predicting** How did your prediction compare with your results? What did you learn about moss from this investigation?

Imagine you are hiking in the forest. You see many ferns along the trail. You walk a little farther and stop to rest near a stream. Here, you see mosses everywhere—on the forest floor, on rocks, and along the banks of the stream. Although ferns and mosses look very different, they have something in common. They reproduce without forming seeds.

## Nonvascular Plants

Mosses are a type of seedless plant that have no vascular tissue. **There are three major groups of nonvascular plants: mosses, liverworts, and hornworts. These low-growing plants live in moist areas where they can absorb water and other nutrients directly from their environment.** The watery surroundings also enable sperm cells to swim to egg cells.



**Mosses** With more than 10,000 species, mosses are the most diverse group of nonvascular plants. You have probably seen mosses growing in sidewalk cracks, on tree trunks, and in other damp, shady spots.

Figure 5 shows the structure of a moss plant. The familiar green, fuzzy moss is the gametophyte generation of the plant. Structures that look like tiny leaves grow off a small, stemlike structure. Thin, rootlike structures called **rhizoids** anchor the moss and absorb water and nutrients from the soil. The sporophyte generation grows out of the gametophyte. It consists of a slender stalk with a capsule at the end. The capsule contains spores.

**Liverworts** There are more than 8,000 species of liverworts. Liverworts are often found growing as a thick crust on moist rocks or soil along the sides of a stream. This group of plants is named for the shape of the plant's leaflike gametophyte, which looks somewhat like a human liver. *Wort* is an old English word for "plant." Liverworts have sporophytes that are too small to see.

**Hornworts** There are fewer than 100 species of hornworts. Unlike mosses or liverworts, hornworts are seldom found on rocks or tree trunks. Instead, hornworts usually live in moist soil, often mixed in with grass plants. Hornworts are named for the slender, curved structures that grow out of the gametophytes. These hornlike structures are the sporophytes.



**Reading Checkpoint**

What does a hornwort sporophyte look like?

Moss plants growing on rock ▶

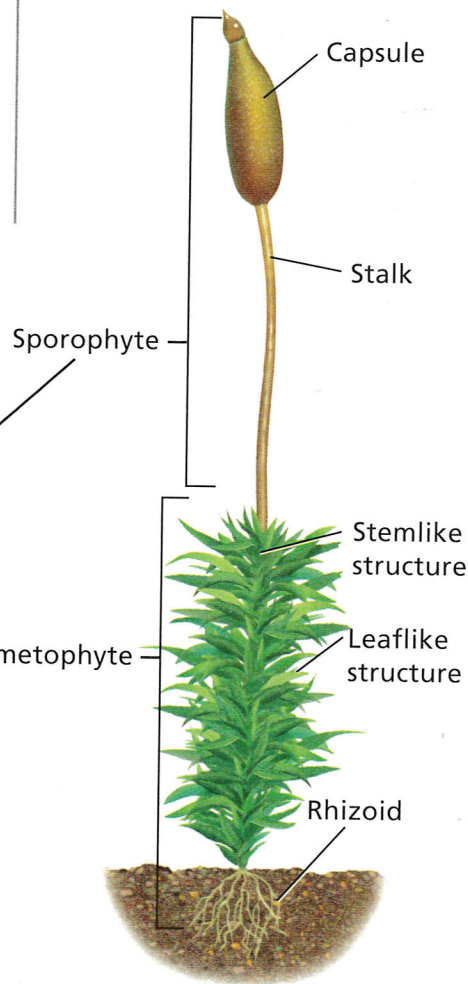


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**FIGURE 5 A Moss Plant**

A moss gametophyte has stemlike, leaflike, and rootlike structures.

**Interpreting Diagrams** What structures anchor the gametophyte?



## Seedless Vascular Plants

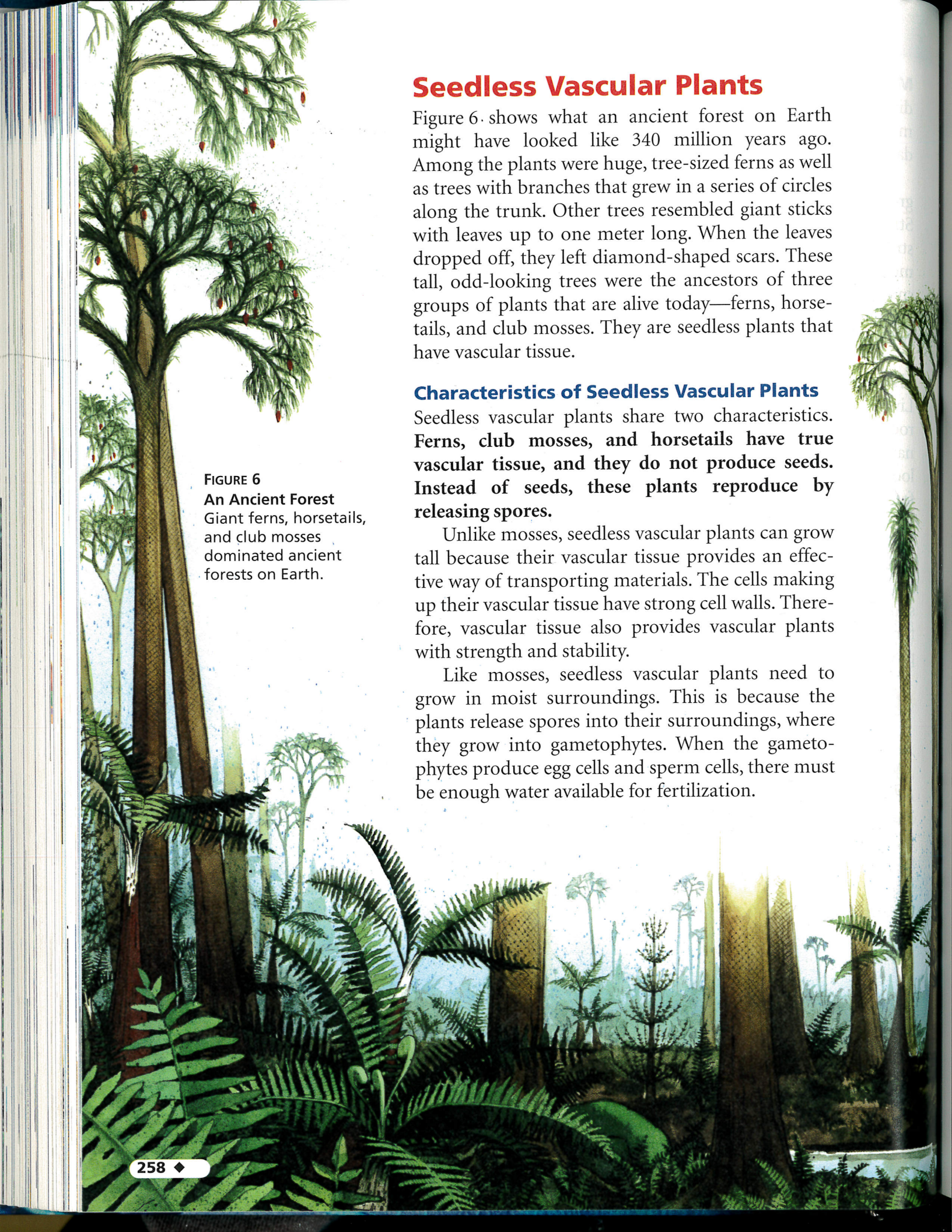
Figure 6 shows what an ancient forest on Earth might have looked like 340 million years ago. Among the plants were huge, tree-sized ferns as well as trees with branches that grew in a series of circles along the trunk. Other trees resembled giant sticks with leaves up to one meter long. When the leaves dropped off, they left diamond-shaped scars. These tall, odd-looking trees were the ancestors of three groups of plants that are alive today—ferns, horsetails, and club mosses. They are seedless plants that have vascular tissue.

### Characteristics of Seedless Vascular Plants

Seedless vascular plants share two characteristics. **Ferns, club mosses, and horsetails have true vascular tissue, and they do not produce seeds. Instead of seeds, these plants reproduce by releasing spores.**

Unlike mosses, seedless vascular plants can grow tall because their vascular tissue provides an effective way of transporting materials. The cells making up their vascular tissue have strong cell walls. Therefore, vascular tissue also provides vascular plants with strength and stability.

Like mosses, seedless vascular plants need to grow in moist surroundings. This is because the plants release spores into their surroundings, where they grow into gametophytes. When the gametophytes produce egg cells and sperm cells, there must be enough water available for fertilization.



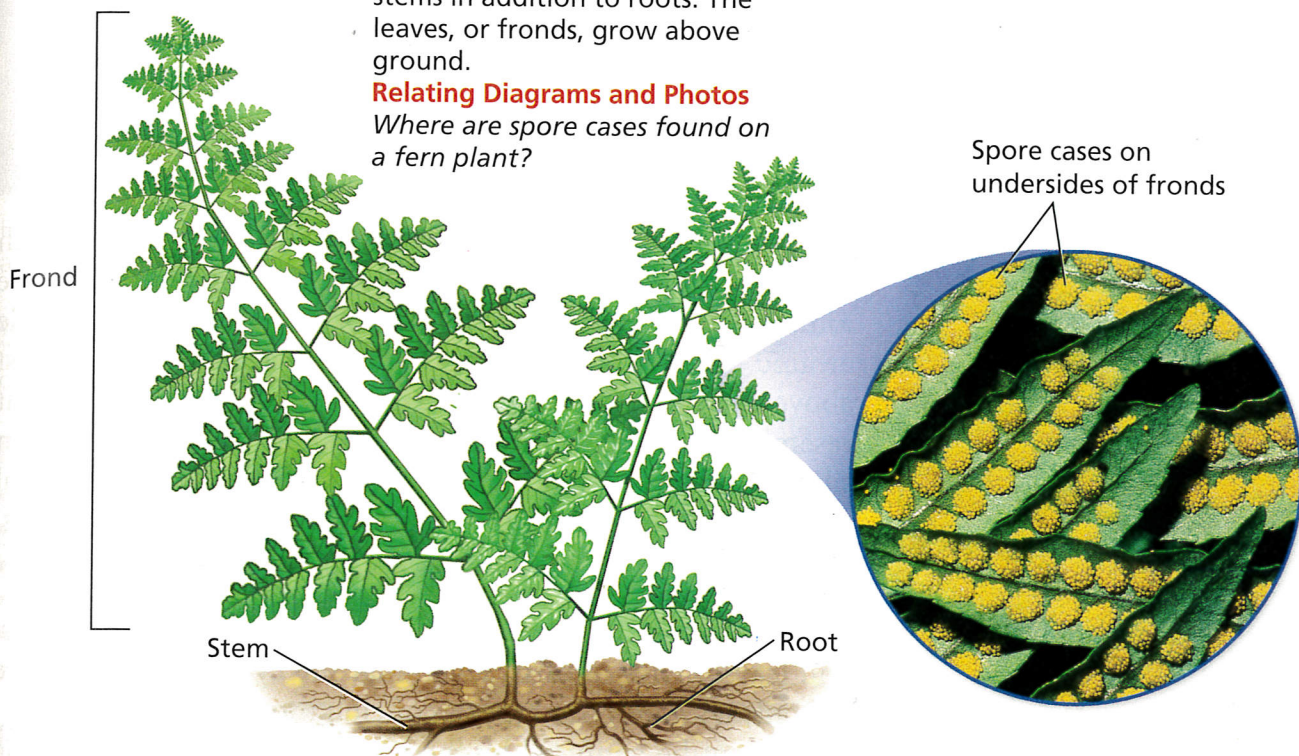
**FIGURE 6**  
**An Ancient Forest**  
Giant ferns, horsetails,  
and club mosses  
dominated ancient  
forests on Earth.

**FIGURE 7**  
**A Fern Plant**

Most ferns have underground stems in addition to roots. The leaves, or fronds, grow above ground.

**Relating Diagrams and Photos**

*Where are spore cases found on a fern plant?*



**Ferns** There are more than 12,000 species of ferns alive today. Like other vascular plants, ferns have true stems, roots, and leaves. The stems of most ferns are underground. Leaves grow upward from the top side of the stems, while roots grow downward from the bottom of the stems. The roots anchor the fern to the ground and absorb water and nutrients from the soil. These substances enter the root's vascular tissue and travel through the tissue into the stems and leaves.

Figure 7 shows a fern's structure. Notice that the fern's leaves, or **fronds**, are divided into many smaller parts that look like small leaves. The upper surface of each frond is coated with a cuticle that helps the plant retain water.

The familiar fern, with its visible fronds, is the sporophyte stage of the plant. On the underside of mature fronds, spores develop in tiny spore cases. Wind and water can carry the spores great distances. If a spore lands in moist, shaded soil, it develops into a gametophyte. Fern gametophytes are tiny plants that grow low to the ground.



**Reading Checkpoint**

How are seedless vascular plants like mosses?

**Lab zone**

**Try This Activity**

**Examining a Fern**

1. Your teacher will give you a fern plant to observe.
2. Draw a diagram of the plant and label the structures that you see.
3. Use a hand lens to observe the top and lower surfaces of the leaf. Run a finger over both surfaces.
4. With a plastic dropper, add a few drops of water to the top surface of the leaf. Note what happens.

**Inferring** Use your observations to explain how ferns are adapted to life on land.



FIGURE 8

### Horsetails and Club Mosses

Horsetails (left) have branches and leaves that grow in a circle around each joint. Club mosses (right) look like tiny pine trees.

**Inferring** Which grow taller—true mosses or club mosses?

**Horsetails** There are very few species of horsetails on Earth today. As you can see in Figure 8, the stems of horsetails are jointed. Long, coarse, needle-like branches grow in a circle around each joint. Small leaves grow flat against the stem just above each joint. The whorled pattern of growth somewhat resembles the appearance of a horse's tail. The stems contain silica, a gritty substance also found in sand. During colonial times, Americans used the plants to scrub their pots and pans. Another name for horsetails is scouring rushes.

**Club Mosses** Like ferns, club mosses have true stems, roots, and leaves. They also have a similar life cycle. However, there are only a few hundred species of club mosses alive today.

Do not be confused by the name *club mosses*. Unlike true mosses, club mosses have vascular tissue. The plant, which looks a little like the small branch of a pine tree, is sometimes called ground pine or princess pine. Club mosses usually grow in moist woodlands and near streams.



Where do club mosses usually grow?

## Section 2 Assessment

**Target Reading Skill Identifying Main Ideas** Use your graphic organizer to help you answer the questions below.

### Reviewing Key Concepts

1. a. **Describing** What two characteristics do mosses, liverworts, and hornworts share?
- b. **Relating Cause and Effect** How are these two characteristics related?
- c. **Comparing and Contrasting** In what ways are mosses, liverworts, and hornworts similar? In what ways do they differ?
2. a. **Listing** What two characteristics do ferns, horsetails, and club mosses share?

- b. **Comparing and Contrasting** In what ways do ferns, horsetails, and club mosses differ from true mosses? In what way are they similar to mosses?
- c. **Inferring** Although ferns have vascular tissue, they still must live in moist, shady environments. Explain why.

### Writing in Science

**Product Label** Create a product label to be attached to pots of fern plants for sale at a garden shop. Describe the structure of ferns and growing instructions. Include other helpful information or diagrams.