

3.1 Communities

Section Objectives:


- Identify some common limiting factors.
- Explain how limiting factors and ranges of tolerance affect distribution of organisms.
- Sequence the stages of ecological succession.
- Describe the conditions under which primary and secondary succession take place.

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3.1 Communities

Life in a Community

- Various combinations of abiotic and biotic factors interact in different places around the world.




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3.1 Communities

Life in a Community

- The result is that conditions in one part of the world are suitable for supporting certain forms of life, but not others.



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3.1 Communities

Limiting factors

- Factors that affect an organism's ability to survive in its environment, such as the availability of water and food, predators, and temperature, are called limiting factors.

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3.1 Communities

Limiting factors

- A **limiting factor** is any biotic or abiotic factor that restricts the existence, numbers, reproduction, or distribution of organisms.


Common Limiting Factors
Sunlight
Climate
Atmospheric gases
Temperature
Water
Nutrients/Food
Fire
Soil chemistry
Space
Other organisms

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3.1 Communities

Limiting factors

- Factors that limit one population in a community may also have an indirect effect on another population.



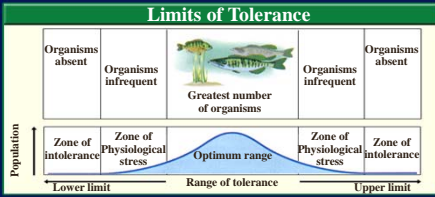
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Ranges of tolerance

- The ability of an organism to withstand fluctuations in biotic and abiotic environmental factors is known as **tolerance**.



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3.1 Communities

Succession: Changes over Time

- Ecologists refer to the orderly, natural changes and species replacements that take place in the communities of an ecosystem as **succession**.
- Succession occurs in stages. At each stage, different species of plants and animals may be present.

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3.1 Communities

Succession: Changes over Time

- As succession progresses, new organisms move in.
- Others may die out or move out.
- There are two types of succession—primary and secondary.

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Primary succession

- The colonization of barren land by communities of organisms is called **primary succession**.
- Primary succession takes place on land where there are no living organisms.

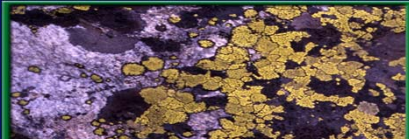
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Primary succession

- The first species to take hold in an area like this are called pioneer species.



- An example of pioneer species is a lichen, which is a combination of small organisms.

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Primary succession

- Decaying lichens, along with bits of sediment in cracks and crevices of rock, make up the first stage of soil development.
- New soil makes it possible for small weedy plants, small ferns, fungi, and insects to become established.

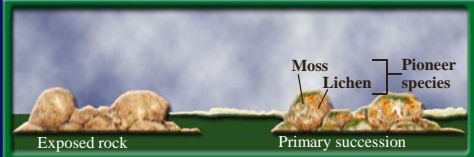
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Primary succession

- As these organisms die, more soil builds.



Exposed rock Moss Lichen Pioneer species Primary succession

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3.1 Communities

Primary succession

- After some time, primary succession slows down and the community becomes fairly stable, or reaches equilibrium.


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3.1 Communities

Primary succession

- A stable, mature community that undergoes little or no change in species is a **climax community**.



Secondary succession → Climax community

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3.1 Communities

Secondary succession

- Secondary succession** is the sequence of changes that takes place after an existing community is severely disrupted in some way.
- Secondary succession, however, occurs in areas that previously contained life, and on land that still contains soil.


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3.1 Communities

Secondary succession

- Because soil already exists, secondary succession may take less time than primary succession to reach a climax community.



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3.2 Biomes

Section Objectives:

- Compare and contrast the photic and aphotic zones of marine biomes.
- Identify the major limiting factors affecting distribution of terrestrial biomes.
- Distinguish among biomes.


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3.2 Biomes

What is a biome?

- A biome is a large group of ecosystems that share the same type of climax community.
- There are terrestrial biomes and aquatic biomes, each with organisms adapted to the conditions characteristic of the biome.




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3.2 Biomes

What is a biome?

- Biomes located on land are called terrestrial biomes.
- Oceans, lakes, streams, ponds, or other bodies of water are aquatic biomes.



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3.2 Biomes

Aquatic Biomes

- Approximately 75 percent of Earth's surface is covered with water.
- Most of that water is salty.
- Freshwater is confined to rivers, streams, ponds, and most lakes.
- As a result, aquatic biomes are separated into marine biomes and freshwater biomes.

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3.2 Biomes

Marine biomes

- Different parts of the ocean differ in biotic and abiotic factors (salinity, depth, availability of light, and temperature) found there.
- One of the ways ecologists study marine biomes is to make separate observations in shallow, sunlit zones and deeper, unlighted zones.


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3.2 Biomes

Marine biomes

- The portion of the marine biome that is shallow enough for sunlight to penetrate is called the **photic zone**.




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3.2 Biomes

Marine biomes

- Deeper water that never receives sunlight makes up the **aphotic zone**.



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3.2 Biomes

Estuaries—Mixed waters

- An estuary is a coastal body of water, partially surrounded by land, in which freshwater and salt water mix.
- The salinity, or amount of salt, in an estuary ranges between that of seawater and that of freshwater, and depends on how much freshwater the river brings into the estuary.


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Estuaries—Mixed waters

- Estuaries, may contain salt marsh ecosystems, which are dominated by salt-tolerant smooth cordgrass, salt marsh hay, or eelgrasses.



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The effects of tides

- Daily, the gravitational pull of the sun and moon causes the rise and fall of ocean tides.
- The portion of the shoreline that lies between the high and low tide lines is called the **intertidal zone**.
- Intertidal ecosystems have high levels of sunlight, nutrients, and oxygen.


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3.2 Biomes

The effects of tides

- Intertidal zones differ in rockiness and wave action.
- If the shore is rocky, waves constantly threaten to wash organisms into deeper water.




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3.2 Biomes

The effects of tides

- If the shore is sandy, wave action keeps the bottom in constant motion.



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3.2 Biomes

In the light

- The photic zone of the marine biome includes the vast expanse of open ocean that covers most of Earth's surface.
- Most of the organisms that live in the marine biome are plankton.


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3.2 Biomes

In the light

- **Plankton** are small organisms that drift and float in the waters of the photic zone.



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In the light

- Plankton are important because they form the base of all aquatic food chains.
- Baleen whales and whale sharks, some of the largest organisms that have ever lived, consume vast amounts of plankton.

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Freshwater biomes

- Although the summer sun heats the surface of a lake the water a few feet below the surface remains cold.
- These temperature variations within a lake are an abiotic factor that limits the kinds of organisms that can survive in deep lakes.

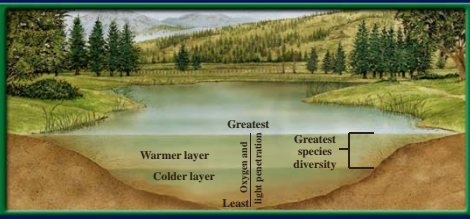
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3.2 Biomes

Freshwater biomes

- Another abiotic factor that limits life in deep lakes is light.



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3.2 Biomes

Other aquatic biomes

- Other places where land and water meet are called wetlands, but there are several different kinds of wetlands. Swamps have trees.
- Marshes do not, but both usually have water flowing through them.
- Other wetland areas, called bogs, get their water supply from rain. Water does not flow through bogs.

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Terrestrial Biomes: Latitude and climate

- Latitude describes your position in degrees north and south of the equator.

North pole
Sun's rays
Equator
South pole

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3.2 Biomes

Terrestrial Biomes: Latitude and climate

- At different latitudes, the sun strikes Earth differently.

North pole
Sun's rays
Equator
South pole

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Terrestrial Biomes: Latitude and climate

- As a result, the climate—wind, cloud cover, temperature, humidity and precipitation in that area—are different.

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3.2 Biomes

Terrestrial Biomes: Latitude and climate

- Latitude and climate are abiotic factors that affect what plants and animals will survive in a given area.

Annual Precipitation vs. Temperature for Various Biomes

Annual precipitation (cm)

Average temperature (°C)

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3.2 Biomes

Life on the tundra

- The **tundra** is a treeless land with long summer days and short periods of winter sunlight.

Temperature (°C)

Precipitation (cm)

Month

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3.2 Biomes

Life on the tundra

- Because of its latitude, temperatures in the tundra never rise above freezing for long, and only the topmost layer of soil thaws during the summer.
- Underneath this top layer is a layer of permanently frozen ground called permafrost.
- The soil is lacking in nutrients.


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3.2 Biomes

Life on the tundra

- Lack of nutrients limits the types of organisms the tundra can support.
- The short growing season limits the type of plants found in this biome to grasses, dwarf shrubs, and cushion plants.




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3.2 Biomes

Life on the tundra

- Hordes of mosquitoes and black-flies are some of the most common tundra insects during the short summer.
- The tundra also is home to a variety of small mammals, including ratlike lemmings, weasels, arctic foxes, snowshoe hares, and even birds such as snowy owls and hawks.




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3.2 Biomes

Life on the tundra

- Musk oxen, caribou and reindeer are among the few large animals that migrate into the area and graze during the summer months.




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3.2 Biomes

Life on the taiga

- Just south of the tundra lies another biome that circles the north pole.
- The **taiga** (TI guh) also is called the boreal or northern coniferous forest.




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3.2 Biomes

Life on the taiga

- Common trees are larch, fir, hemlock, and spruce trees.



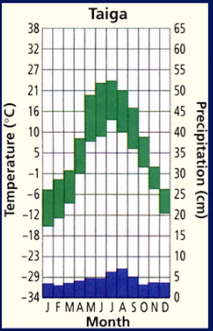
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3.2 Biomes

Life on the taiga

- Because of their latitude, taiga communities usually are somewhat warmer and wetter than tundra.



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3.2 Biomes

Life on the taiga

- However, the prevailing climatic conditions are still harsh, with long, severe winters and short, mild summers.
- The topsoil, which develops slowly from decaying coniferous needles, is acidic and poor in minerals.

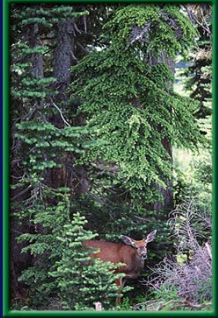
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Life on the taiga

- More large species of animals are found in the taiga as compared with the tundra.




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Life in the desert



- The driest biome is the desert biome. A **desert** is an arid region with sparse to almost nonexistent plant life.

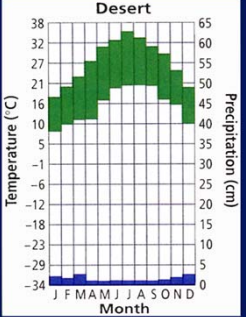
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3.2 Biomes

Life in the desert

- Deserts usually get less than 25 cm of precipitation annually.




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Life in the desert

- With rainfall as the major limiting factor, vegetation in deserts varies greatly.
- The driest deserts are drifting sand dunes.



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3.2 Biomes

Life in the desert

- Many desert plants are annuals that germinate from seed and grow to maturity quickly after sporadic rainfall.
- The leaves of some desert plants curl up, or even drop off altogether, thus reducing water loss during extremely dry spells.
- Many desert mammals are small herbivores that remain under cover during the heat of the day, emerging at night to forage on plants.


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Life in the desert

- Coyotes, hawks, owls and roadrunners are carnivores that feed on the snakes, lizards, and small mammals of the desert.



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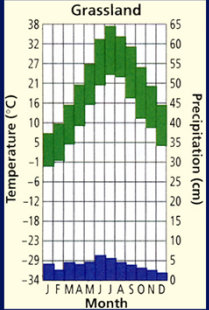
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3.2 Biomes

Life in the grassland

- Grasslands are large communities covered with rich soil, grasses, and similar plants.



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3.2 Biomes

Life in the grassland

- Grasslands, occur principally in climates that experience a dry season, where insufficient water exists to support forests.
- Grasslands contain few trees per hectare.

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3.2 Biomes

Life in the grassland

- The soils of grasslands have considerable humus content because many grasses die off each winter, leaving byproducts to decay and build up in the soil.
- At certain times of the year, many grasslands are populated by herds of grazing animals.

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Life in the grassland

- Other important prairie animals include jack rabbits, deer, elk, and prairie dogs.
- Many species of insects, birds, and reptiles, also make their homes in grasslands.



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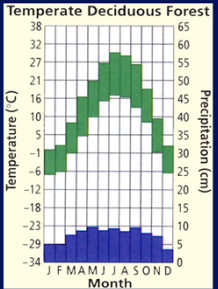
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Life in the temperate forest

- When precipitation ranges from about 70 to 150 cm annually in the temperate zone, temperate deciduous forests develop.



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3.2 Biomes

Life in the temperate forest

- **Temperate** or **deciduous** forests are dominated by broad-leaved hardwood trees that lose their foliage annually.
- The soil of temperate forests usually consists of a top layer that is rich in humus and a deeper layer of clay.




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3.2 Biomes

Life in the temperate forest

- The animals that live in the temperate deciduous forest include squirrels, mice, rabbits, deer, and bears.




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3.2 Biomes

Life in the temperate forest

- Many birds, such as bluejays, live in the forest all year long, whereas other birds migrate seasonally.



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3.2 Biomes

Life in rain forests

- There are two types of rain forests in the world—the temperate rain forest and the more widely known tropical rain forest.
- Temperate rain forests are found on the Olympic peninsula in Washington state and in other places throughout the world, such as South America, New Zealand, and Australia.

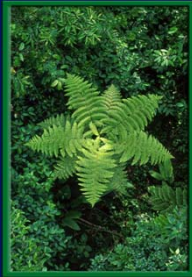
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Life in rain forests

- As their name implies, **tropical rain forests** have warm temperatures, wet weather, and lush plant growth.



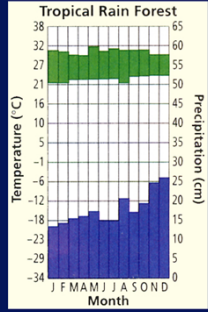
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3.2 Biomes

Life in rain forests

- The average temperature is about 25°C.



Month	Temperature (°C)	Precipitation (mm)
J	25	2000
F	25	2000
M	25	2000
A	25	2000
M	25	2000
J	25	2000
J	25	2000
A	25	2000
S	25	2000
O	25	2000
N	25	2000
D	25	2000

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3.2 Biomes

Life in rain forests

- Rain forests receive at least 200 cm of rain annually; some rain forests receive 600 cm.
- One reason for the large number of niches in rain forests is vertical layering.

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3.2 Biomes

A Tropical Rain Forest: Canopy

- The canopy layer, 25-45 meters high, is a living roof.
- The tree tops are exposed to rain, sunlight, and strong winds.
- A few giant trees called emergents pole through the canopy.

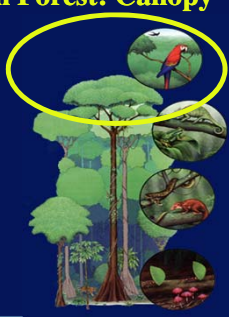
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3.2 Biomes

A Tropical Rain Forest: Canopy

- Monkeys frequently pass through.
- Birds, such as scarlet macaws, live on the fruits and nuts of the trees.



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3.2 Biomes

A Tropical Rain Forest: Understory

- In the understory, the air is still, humid, and dark. Vines grow from the soil to the canopy.
- Leaf cutter ants harvest leaves and bring them to the ground.
- Plants include ferns, broad-leaved shrubs, and dwarf palms.

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3.2 Biomes

A Tropical Rain Forest: Understory

- Insects are common in the understory.
- The limbs of the trees are hung with a thick layer of epiphytes, plants that get most of their moisture from the air.
- Birds and bats prey upon the insects.


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3.2 Biomes

A Tropical Rain Forest: Understory

- Tree frogs are common understory amphibians.
- Reptiles include chameleons and snakes.



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3.2 Biomes

A Tropical Rain Forest: Ground

- The ground layer is a moist forest floor.
- Leaves and other organic materials decay quickly.
- Roots spread throughout the top 18 inches of soil
- There is great competition for nutrients.


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3.2 Biomes

A Tropical Rain Forest: Ground

- Mammals living on the ground include rodents and cats, such as the jaguar.
- Ants, termites, earthworms, bacteria, and fungi live in the soil and quickly decompose organic materials.



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Life in rain forests

- Some rain forest plants are important sources of medicinal products and hardwood trees and have provided a source of income for people.

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3.2 Biomes

Life in rain forests

- Agricultural land is not common in rain forests.



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3.2 Biomes

Life in rain forests

- Soils in rain forests do not have substantial amounts of organic matter because leaf matter, which contains nutrients, disappears so quickly.
- Without organic matter, once rain forest soil is exposed and farmed, it becomes hard, almost brick-like, and nutrient-poor in a matter of a few years.

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