

Lesson Overview

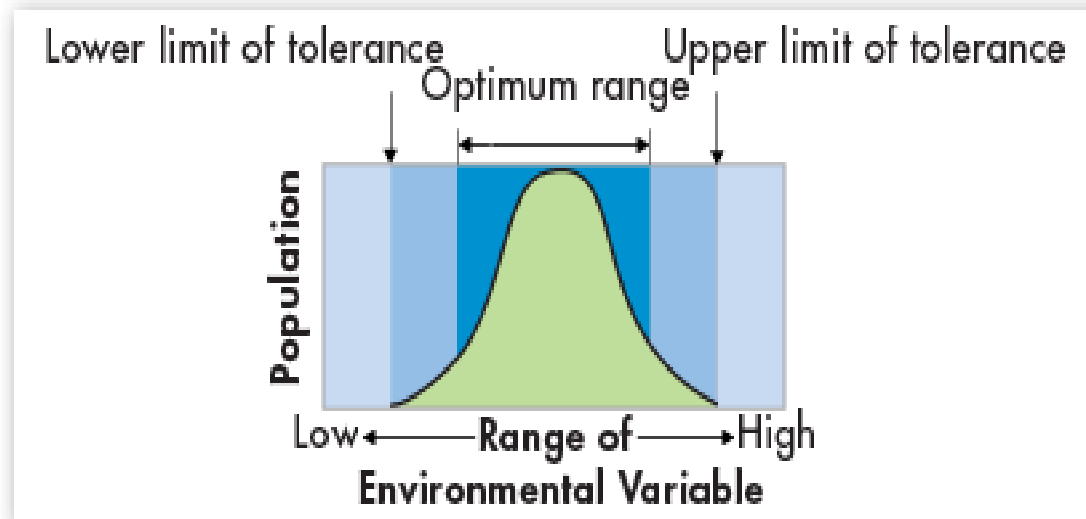
4.2 Niches and
Community Interactions

The Niche

- 🔑 **What is a niche?**
- 🔑 **A niche is the range of physical and biological conditions in which a species lives and the way the species obtains what it needs to survive and reproduce.**

Tolerance

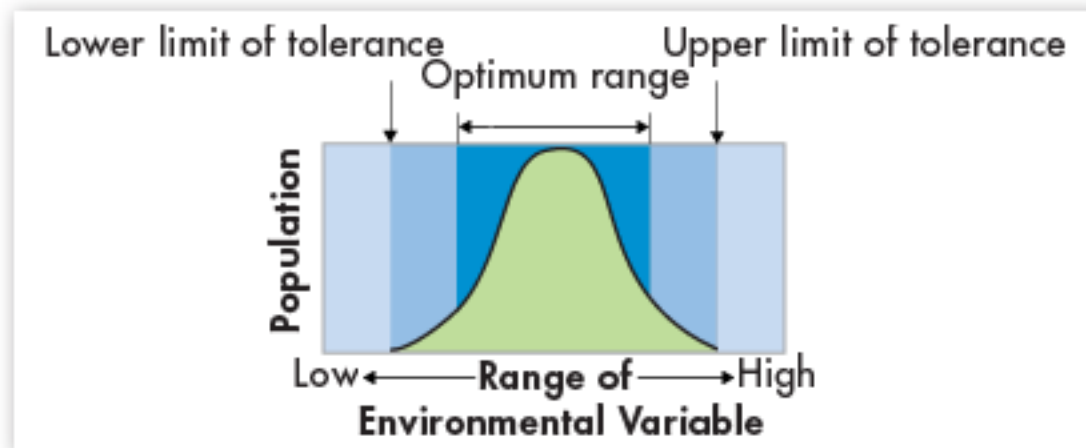
Every species has its own range of **tolerance**, the ability to survive and reproduce under a range of environmental circumstances.



Tolerance

When an environmental condition, such as temperature, extends in either direction beyond an organism's optimum range, the organism experiences stress.

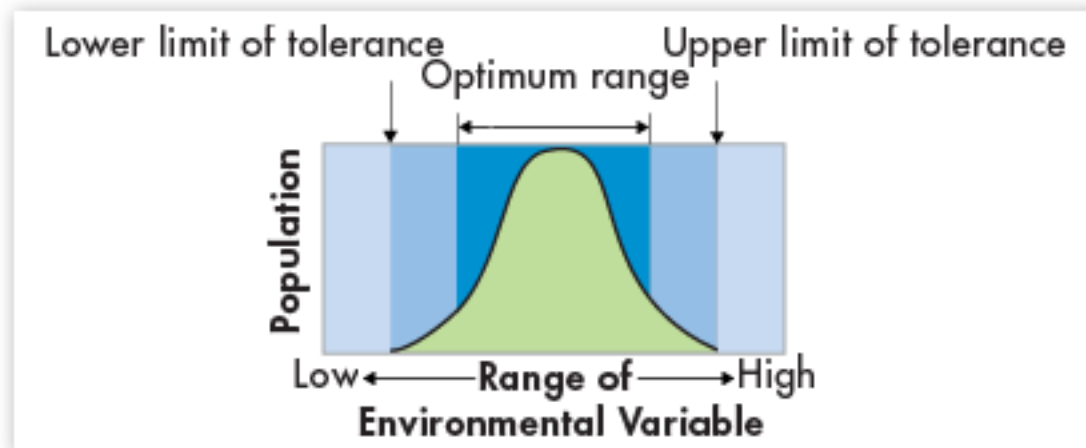
The organism must expend more energy to maintain homeostasis, and so has less energy left for growth and reproduction.



Tolerance

Organisms have an upper and lower limit of tolerance for every environmental factor. Beyond those limits, the organism cannot survive.

A species' tolerance for environmental conditions, then, helps determine its **habitat**—the general place where an organism lives.



Defining the Niche

An organism's **niche** describes not only the environment where it lives, but *how* it interacts with biotic and abiotic factors in the environment.

In other words, an organism's niche includes not only the physical and biological aspects of its environment, but also the way in which the organism uses them to survive and reproduce.

Resources and the Niche

The term **resource** can refer to any necessity of life, such as water, nutrients, light, food, or space.

For plants, resources can include sunlight, water, and soil nutrients.

For animals, resources can include nesting space, shelter, types of food, and places to feed.

Competition

- 🔑 How does competition shape communities?
- 🔑 By causing species to divide resources, competition helps determine the number and kinds of species in a community and the niche each species occupies.

Competition

Competition occurs when organisms attempt to use the same limited ecological resource in the same place at the same time.

In a forest, for example, plant roots compete for resources such as water and nutrients in the soil.

Competition

Animals **compete** for resources such as food, mates, and places to live and raise their young.

Competition can occur both between members of the same species (known as intraspecific competition) and between members of different species (known as interspecific competition).

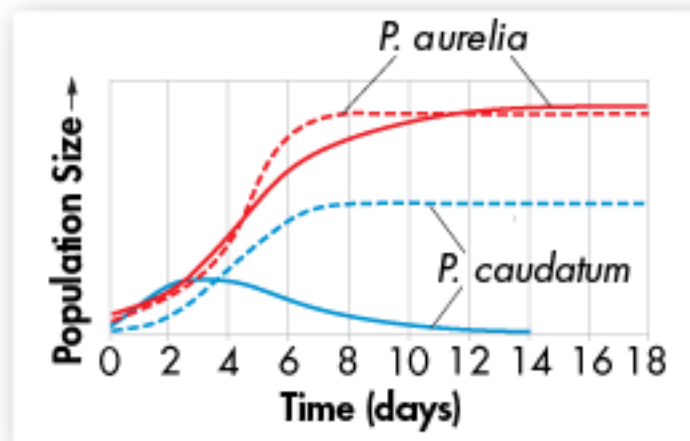
The Competitive Exclusion Principle

Direct competition between different species almost always produces a winner and a loser—and the losing species dies out.

The Competitive Exclusion Principle

In the the experiment shown in the graph, two species of paramecia (*P. aurelia* and *P. caudatum*) were first grown in separate cultures (dashed lines) . In separate cultures, but under the same conditions, both populations grew.

However, when both species were grown together in the same culture (solid line), one species outcompeted the other, and the less competitive species did not survive.



The Competitive Exclusion Principle

The **competitive exclusion principle** states that no two species can occupy exactly the same niche in exactly the same habitat at exactly the same time.

If two species attempt to occupy the same niche, one species will be better at competing for limited resources and will eventually exclude the other species.

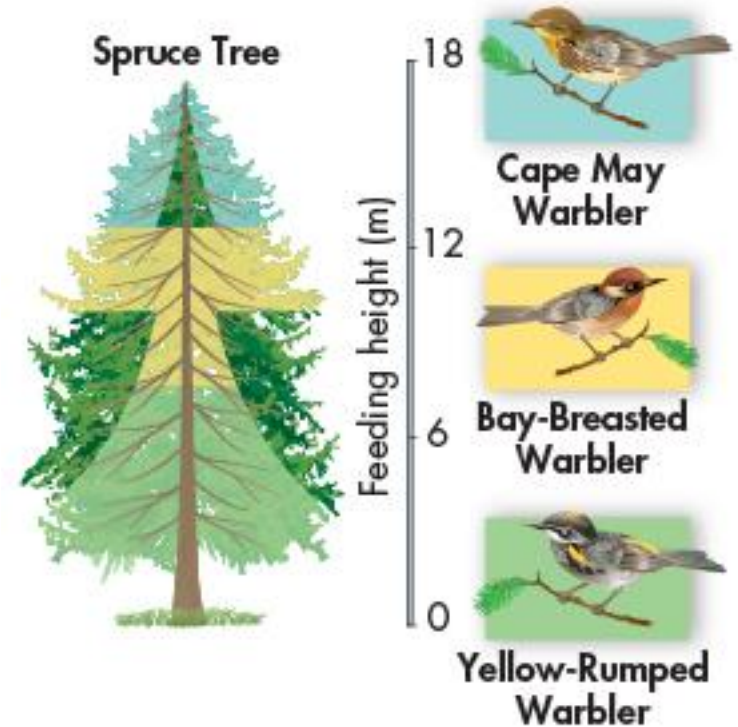
As a result of competitive exclusion, natural communities rarely have niches that overlap significantly.

Dividing Resources




Instead of competing for similar resources, species usually divide them.

For example, the three species of North American warblers shown all live in the same trees and feed on insects.

But one species feeds on high branches; another feeds on low branches, and another feeds in the middle.



Predation, Herbivory, and Keystone Species

-  How do predation and herbivory shape communities?
-  Predators can affect the size of prey populations in a community and determine the places prey can live and feed.
-  Herbivores can affect both the size and distribution of plant populations in a community and determine the places that certain plants can survive and grow.

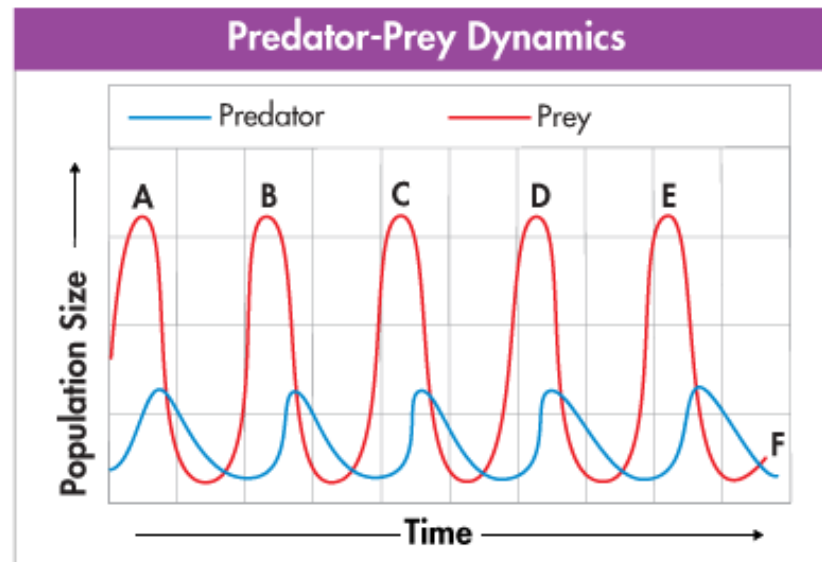
Predator-Prey Relationships

An interaction in which one animal (the predator) captures and feeds on another animal (the prey) is called **predation**.

Predators can affect the size of prey populations in a community and determine the places prey can live and feed.

Predator-Prey Relationships

This graph shows an idealized computer model of changes in predator and prey populations over time.



Keystone Species

Sometimes changes in the population of a single species, often called a **keystone species**, can cause dramatic changes in the structure of a community.

Symbioses

- 🔑 What are the three primary ways that organisms depend on each other?
- 🔑 Biologists recognize three main classes of symbiotic relationships in nature: mutualism, parasitism, and commensalism.

Symbioses

Any relationship in which two species live closely together is called **symbiosis**, which means “living together.”

The three main classes of symbiotic relationships in nature are mutualism, parasitism, and commensalism.

Mutualism

This kind of relationship between species in which both benefit is known as **mutualism**.

Parasitism

Tapeworms live in the intestines of mammals, where they absorb large amounts of their hosts' food.

Fleas, ticks, lice, and the leech shown, live on the bodies of mammals and feed on their blood and skin.

These are examples of **parasitism**, relationships in which one organism lives inside or on another organism and harms it.

Parasitism

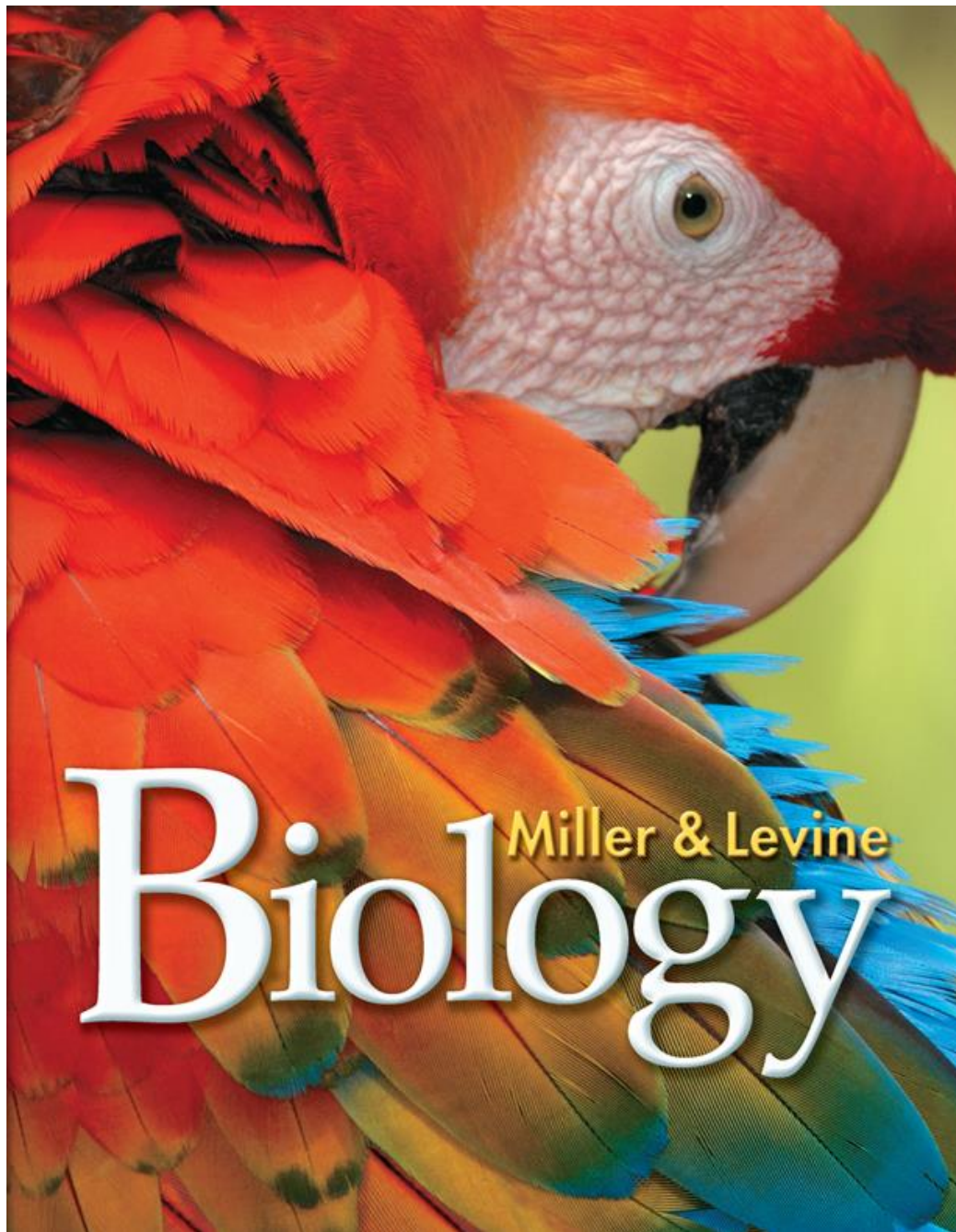
The parasite obtains all or part of its nutritional needs from the host organism.

Generally, parasites weaken but do not kill their host, which is usually larger than the parasite.

Commensalism

Barnacles often attach themselves to a whale's skin. They perform no known service to the whale, nor do they harm it. Yet the barnacles benefit from the constant movement of water—that is full of food particles—past the swimming whale.

This is an example of **commensalism**, a relationship in which one organism benefits and the other is neither helped nor harmed.



Lesson Overview

4.3 Succession

Primary and Secondary Succession

- 🔑 How do communities change over time?
- 🔑 Ecosystems change over time, especially after disturbances, as some species die out and new species move in.

Primary and Secondary Succession

Ecological succession is a series of more-or-less predictable changes that occur in a community over time.

Ecosystems change over time, especially after disturbances, as some species die out and new species move in.

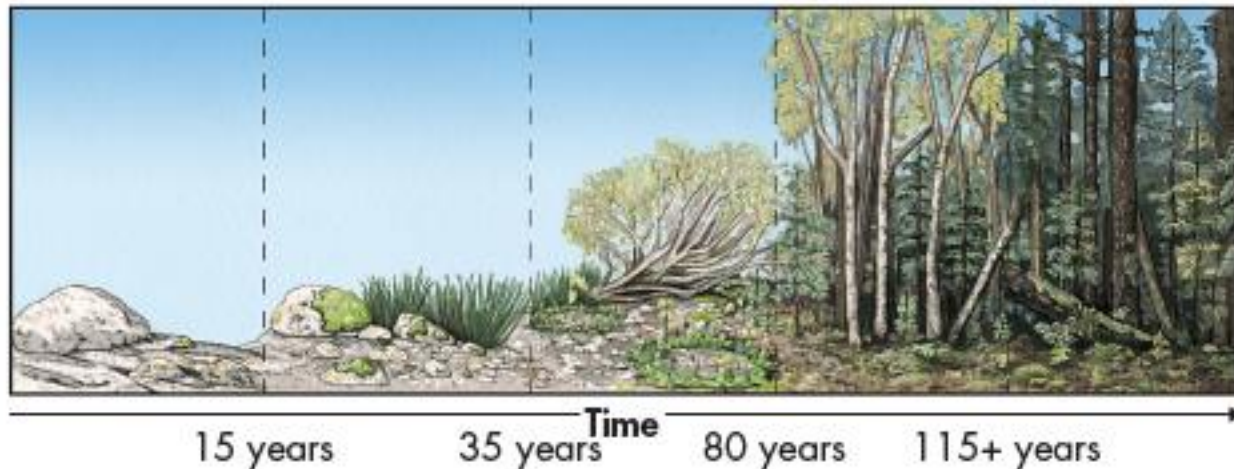
Over the course of succession, the number of different species present typically increases.

Primary Succession

Volcanic explosions can create new land or sterilize existing areas.

Retreating glaciers can have the same effect, leaving only exposed bare rock behind them.

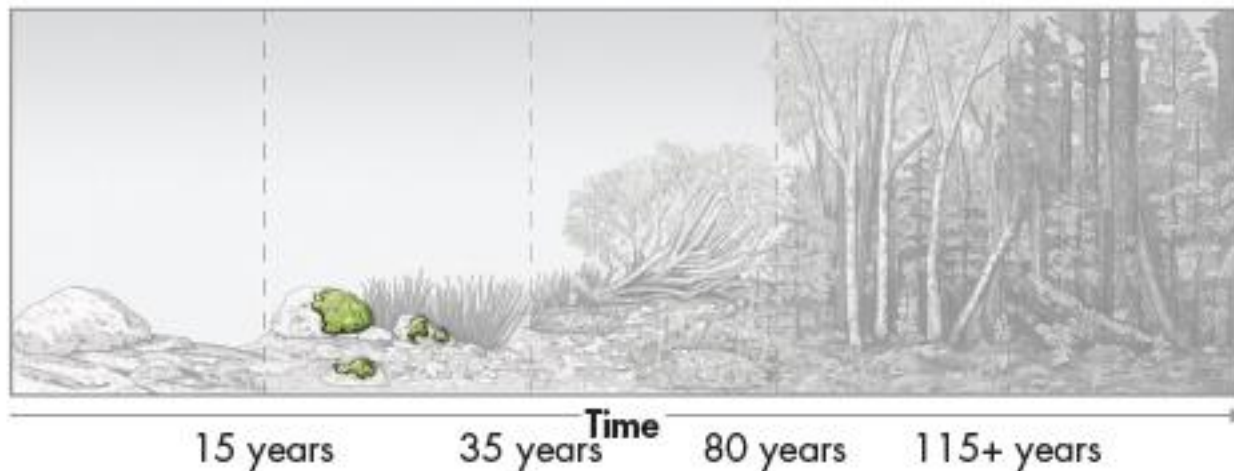
Succession that begins in an area with no remnants of an older community is called **primary succession**.



Primary Succession

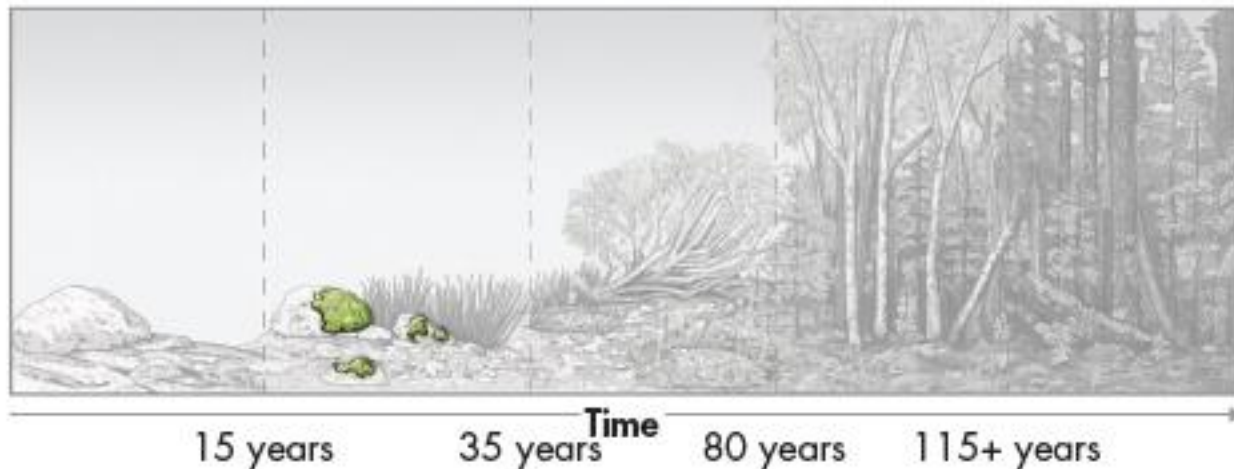
The first species to colonize barren areas are called **pioneer species**.

One ecological pioneer that grows on bare rock is lichen—a mutualistic symbiosis between a fungus and an alga.



Primary Succession

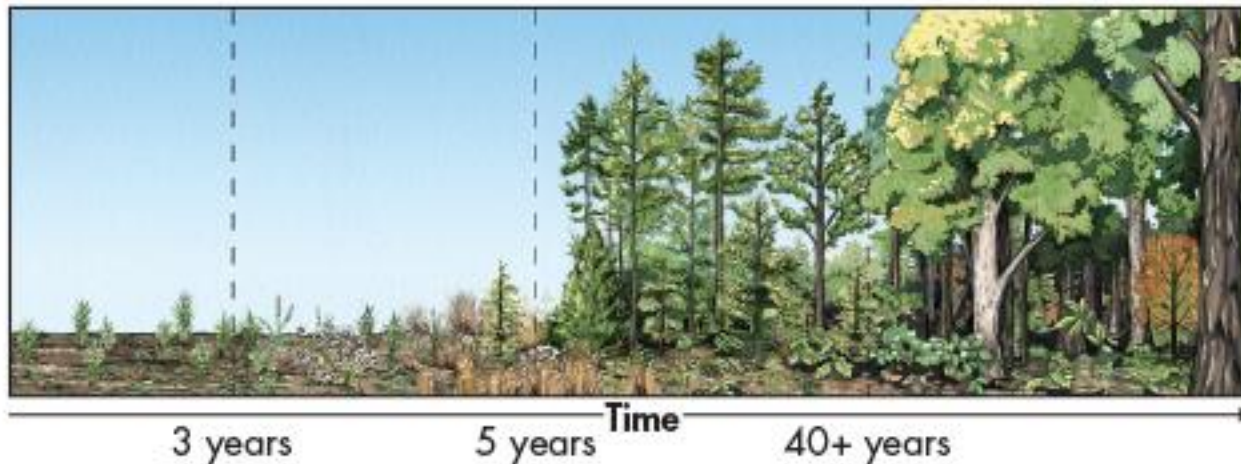
Over time, lichens convert, or fix, atmospheric nitrogen into useful forms for other organisms, break down rock, and add organic material to form soil.



Secondary Succession

Sometimes, existing communities are not completely destroyed by disturbances. In these situations, **secondary succession** occurs.

Secondary succession proceeds faster than primary succession, in part because soil survives the disturbance. As a result, new and surviving vegetation can regrow rapidly.



Secondary Succession

Secondary succession often follows a wildfire, hurricane, or other natural disturbance.

Secondary succession can also follow human activities like logging and farming.

Why Succession Occurs

Every organism changes the environment it lives in.

One model of succession suggests that as one species alters its environment, other species find it easier to compete for resources and survive.

Climax Communities

- 🔑 Do ecosystems return to “normal” following a disturbance?
- 🔑 Secondary succession in healthy ecosystems following natural disturbances often reproduces the original climax community.
- 🔑 Ecosystems may or may not recover from extensive human-caused disturbances.

Succession After Human-Caused Disturbances

Ecosystems may or may not recover from extensive human-caused disturbances.

Clearing and farming of tropical rain forests, for example, can change the microclimate and soil enough to prevent regrowth of the original community.