

Ecosystems

The organization of the biosphere, from the broadest level of organization to the most specific level of organization, is shown below:

biosphere → biome → ecosystem → community → population → organism

Biosphere

The **biosphere** includes any part of the Earth where organisms live. It extends from the crust of the Earth to the atmosphere. All of the ecosystems on the Earth are included within the biosphere.



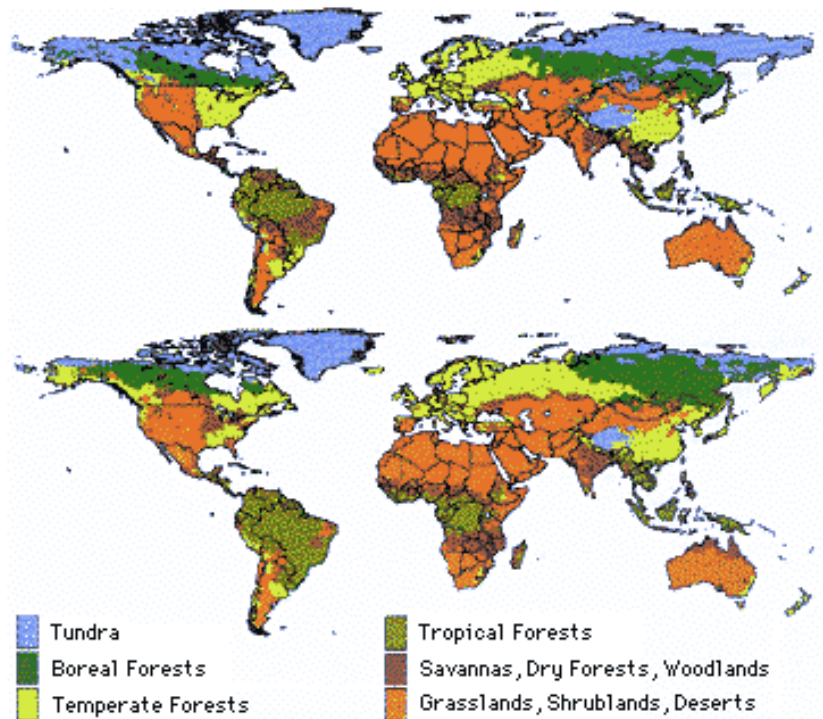
All of the ecosystems on Earth are part of the biosphere.

The biosphere is the broadest level of ecological study. It includes interactions between different ecosystems that can only be studied by viewing the entire Earth as one large system. The lithosphere, hydrosphere, and atmosphere are all part of the biosphere.

Biome

A **biome** is a geographic region that has a distinct climate. A biome is made up of separate (but similar) ecosystems, so it contains characteristic types of plants and animals adapted to the region and its climate.

Deserts, grasslands, and rainforests are all examples of biomes.



Ecosystem

An **ecosystem** is made up of the **biotic**, or living, community and its **abiotic**, or nonliving, environment. Abiotic factors include rocks, air, dirt, sunlight and water.

An example of an ecosystem would include all of the living and nonliving factors that are inside a pond. The water in the pond, the algae and plants that grow in the water, the animals and bacteria that live in the water, the dirt and rocks on the bottom of the pond, and the sunlight that hits the water would all be considered a part of this ecosystem.



All of the living and nonliving factors of this coral reef are part of the coral reef ecosystem.

Ecosystems can vary greatly in size and conditions. The abiotic factors that make up an ecosystem determine what kinds of plants and animals that can live there. For example, a desert ecosystem that is very hot and does not receive much water can only support certain kinds of organisms, such as cacti and lizards.

Community

A **community** includes all of the populations that live and interact in the same area. An example of a community is all of the plants and animals inside of a forest. All of these organisms interact and depend on one another for survival. ***A community makes up an ecosystem's living, or biotic, portion.***



All of the plants and animals in this forest belong to the same community.

At the community level, interactions between organisms can be observed. For example, predator/prey and consumer/producer interactions occur at this level. Competition and cooperation between different species are also part of community ecology.

Population

A **population** is a group of individuals of the same species living in the same area at the same time. An example of a population of organisms is a grove of orange trees.



All of the orange trees in this grove belong to the same population.

Populations can be defined at different levels of size. For example, a local population could occupy a very small habitat, such as a puddle. A population could also include every member of a species of monkey that occupies a large island. There is generally a boundary between populations of the same species, such as an ocean or an area of land that the animals do not freely cross.

Changes in Ecosystems

The survival of organisms depends greatly on physical factors in their environment. Any changes to either the biotic or abiotic factors can impact an ecosystem. Some changes that might appear to be minor could have a large effect. For example, minor changes in the pH of a body of water can cause massive fish kills.

But not all changes are negative, some could be positive. By simply moving through the soil, worms are able to help break up the soil and add air. This improves the quality of soil, which plants benefit from.

Changes in an environment also have ongoing effects. For example, if some or all of the plants in an ecosystem were to die, the animals that feed on the plants would have less food, so fewer of the animals would survive.

As the population of these primary consumers becomes smaller, secondary consumers would begin to compete with each other more for food, and this population would also begin to shrink.

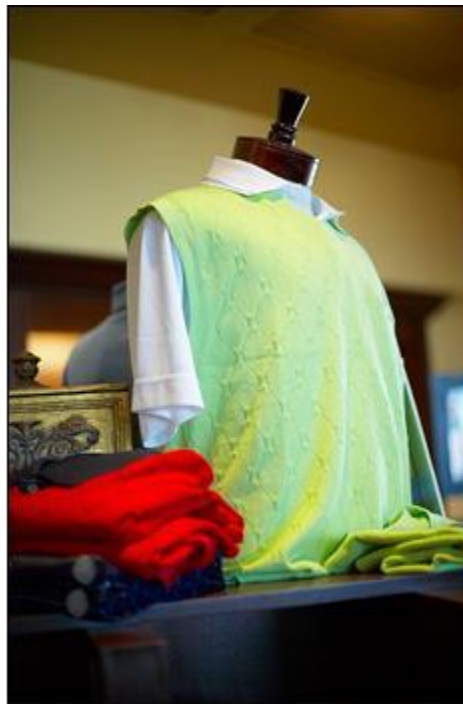
Biotic & Abiotic Factors

*Factors which can affect change in a population or species are usually divided into two types: **abiotic** and **biotic**. Abiotic refers to the nonliving environmental factors, while biotic refers to the influence or effect created by a living organism.*

Both abiotic and biotic factors can limit or enhance a population's success in a particular environment.

Biotic Factors

The word *biotic* comes from the Greek word for "life". Biotic factors include not only living organisms but also factors from formerly living organisms.



Biotic factors include both living things and things that were once living. This means that the cotton plant and a cotton shirt are both considered biotic.

For example, both a cotton plant and a cotton t-shirt would be considered biotic factors because they are derived from the same living organism. Biotic factors typically influence the viability of a community and include interactions between members of the same species and members of different species.

Abiotic Factors

Abiotic factors include any nonliving geological, geographical and climatological factors. Specific abiotic factors are water, air, soil, light, temperature, and natural disasters. These things are a part of each species' ecological niche because they influence how populations affect, and are affected by, resources and enemies.



Abiotic factors shown here include air, water, light, soil, and even the forest fire.

Biomes

*The term **biome** refers to a geographic region that has a distinct climate. A biome contains characteristic types of plants and animals adapted to the region and its climate.*

Characteristics of Biomes

The climate of a location determines which types of organisms are able to live there. Climates that are very cold are home to plants and animals that have adapted to the extreme temperatures. The same is true for climates that are extremely hot and dry.

The major biomes on Earth include: tropical rainforest, temperate rainforest, desert, grassland, deciduous forest, coniferous forest, tundra, estuary, savanna, and taiga.

Tropical Rainforest

The climate of a tropical rainforest is hot and wet. Heavy rainfall (around 150 cm per year) and year-round warm temperatures make it very humid. This climate is found near the equator. A tropical rainforest is very dense with lots of large trees that block out sunlight. Very little sunlight reaches the rainforest floor.



Tropical rainforests are very hot and wet.

Temperate Rainforest

The climate of a temperate rainforest is mild and wet. Temperatures are moderate and change with the seasons. Rainfall amounts are very high. Like tropical rainforests, temperate rainforests have a thick canopy of trees that block most sunlight from hitting the forest floor. However, while tropical rainforest canopies are generally broadleaf trees, temperate rainforest canopies may be broadleaf or coniferous trees.



Temperate rainforests commonly have coniferous canopies, with smaller broadleaf plants in the understory.

Image courtesy of NPS.

Temperate rainforests are farther from the equator than tropical rainforests and can be found in the U.S. Pacific Northwest, Asia, South America, Europe, and Australia.

Desert

The climate of tropical deserts is generally hot and dry. However, temperate deserts, such as the Gobi in Asia, are much cooler. The amount of precipitation in all deserts is less than the amount of water that could potentially evaporate. Deserts get less than 25 centimeters of rain every year. Desert plants and animals are adapted to store water and withstand year-round hot temperatures.



Deserts are very dry and generally hot.

Succulents, snakes, scorpions, and mice are examples of organisms that live in desert ecosystems.

Temperate Grasslands

Temperate grasslands are located in the dry temperate interiors of continents. In North America, they are called **prairies**, in Asia they are referred to as **steppes**, and in South America they are **pampas**.

Temperate grasslands receive enough rainfall to support grasses, but not enough to support the growth of large trees. The temperatures are generally warm in the summer and cold in the winter. Drought and wildfires are also common in this biome.



The temperate grassland is characterized by thick, mixed grasses.

Prairies are often converted into farmland due to the rich soils found there. Some of the animals that can be found in this ecosystem include grasshoppers, prairie dogs, and bison.

Deciduous Forest

The climate of a deciduous forest is temperate with four distinct seasons (spring, summer, fall, and winter). Deciduous forests have warm summers and cold winters. They have moderate precipitation throughout the year.



Deciduous forests have four distinct seasons.

During winter months, however, the precipitation is usually frozen and unavailable to the organisms that live there. Trees in a deciduous forest usually lose their leaves during the winter and have thick bark to conserve water and protect them from the cold.

Taiga

The taiga, known also as a *boreal forest*, is the largest continental biome. It experiences long, cold winters; short, warm summers; and low precipitation. It is characterized by coniferous forests. Taiga covers most of Canada and Siberia and is not found in the Southern Hemisphere.



The taiga is characterized by coniferous forests; long, cold winters; short, warm summers; and low precipitation.

Arctic foxes, wolves, and snowy owls are a few examples of the animals that live in the taiga.

Tundra

The tundra has very low temperatures and very little precipitation. Winters in the tundra are long and extremely cold; summers are short, mild, and cool. The animals living in tundra ecosystems have adaptations that allow them to stay warm in the very low temperatures. For instance, Arctic foxes, grizzly bears, and ermines (a kind of weasel) all have thick fur that protects them from the cold.



The tundra is very cold and dry.

Tundra is characterized by its frozen subsoil, which makes only a small layer of soil available to plant life. This limits the plants that can grow to small low growing plants such as mosses and grasses and makes it *impossible for trees to grow*.

Estuary

An estuary is an area in which fresh water and salty ocean waters mix together. These areas may include bays, mouths of rivers, salt marshes, and lagoons. These brackish (salt mixed with fresh) water ecosystems shelter and feed marine life, birds, and other wildlife with nutrients from the ocean.



Estuaries provide a place where young animals can grow up.

The plants in estuaries are marsh grasses and other plants that are adapted to water levels that change with the tides. Muskrats, herons, egrets, shrimp, and crabs are animals often found in estuaries.

Savanna

A savanna is a **dry tropical grassland** where trees are present but more widely scattered than in forest ecosystems. The savanna climate has a temperature range of 68° to 86°F.

Savannas receive around 125 centimeters of rain every year, with most of the rain falling during the summer. Because of the vast differences in precipitation, the summer is referred to as the "wet season," and the winter is the "dry season."



The trees in a savanna are very sparse and spread out.

Zebras, giraffes, lions, and acacia trees are found in the savannas of Africa.

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