

14.5 Ecological Succession

VOCABULARY

succession
primary succession
pioneer species
secondary succession

KEY CONCEPT Ecological succession is a process of change in the species that make up a community.

MAIN IDEAS

- ▶ Succession occurs following a disturbance in an ecosystem.

☀️ Connect to Your World

It begins with a dirty sock. Then a discarded homework assignment. But this is only the start. If you have ever spent a Saturday afternoon cleaning your bedroom, you may have wondered how a perfectly clean room could manage to become such a cluttered mess. A clean room becoming cluttered is a gradual process much like the process that rebuilds damaged ecosystems.

▶ MAIN IDEA

Succession occurs following a disturbance in an ecosystem.

After an ecosystem experiences a devastating catastrophe and begins to regrow, the space re-forms itself through a process known as succession. **Succession** is the sequence of biotic changes that regenerate a damaged community or create a community in a previously uninhabited area.

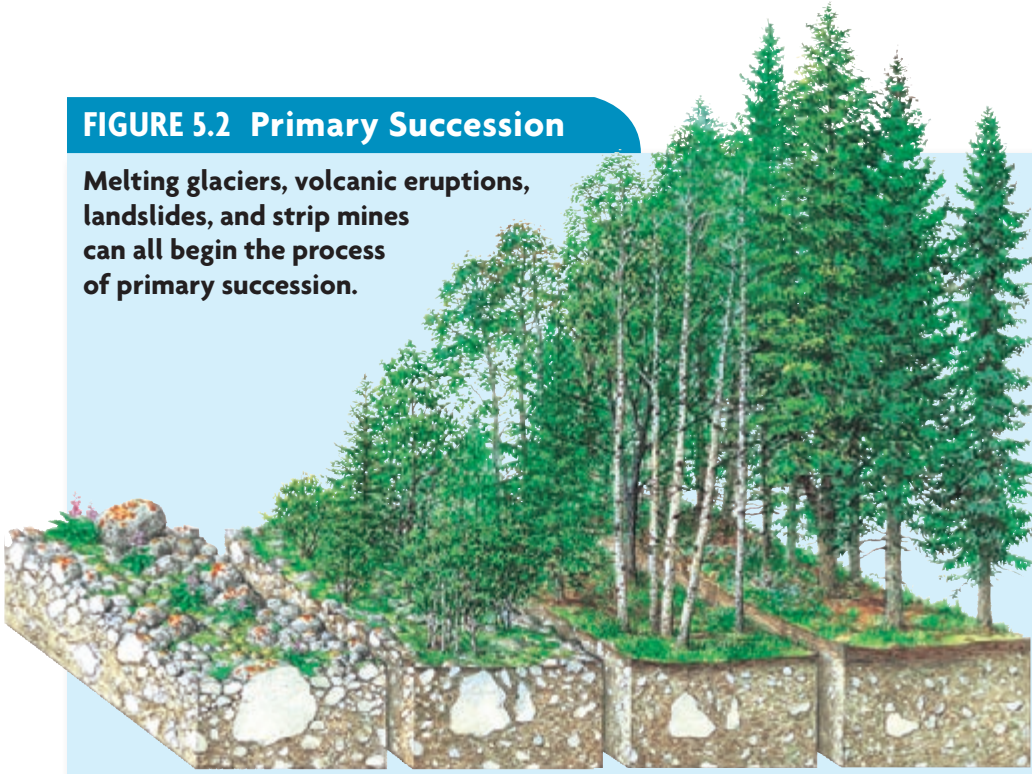
The Hawaiian Islands began to form more than 70 million years ago. Over time, volcanic eruptions like the one shown in **FIGURE 5.1** created these islands in the middle of the Pacific Ocean. Eventually, the bare volcanic rock began to break down into soil, which provided a place for plants to grow. As time passed, the process of succession created unique tropical ecosystems. Succession from bare rock to such highly diverse vegetation takes a great deal of time.

FIGURE 5.1 The path of a lava flow, like this one on the island of Hawaii (left), leaves behind nothing but solid rock. Over time, primary succession will turn this harsh landscape into a fertile ecosystem (right).



FIGURE 5.2 Primary Succession

Melting glaciers, volcanic eruptions, landslides, and strip mines can all begin the process of primary succession.



0–15 years Moss, lichens, grasses

15–80 years Shrubs, cottonwoods, alder thicket

80–115 years Transition to forest, alder, spruce

115–200 years Hemlock-spruce forest



Glacier Bay National Park in Alaska has given scientists an opportunity to witness primary succession as the glacier recedes.

Apply What function might the mosses and lichens serve in primary succession?

Primary Succession

One of the best ways to understand succession is to watch it progress.

Primary succession is the establishment and development of an ecosystem in an area that was previously uninhabited. The first organisms that live in a previously uninhabited area are called **pioneer species**. Typical examples of pioneer species are lichens and some mosses, which can break down solid rock into smaller pieces. The process of primary succession, which is illustrated in **FIGURE 5.2**, follows this basic pattern:

- Bare rock is exposed by a retreating glacier or is created when lava cools. Wind, rain, and ice begin to break down the surface of the rock, forming cracks and breaking the rock into smaller pieces.
- Lichen and moss spores are blown in by wind. As they grow, they break up the rock further. When they die, their remains mix with the rock pieces to form a thin layer of soil.
- Over time, seeds are blown into the area or are dropped by birds. Small flowers and hardy shrubs grow from these seeds. These new plants provide a habitat for small animals, break up the rock with their roots, and add material to the soil when they die.
- As the soil continues to grow thicker, small trees take root, and different animals move into the area. These trees provide shade.
- Different tree species take root in the shade and eventually replace the original trees, which need direct sunlight to thrive.

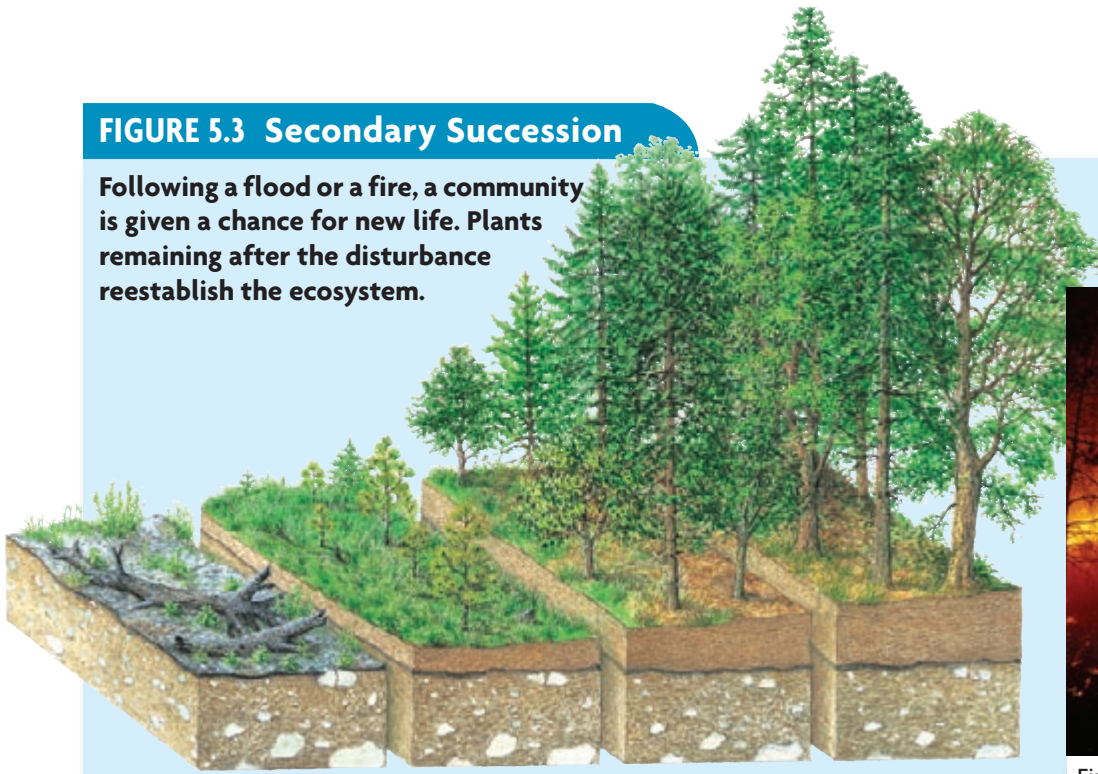
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SYMBIOSIS

A lichen is actually two completely different species. Fungus and algae form a symbiotic relationship in which the fungi collects water, while the algae uses chlorophyll to conduct photosynthesis and synthesize food for the lichen community.

FIGURE 5.3 Secondary Succession

Following a flood or a fire, a community is given a chance for new life. Plants remaining after the disturbance reestablish the ecosystem.



0–2 years Horse-weed, crabgrass, asters

2–18 years Grass, shrubs, pine seedlings

18–70 years Pine forest and young hardwood seedlings

70–100 years Oak-hickory forest



Fire is important in helping forests return nutrients to the soil. Secondary succession uses these nutrients to grow.

Analyze Why does secondary succession take less time than primary succession?

Secondary Succession

Succession does not always begin from bare rock. More often, a disturbance, such as a fire or hurricane, halts the progress of succession or destroys an established community. **Secondary succession**, which is illustrated in **FIGURE 5.3**, is the reestablishment of a damaged ecosystem in an area where the soil was left intact. Plants and other organisms that remain start the process of regrowth. There is no end to secondary succession. Small disturbances, such as a tree falling, start the process again and again. The dynamic processes of succession are always changing the face of an ecosystem.

Connect Where might succession occur in the ocean?

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14.5 Formative Assessment

REVIEWING MAIN IDEAS

1. How is **primary succession** different from **secondary succession**?
2. Why are **pioneer species** so important for primary succession?

CRITICAL THINKING

3. **Infer** Does the process of primary succession take longer in tropical or arctic areas? Explain.
4. **Predict** During **succession**, what might become the limiting factor for sun-loving mosses as taller plants begin to grow?



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PREMIUM CONTENT

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5. At what point during primary succession does an ecosystem provide the fewest habitats for organisms? Explain your reasoning.