

Succession

Ecosystems can change over time. The process is referred to as succession. In **succession** the dominant species within an ecosystem are gradually replaced by others.

There are two types of succession. **Primary succession** occurs in an area where there was no community before. **Secondary succession** occurs after the partial or complete destruction of a community. The damaged community is replaced by another or by a series of other communities until a stable community is re-established.

Primary Succession: A New Island

Imagine the eruption of an underwater volcano. Lava spills above the ocean's surface and a new island forms (**Figure 1**). The new island starts off as bare rock, but a dynamic ecosystem will soon develop.

- (a) Why wouldn't you expect to find animals on the new island?

The First Green

Within a short time the island begins to turn green. Lichens appear first (**Figure 2**). Because they are the first organisms to appear in such situations, lichens are called **pioneer species**.

Lichens contain two different organisms: algae and fungi. The algae have chlorophyll and are capable of photosynthesis. They make the food the lichen needs. The fungi have threadlike filaments that absorb water well. The filaments also secure the lichen to the rock.

- (b) Why are lichens able to grow on barren rock?

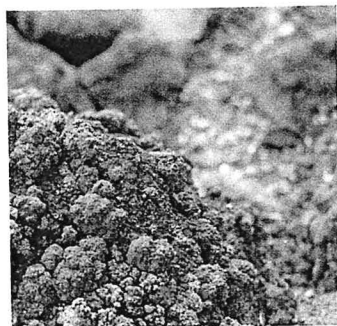


Figure 2

Lichens are made of algae and fungi working together. The algae provide food; the fungi provide water.

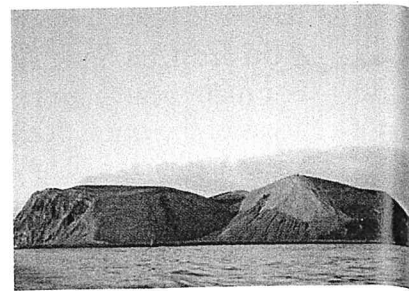


Figure 1

A new volcanic island

Soil and Moss

Lichens begin the process of breaking down rock to make soil. Also, as they grow, die, and decompose, they create some small scraps of soil in crannies in the rock. That tiny amount of soil is enough for moss. It takes over wherever the soil is created (see **Figure 3**).

Mosses produce more food and store more water than lichens, making the ecosystem richer. As they die, the soil becomes thicker. Eventually, there is enough soil for small grasses and weeds to grow.



Figure 3

Mosses can absorb more water than lichens.

- (c) Speculate about why moss communities would succeed lichen communities.
- (d) Often marine birds stop to rest or even nest on new islands (see **Figure 4**). Because there are no predatory animals, they feel safe. How might birds stopping on the island affect succession?



Figure 4

Marine birds may have mud on their feet from previous stops. What might be in the mud?

More Plants Arrive

Most plants can grow higher than lichens and mosses. Tall plants put short plants in the shade and limit the amount of sunlight they can receive. The more soil there is, the taller plants can grow. And more soil is constantly being created as weathering breaks down rocks and as each generation of plants dies and decomposes. Eventually, the island will have enough soil to support shrubs, and then trees. This final community, called the **climax community**, remains unchanged for many years.

- (e) What advantages do plants such as dandelions and crabgrass have over mosses and lichens?

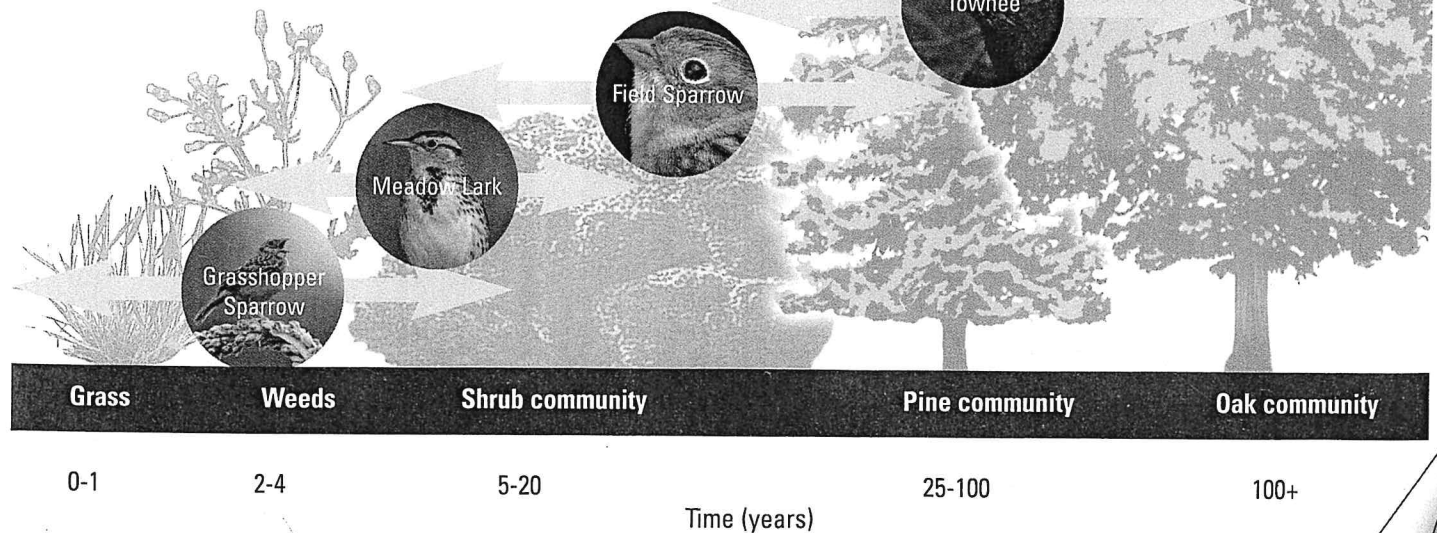
Birds and Succession

As vegetation changes, the animals living in the area also change (see **Figure 5**). In addition to marine birds, the island will first host small, well-camouflaged birds, such as the grasshopper sparrow, that nest on the ground. These birds feed on grass seeds and the insects that feed on the grasses.

Each plant is eaten by different species of insects. As grass and weeds are replaced by shrubs, insects that eat grasses are replaced by insects that live on the leaves of shrubs.

Figure 5

As the vegetation changes, the animals in the community also change.



The birds of the island will change as the new kinds of food become available. The original sparrows are gradually replaced by birds like the towhee that are adapted to life among shrubs and trees.

As the amount of vegetation increases, the island can support more animals, including predators such as hawks and falcons.

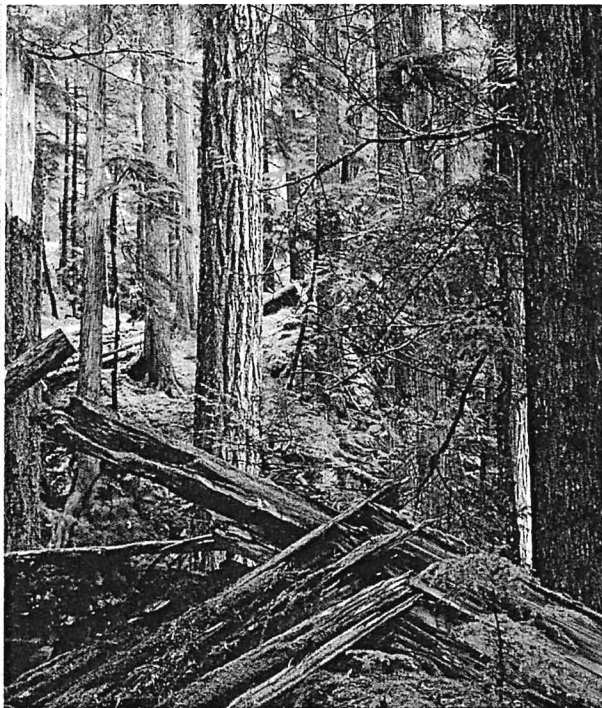
- (f) Birds often first arrive on islands by accident, carried there by storms. What might happen to the first pair of vireos that arrived on the island 10 years after succession had begun? What might happen to a pair that arrived 40 years after?
- (g) Why would a forest support more species of birds than a grassland community?

Secondary Succession: Forest Fires

Nothing looks so devastating as the destruction of a mature forest by a fire. All that remains is a blackened landscape with a few solitary trunks pointing brokenly skyward. But in nature, nothing is final. Within a few months the ground slowly turns green. Animals move back into the area, and the forest community begins to recover.

Years later the new forest will be more vital than a neighbouring forest that escaped the fire. The pattern of rejuvenation by fire, shown in **Figure 6**, is part of the natural cycle of forest ecosystems.

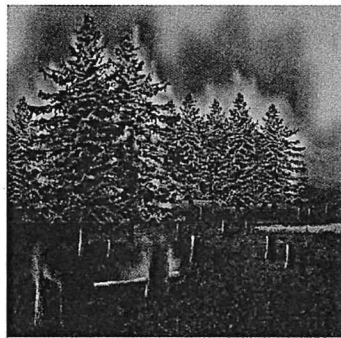
- (h) Speculate on why a fire might be more likely in a mature forest.
- (i) Which plants act as pioneers following a forest fire?
- (j) Why do grasses and weeds appear before trees and shrubs?
- (k) Speculate about why grouse don't appear until conifers begin to grow.



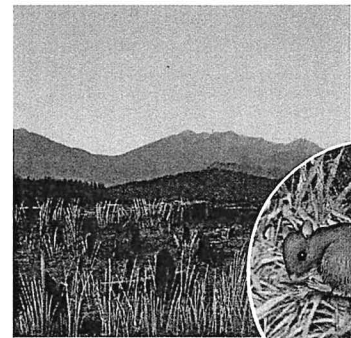
a Stage 1: mature forest

Figure 6

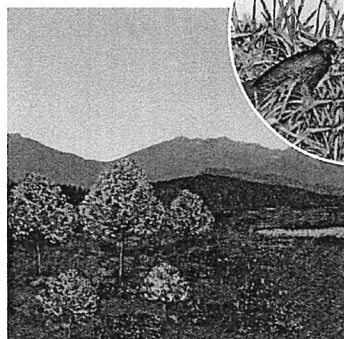
Secondary succession as a result of a forest fire



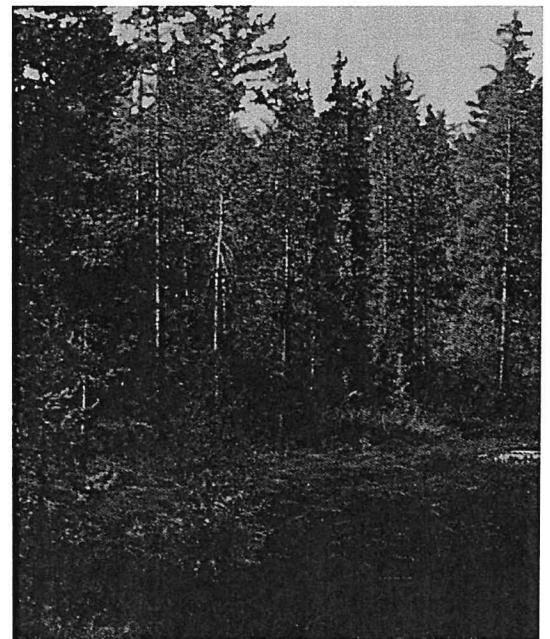
b Stage 2: destruction



c Stage 3: pioneer species move in



d Stage 4: the forest returns

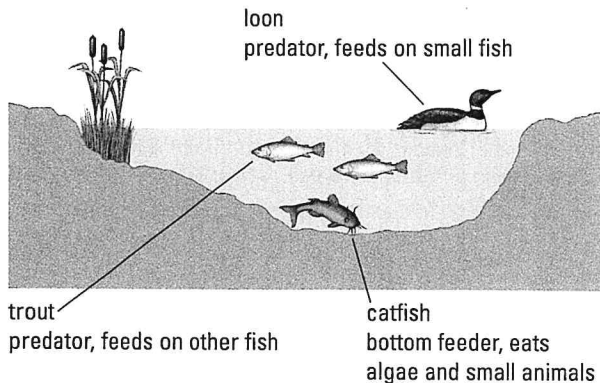


e Stage 5: a young forest

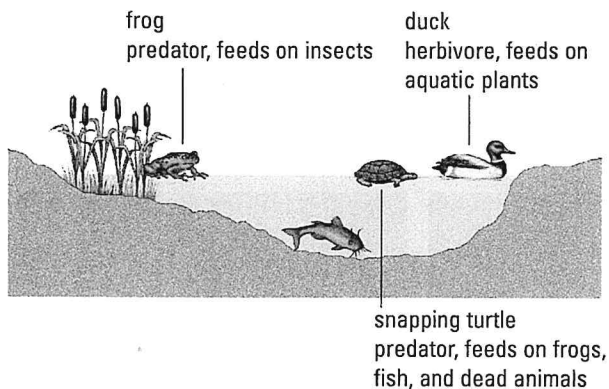
Figure 7

Secondary succession in a pond

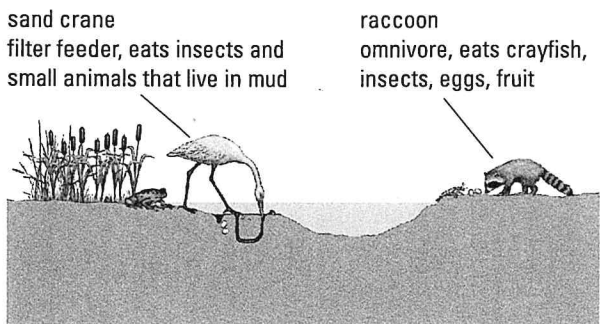
a Stage 1



b Stage 2



c Stage 3



Design Challenge

Speculate about the environmental impact of your Challenge. How could things be changed?

Secondary Succession: A Pond

Secondary succession is often a very slow process. **Figure 7** shows changes in a pond over many years.

- (l) What happens to the depth of the pond over time? Explain how this might happen.
- (m) Explain how the change in pond temperature is related to the depth of the pond.
- (n) How does the change in temperature affect the type and number of plants found in the pond?
- (o) Describe changes in the type and number of fish found in the pond through the three stages.
- (p) Speculate as to why the trout seem to disappear after stage 1.
- (q) Why might turtles be found in stage 2, but not in stage 1?
- (r) Speculate about why loons are replaced by ducks.

Understanding Concepts

1. Define succession.
2. What is a pioneer species?
3. Indicate whether each item below is an example of primary or secondary succession. Give your reasons for each choice.
 - (a) Lichen grows on barren rock in the tundra.
 - (b) A farm field left untended becomes a forest.
 - (c) As a glacier retreats, plants grow in the areas it leaves.
 - (d) A dam is constructed and a forest changes into a lake.

Making Connections

4. Draw a climax community for a pond and explain why it is a climax community.
5. Hypothesize about why trout are found only in cold waters.
6. Describe succession in an abandoned lot in a city, using a series of diagrams.