Biomes

Ecosystems **can be small-scale, covering a small area (such as a pond) or large-scale covering a large area (such as a tropical rainforest).**

The world is divided up into ten major ecosystems. These large-scale ecosystems are called *biomes*.

Biomes are large scale ecosystems defined by abiotic factors. These are:

- ✓ climate
- ✓ ***relief***
- ✓ ***geology***
- ✓ soils
- ✓ vegetation

Biome characteristics

Tropical forests are found 5°N and 5°S of the equator in Central and South America, parts of Africa and Asia. They are hot and humid and contain a huge variety of plants and animals - around half of all the world's species. The trees are mostly hardwood. The climate is called equatorial.
Savannah or tropical grasslands are hot and dry, dominated by grass, ***scrub*** and occasional trees. They have two distinct seasons - a dry season when much of the vegetation dies back, and a rainy season when it grows rapidly. They are found in central Africa (Kenya, Zambia, Tanzania), northern Australia and central South America (Venezuela and Brazil).
Desert is the driest and hottest of areas. The world's largest desert is the Sahara in North Africa. Areas of scrub land that border the desert are called **desert scrub**.
Mediterranean climates are not too hot or cold. They are found around the Mediterranean Sea, near Cape Town in South Africa and Melbourne in Australia.
Temperate grasslands are dominated by grass and trees and large bushes are scarce. They have a temperate continental climate - the weather is mild with moderate rainfall. Grasslands include the Puszta in Hungary, the Veldt in South Africa, the Pampas in Argentina and the Prairies in the USA.
Temperate deciduous forests contain trees that lose their leaves and are found across Europe and USA. The weather is mild and wet. The climate is called temperate maritime.
Coniferous forests, containing evergreen trees, are found in Scandinavia, Russia and Canada. They have a cool climate with moderate rainfall called cool temperate.
Mountain areas can be very cold at night and during winter. The growing season is short and at higher levels trees will not grow.
Tundra surrounds the North and South poles. They have an extremely cold climate, with limited numbers of plants and animals able to survive there.

Tropical Rainforest

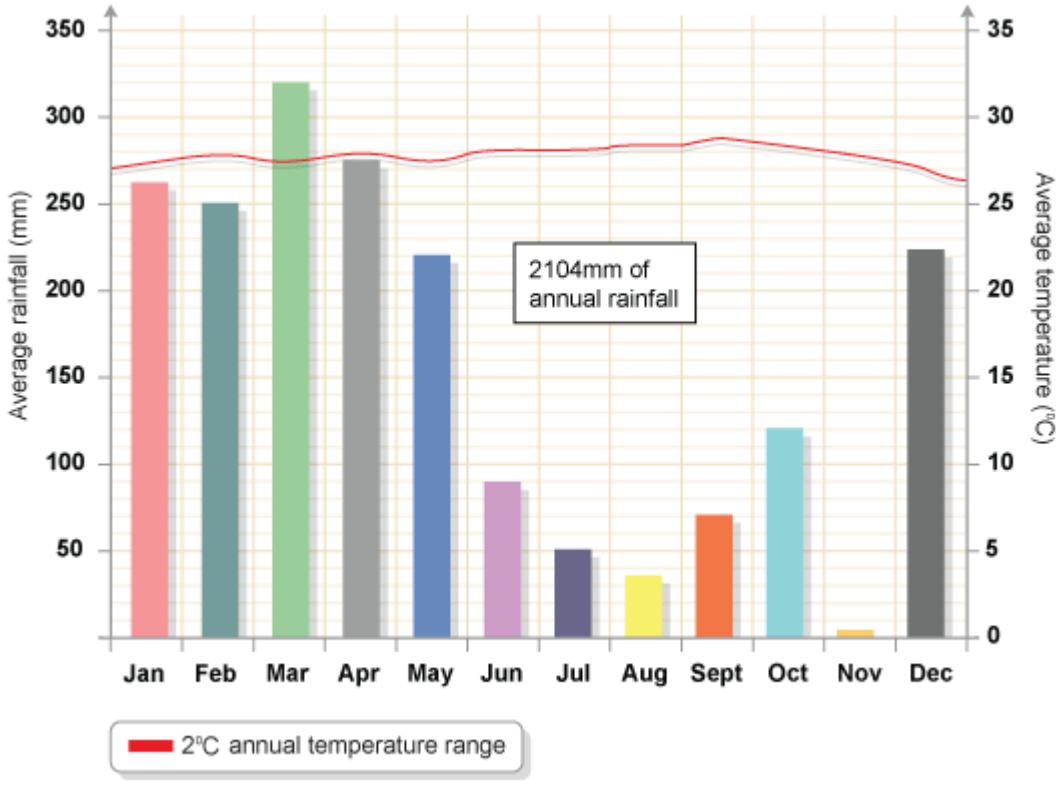
The tropical rainforest is a *biome* with a constant temperature and a high rainfall. The level of *humidity* and density of the vegetation give the ecosystem a unique water and nutrient cycle. Rainforests around the world are threatened by human expansion.

Characteristics and climate

A ***tropical*** rainforest biome is found in hot, humid environments in equatorial climates (5°N and 5°S of the equator). They contain the most diverse range and highest volume of plant and animal life found anywhere on earth.

In general, tropical rainforests have hot and humid climates where it rains virtually everyday. The level of rainfall depends on the time of year. Temperatures vary through the year - but much less than the rainfall.

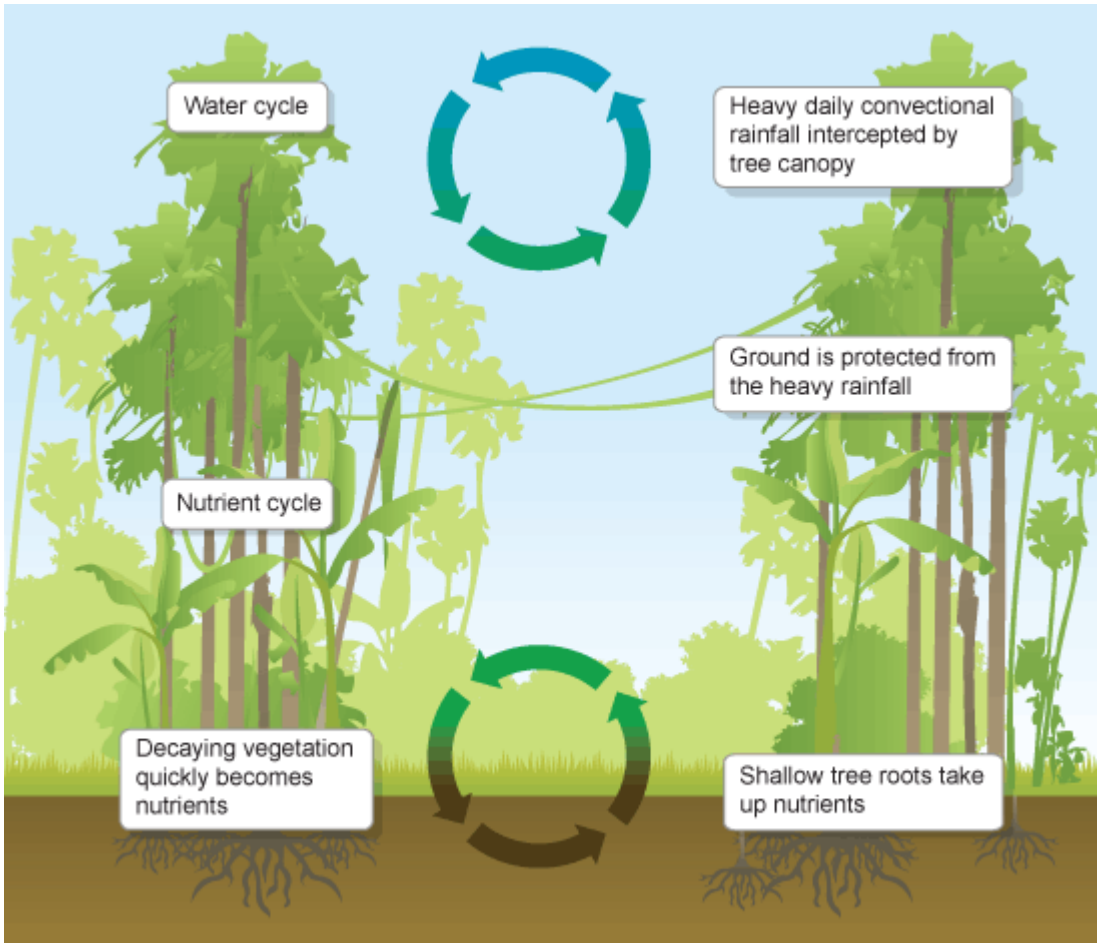
The graph shows average rainfall and temperature in Manaus, Brazil, in the Amazon rainforest. The rainy season is from December to May. Notice how much the rainfall varies over the year - the highest monthly rainfall is in March with over 300mm, while the lowest is in August with less than 50mm. Over the year, the temperature only varies by 2°C.



Monthly average of rainfall/temp in rainforest area of Manaus, Brazil

Rainforest water and nutrient cycles

Rainforest ecosystems are characterised by heavy ***convectional rainfall***, high ***humidity***, lushness of vegetation and nutrient-rich but shallow soil. These factors give rise to a unique water and ***nutrient cycle***.



Rainforest nutrient and water cycle

Rainforest nutrient cycle

The rainforest nutrient cycling is rapid. The hot, damp conditions on the forest floor allow for the rapid decomposition of dead plant material. This provides plentiful nutrients that are easily absorbed by plant roots. However, as these ***nutrients*** are in high demand from the rainforest's many fast-growing plants, they do not remain in the soil for long and stay close to the surface of the soil. If vegetation is removed, the soils quickly become infertile and vulnerable to erosion.

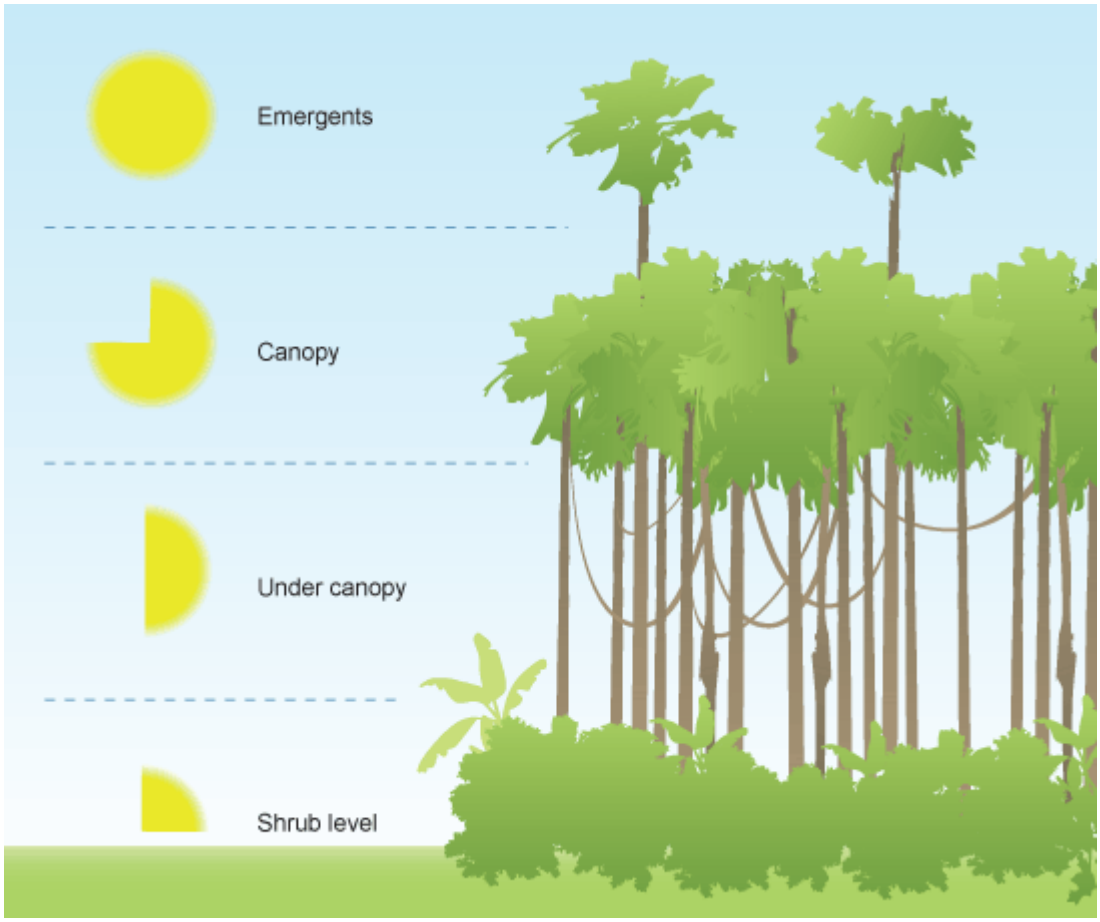
If the rainforest is cleared for agriculture it will not make very good farmland, as the soil will not be rich in nutrients.

Rainforest vegetation levels

Tropical rainforests have dense vegetation. From ground level up these levels of vegetation are:

- ✓ The **shrub layer**. It is dark and gloomy with very little vegetation between the trees. During heavy rainfalls this area can flood.
- ✓ The **under canopy** is the second level up. There is limited sunlight. Saplings wait here for larger plants and trees to die, leaving a gap in the canopy which they can grow into. Woody climbers called lianas avoid having to wait for gaps by rooting in the ground and climbing up trees to get to the sunlight.
- ✓ The **canopy** is where the upper parts of most of the trees are found. The canopy is typically about 65 to 130 feet (20 to 40 metres) tall. This leafy environment is home to insects, arachnids, birds and some mammals.
- ✓ **Emergents** are the tops of the tallest trees in the rainforest. These are much higher, and so are able to get more light than the average trees in the forest canopy.

- ✓ The graphic shows the levels of rainforest vegetation and the relative amount of sunlight that each one receives.



Vegetation levels in tropical rainforest

Adapting to rainforest life

The vegetation in the rainforest has evolved characteristics which help it to survive in this unique environment.


A fan palm


Buttress roots


Lianas


Strangler fig

Each has adapted to rainforest conditions in a different way.

- ✓ **Fan palms** have large, fan-shaped leaves that are good for catching sunshine and water. The leaves are segmented, so excess water can drain away.
- ✓ Rainforests have a shallow layer of fertile soil, so trees only need shallow roots to reach the nutrients. However, shallow roots can't support huge rainforest trees, so many tropical trees have developed huge **buttress roots.** These stretch from the ground to two metres or more up the trunk and help to anchor the tree to the ground.
- ✓ ***Lianas*** are woody vines that start at ground level, and use trees to climb up to the canopy where they spread from tree to tree to get as much light as possible.
- ✓ **Strangler figs** start at the top of a tree and work down. The seed is dropped in a nook at the top of a tree and starts to grow, using the debris collected there as nourishment. Gradually the fig sends aerial roots down the trunk of the host, until they reach the ground and take root. As it matures, the fig will gradually surround the host, criss-cross its roots around the trunk and start to strangle. The figs branches will grow taller to catch the sunlight and invasive roots rob the host of nutrients. Eventually the host will die and decompose leaving the hollow but sturdy trunk of the strangler fig.
- ✓ **Drip tips** make sure that the water goes to the plants roots
- ✓ **Rapid Vertical Growth** make sure that the plants receive the most sunlight.
- ✓

The Mediterranean

The Mediterranean *biome* is located further away from the equator than the tropical rainforest biome and the Savannah between 30-40°N and 30-40°S. It is dry and hot in summer, but warm and wet in the winter. Countries with Mediterranean climates are Italy, Spain, Central Chile, California, South-west Australia and South-east Australia.

Summers are hot and dry as the prevailing winds come from the continent meaning that the air is dry and hot. This is the opposite to the winter where the prevailing winds come from the oceans bring moisture from the oceans that have been heated over the summer and therefore it in warm.

Vegetation has adapted by having:

- ✓ **Thick Bark** as protection against the heat.
- ✓ **Quick life cycle** to fit into the short growing season.
- ✓ **Long roots** to reach underground water storages in the dry season.
- ✓ **Small leaves** to reduce loss of moisture from the leaves.

The Savannah

The savannah *biome* is located further away from the equator than the tropical rainforest biome in the central part of Africa and in South America. It is dry, but not as dry as desert areas.

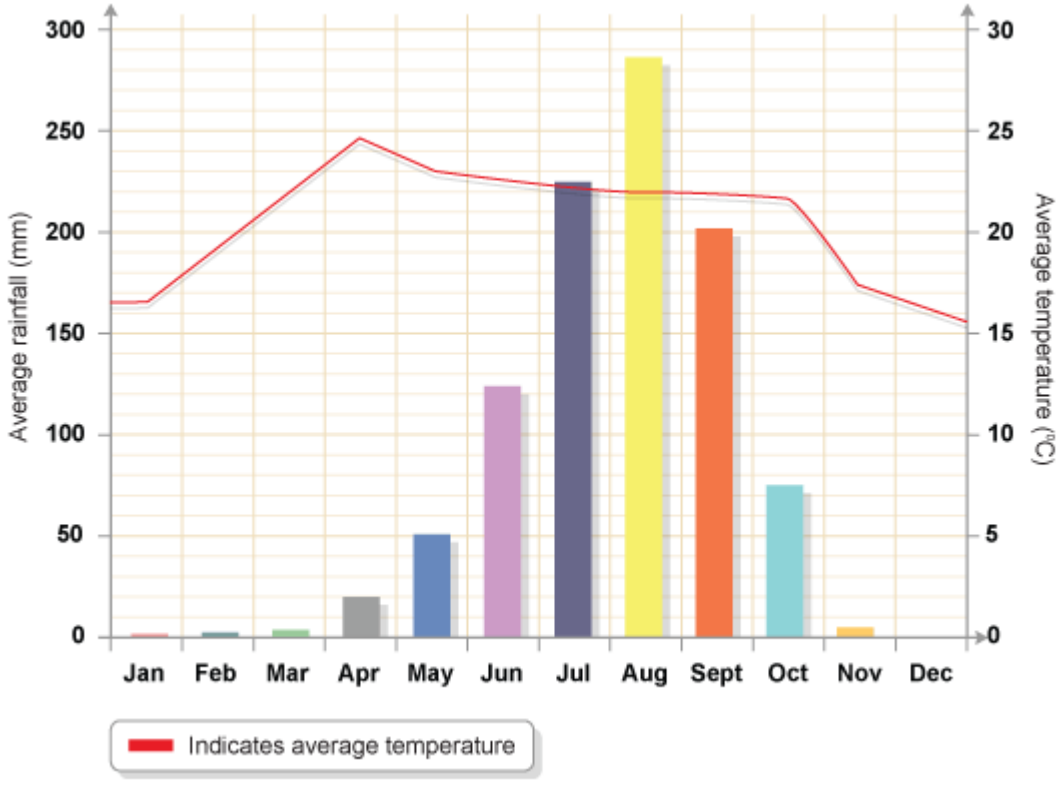
Characteristics

Savannahs - also known as tropical grasslands - are found to the north and south of tropical rainforest biomes. The largest expanses of savannah are in Africa, where much of the central part of the continent, for example **Kenya** and **Tanzania**, consists of tropical grassland. Savannah grasslands can also be found in **Brazil** in South America.

Savannah regions have two distinct seasons - a wet season and a dry season. There is very little rain in the dry season. In the wet season vegetation grows, including lush green grasses and wooded areas. As you move further away from the equator and its heavy rainfall, the grassland becomes drier and drier - particularly in the dry season.

Plants and animals have to adapt to the long dry periods. The acacia tree is small with waxy leaves and thorns. Plants may also store water, for example the baobab tree) or have long roots that reach down to the water table. Animals may ***migrate*** great distances in search of food and water.

The graph below shows average monthly temperatures and rainfall levels in the savannah region of Mali. Notice how the temperature and rainfall patterns relate to each other - the hottest temperatures come just before heavy rainfall, and the coolest time of the year comes just after the rains. This pattern is typical of savannah climates.



Temperature and rainfall in Mali

Soils

Savannah grassland soils are not very fertile. The nutrients in the soil are found near the surface as they come from decayed organic matter (vegetation) from the previous growing season. This organic matter decays rapidly due to the high temperatures.

There are two main types of vegetation in the Savannah. Grasses cover the vast open plains of the southeast while in the central region, acacia plants are more common. The Savannah is rich in wildlife - including giraffes, zebras, elephants, lions and over 2 million wildebeest.

The savannah ecosystem is a delicate balance of interdependent relationships between different species. This balance is easily disrupted by any human intervention, and the smallest change can have knock-on effects on other people, animals, plants and the wider environment.

Desertification

Desertification can result from poorly managed human intervention in the savannah. Areas of desert are created by the destruction of natural vegetation. Causes of desertification include:

- ✓ Removal of vegetation cover.
- ✓ Overgrazing.
- ✓ Uncontrolled fuel wood collection.
- ✓ Unsustainable farming practice and loss in fertility of soil.
- ✓ Excessive tree felling.

Hot Deserts

The Hot Desert *biome* is located between 10° and 30° north and south of the equator. The wind usually comes from the dry land and not from the oceans.

Characteristics

The largest expanses of hot deserts are in Northern Africa – Sahara, Saudi Arabia – Arabian Desert. Savannah regions have two distinct seasons - a Hot season and a Cool season. There is very little rain in the throughout the year, normally less than 250mm. This is due to High pressure where air descends.

During the night, temperatures can drop considerably as there is no clouds to trap the heat from the day. During the day temperatures can reach up to 50°C as there are no clouds and therefore the land is exposed to the Sun's energy.

Vegetation has adapted by:

- ✓ **Storing water** The Saguaro cactus can soak up large quantities of water (8000 litres) when there is heavy rainfall, so that it can survive the dry climate.
- ✓ **Long shallow roots** mean that plants can soak up water from a larger area after heavy rain.
- ✓ **Spikes instead of leaves** protects the plants from animals and reduces moisture loss.
- ✓ **Thick waxy skin** reflects the sun's heat and reduces moisture loss.