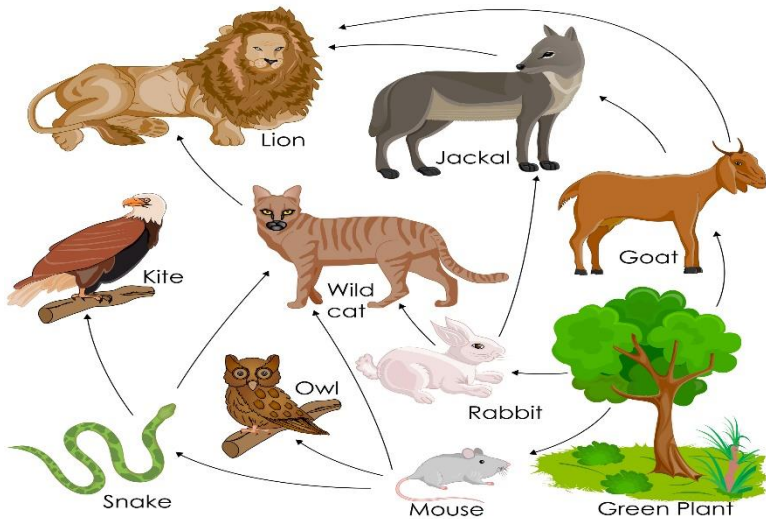


What is an Ecosystem?

An ecosystem is a system in which organisms interact with each other and with their environment.

Ecosystem's Components

Abiotic	These are non-living, such as air, water, heat and rock.	
Biotic	These are living, such as plants, insects, and animals.	
↳	Flora	Plant life occurring in a particular region or time.
	Fauna	Animal life of any particular region or time.



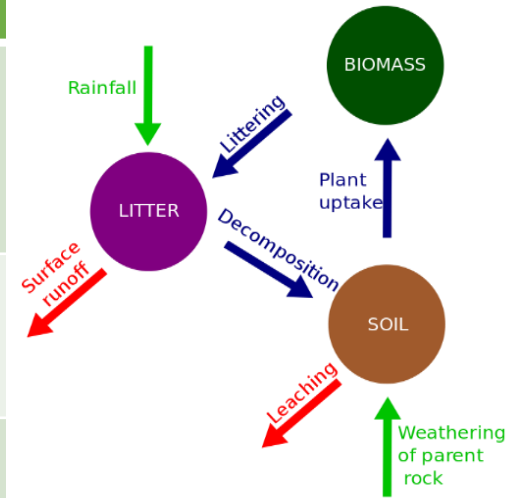
Food Web and Chains

Simple food chains are useful in explaining the basic principles behind ecosystems. They show only one species at a particular trophic level. Food webs however consists of a network of many food chains interconnected together.

Nutrient cycle

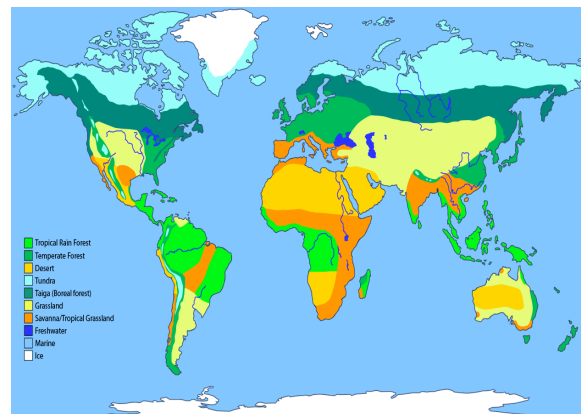
Plants take in nutrients to build into new organic matter. Nutrients are taken up when animals eat plants and then returned to the soil when animals die and the body is broken down by **decomposers**.

Litter	This is the surface layer of vegetation, which over time breaks down to become humus.
Biomass	The total mass of living organisms per unit area.



Biomes

A biome is a **large geographical area of distinctive plant and animal groups**, which are adapted to that particular environment. The climate and geography of a region determines what type of biome can exist in that region.



	Coniferous forest
	Deciduous forest
	Tropical rainforests
	Tundra
	Temperate grasslands
	Tropical grasslands
	Hot deserts.

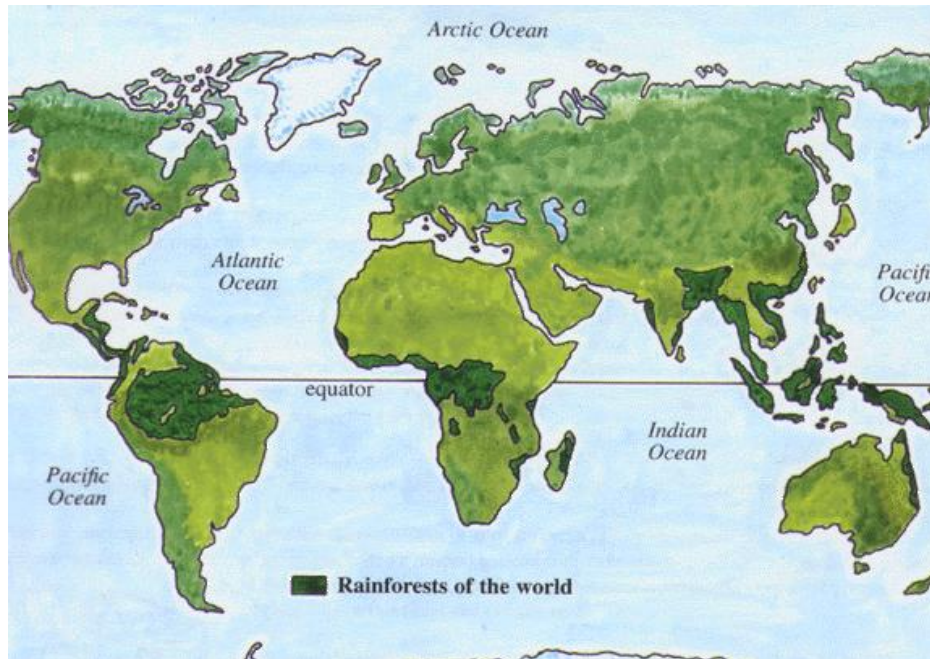
The **most productive biomes**, which have the greatest biomass, grow in climates that are **hot and wet**.

Biome's climate and plants

Biome	Location	Temperature	Rainfall	Flora	Fauna
Tropical rainforest	Centred along the Equator.	Hot all year (25-30°C)	Very high (over 200mm/year)	Tall trees forming a canopy; wide variety of species.	Greatest range of different animal species. Most live in canopy layer
Tropical grasslands	Between latitudes 5°- 30° north & south of Equator.	Warm all year (20-30°C)	Wet + dry season (500-1500mm/year)	Grasslands with widely spaced trees.	Large hooved herbivores and carnivores dominate.
Hot desert	Found along the tropics of Cancer and Capricorn.	Hot by day (over 30°C) Cold by night	Very low (below 300mm/year)	Lack of plants and few species; adapted to drought.	Many animals are small and nocturnal: except for the camel.
Temperate forest	Between latitudes 40°-60° north of Equator.	Warm summers + mild winters (5-20°C)	Variable rainfall (500-1500m /year)	Mainly deciduous trees; a variety of species.	Animals adapt to colder and warmer climates. Some migrate.
Tundra	Far Latitudes of 65° north and south of Equator	Cold winter + cool summers (below 10°C)	Low rainfall (below 500mm/ year)	Small plants grow close to the ground and only in summer.	Low number of species. Most animals found along coast.
Coral Reefs	Found within 30° north – south of Equator in tropical waters.	Warm water all year round with temperatures of 18°C	Wet + dry seasons. Rainfall varies greatly due to location.	Small range of plant life which includes algae and sea grasses that shelters reef animals.	Dominated by polyps and a diverse range of fish species.

Tropical Rainforest Biome

Tropical rainforest cover about **2 per cent** of the Earth's surface yet they are home to **over half of the world's plant and animals**.



Rainforest nutrient cycle

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 many fast-growing plants, they do not remain in the soil for long and stay close to the surface. If vegetation is removed, the soils quickly become **infertile**.

Distribution of Tropical Rainforests

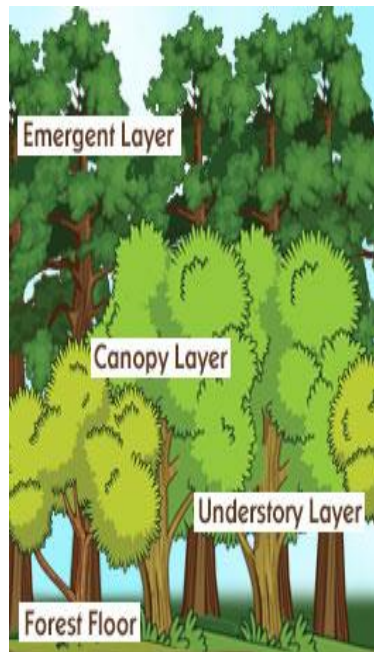
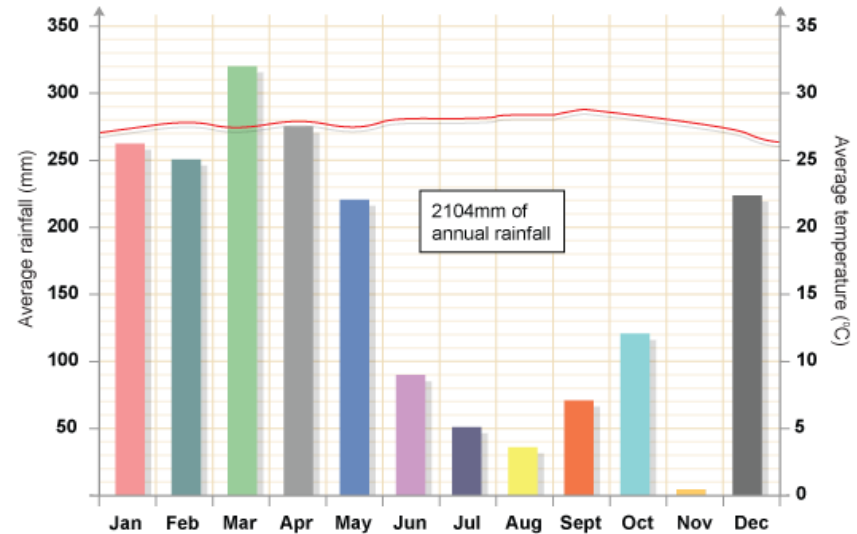
Tropical rainforests are **centred along the Equator** between the Tropic of Cancer and Capricorn. Rainforests can be found in South America, central Africa and South-East Asia. **The Amazon** is the world's largest rainforest and takes up the majority of northern South America, encompassing countries such as Brazil and Peru.

Inter-dependence in the rainforest

A rainforest works through **interdependence**. This is where the plants and animals **depend on each other** for survival. If one component changes, there can be **serious knock-up effects** for the entire ecosystem.

Climate of Tropical Rainforests

- Evening temperatures rarely fall below **22°C**.
- Due to the **presence of clouds**, temperatures rarely rise above **32°C**.
- Most afternoons have heavy showers.
- At night with no clouds insulating, temperature drops.



Layers of the Rainforest

Emergent	Highest layer with trees reaching 50 metres.
Canopy	Most life is found here as it receives 70% of the sunlight and 80% of the life.
U-Canopy	Consists of trees that reach 20 metres high.
Shrub Layer	Lowest layer with small trees that have adapted to living in the shade.

CASE STUDY: UK Ecosystem: Epping Forest, Essex

This is a typical English lowland deciduous woodland. 70% of the area is designated as a Site of Special Scientific Interest (SSI) for its biological interest, with 66% designated as a Special Area of Conservation (SAC).

Components & Interrelationships		Management
Spring	Flowering plants (producers) such as bluebells store nutrients to be eaten by consumers later.	- Epping has been managed for centuries. - Currently now used for recreation and conservation. - Visitors pick fruit and berries, helping to disperse seeds. - Trees cut down to encourage new growth for timber.
Summer	Broad tree leaves grow quickly to maximise photosynthesis.	
Autumn	Trees shed leaves to conserve energy due to sunlight hours decreasing.	
Winter	Bacteria decompose the leaf litter, releasing the nutrients into the soil.	

Tropical Rainforests: Case Study Malaysia



Malaysia is a LIC country in south-east Asia. 67% of Malaysia is a tropical rainforest with 18% of it not being interfered with. However, Malaysia has the fastest rate of deforestation compared to anywhere in the world

Adaptations to the rainforest


Orangutans	Large arms to swing & support in the tree canopy.
Drip Tips	Allows heavy rain to run off leaves easily.
Lianas & Vines	Climbs trees to reach sunlight at canopy.

Rainforest inhabitants

Many tribes have developed sustainable ways of survival. The rainforest provides inhabitants with...

- Food through hunting and gathering.
- Natural medicines from forest plants.
- Homes and boats from forest wood.

What are the causes of deforestation?

Logging  <ul style="list-style-type: none"> • Most widely reported cause of destructions to biodiversity. • Timber is harvested to create commercial items such as furniture and paper. • Violent confrontation between indigenous tribes and logging companies. 	Agriculture  <ul style="list-style-type: none"> • Large scale 'slash and burn' of land for ranches and palm oil. • Increases carbon emission. • River saltation and soil erosion increasing due to the large areas of exposed land. • Increase in palm oil is making the soil infertile.
Mineral Extraction  <ul style="list-style-type: none"> • Precious metals are found in the rainforest. • Areas mined can experience soil and water contamination. • Indigenous people are becoming displaced from their land due to roads being built to transport products. 	Tourism  <ul style="list-style-type: none"> • Mass tourism is resulting in the building of hotels in extremely vulnerable areas. • Lead to negative relationship between the government and indigenous tribes • Tourism has exposed animals to human diseases.
Energy Development  <ul style="list-style-type: none"> • The high rainfall creates ideal conditions for hydro-electric power (HEP). • The Bakun Dam in Malaysia is key for creating energy in this developing country, however, both people and environment have suffered. 	Road Building  <ul style="list-style-type: none"> • Roads are needed to bring supplies and provide access to new mining areas, settlements and energy projects. • In Malaysia, logging companies use an extensive network of roads for heavy machinery and to transport wood.

Issues related to biodiversity

Why are there high rates of biodiversity?

- Warm and wet climate encourages a wide range of vegetation to grow.
- There is rapid recycling of nutrients to speed plant growth.
- Most of the rainforest is untouched.

Main issues with biodiversity decline

- Keystone species (a species that are important of other species) are extremely important in the rainforest ecosystem. Humans are threatening these vital components.
- Decline in species could cause tribes being unable to survive.
- Plants & animals may become extinct.
- Key medical plants may become extinct.

Impacts of deforestation

Economic development

- ✓ Mining, farming and logging creates employment and tax income for government
- ✓ Products such as palm oil provide valuable income for countries
- ✗ The loss of biodiversity will reduce tourism



Soil erosion

- ✗ Once the land is exposed by deforestation, the soil is more vulnerable to rain
- ✗ With no roots to bind soil together, soil can easily wash away



Climate Change

- ✗ When rainforests are cut down, the climate becomes drier
- ✗ Trees are carbon 'sinks'. With greater deforestation comes more greenhouse emissions in the atmosphere
- ✗ When trees are burnt, they release more carbon in the atmosphere. This will enhance the greenhouse effect.



Sustainability for the Rainforest

Uncontrolled and unchecked exploitation can cause irreversible damage such as loss of biodiversity, soil erosion and climate change.

Possible strategies include:

- Agro-forestry - Growing trees and crops at the same time. It prevents soil erosion and the crops benefit from the nutrients.
- Selective logging - Trees are only felled when they reach a particular height.
- Education - Ensuring those people understand the consequences of deforestation
- Afforestation - If trees are cut down, they are replaced.
- Forest reserves - Areas protected from exploitation.
- Ecotourism - tourism that promotes the environments & conservation



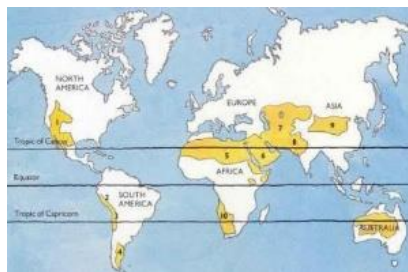
The Thar Desert is located on the border between India and Pakistan in Southern Asia. With India soon becoming the most populated country in the world in the next five years. With this, more people will plan to live in the desert.

Distribution of the world's hot deserts

Most of the world's hot deserts are found in the subtropics between 20 degrees and 30 degrees north & south of the Equator. The Tropics of Cancer and Capricorn run through most of the world's major deserts.

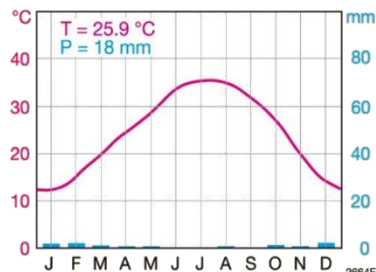
Hot Deserts inhabitants

- People often live in large open tents to keep cool.
- Food is often cooked slowly in the warm sandy soil.
- Head scarves are worn by men to provide protection from the Sun.



Major characteristics of hot deserts

- Aridity – hot deserts are extremely dry, with annual rainfall below 250 mm.
- Heat – hot deserts rise over 40 degrees.
- Landscapes – Some places have dunes, but most are rocky with thorny bushes.



Climate of Hot Deserts



- Very little rainfall with less than 250 mm per year.
- It might only rain once every two to three years.
- Temperatures are hot in the day (45 °C) but are cold at night due to little cloud cover (5 °C).
- In winter, deserts can sometimes receive occasional frost and snow.

Adaptations to the desert

Cactus



- Large roots to absorb water soon after rainfall.
- Needles instead of leaves to reduce surface area and therefore transpiration.

Camels



- Hump for storing fat (NOT water).
- Wide feet for walking on sand.
- Long eyelashes to protect from sand.

Desert Interdependence

Different parts of the hot desert ecosystem are closely linked together and depend on each other, especially in such a harsh environment.

Opportunities and challenges in the Hot desert

Opportunities

- There are valuable minerals for industries and construction.
- Energy resources such as coal and oil can be found in the Thar desert.
- Great opportunities for renewable energy such as solar power at Bhaleri.
- Thar desert has attracted tourists, especially during festivals.

Challenges

- The extreme heat makes it difficult to work outside for very long.
- High evaporation rates from irrigation canals and farmland.
- Water supplies are limited, creating problems for the increasing number of people moving into area.
- Access through the desert is tricky as roads are difficult to build and maintain.

Causes of Desertification

Desertification means the turning of semi-arid areas (or drylands) into deserts.

Climate Change

Reduce rainfall and rising temperatures have meant less water for plants.

Fuel Wood

People rely on wood for fuel. This removal of trees causes the soil to be exposed.

Overgrazing

Too many animals mean plants are eaten faster than they can grow back. Causing soil erosion.

Over-Cultivation

If crops are grown in the same areas too often, nutrients in the soil will be used up causing soil erosion.

Population Growth

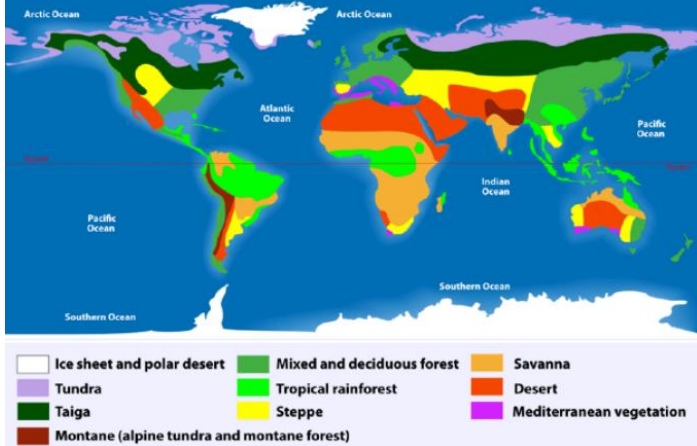
A growing population puts pressure on the land leading to more deforestation, overgrazing and over-cultivation.

Strategies to reduce Desertification

- Water management - growing crops that don't need much water.
- Tree Planting - trees can act as windbreakers to protect the soil from wind and soil erosion.
- Soil Management - leaving areas of land to rest and recover lost nutrients.
- Technology – using less expensive, sustainable materials for people to maintain. i.e. sand fences, terraces to stabilise soil and solar cookers to reduce deforestation.

Location

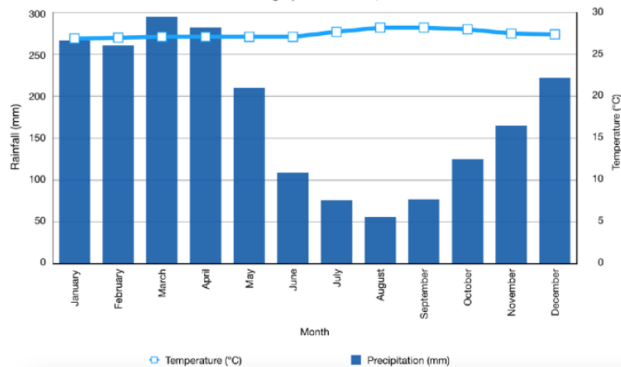
The main biomes in the world



10° degrees north and south of the Equator
The largest rainforests are in Brazil (South America), Zaire (Africa) and Indonesia (South East Asia). Other tropical rainforest places are in Hawaii and the islands of the Pacific and Caribbean.

Climate

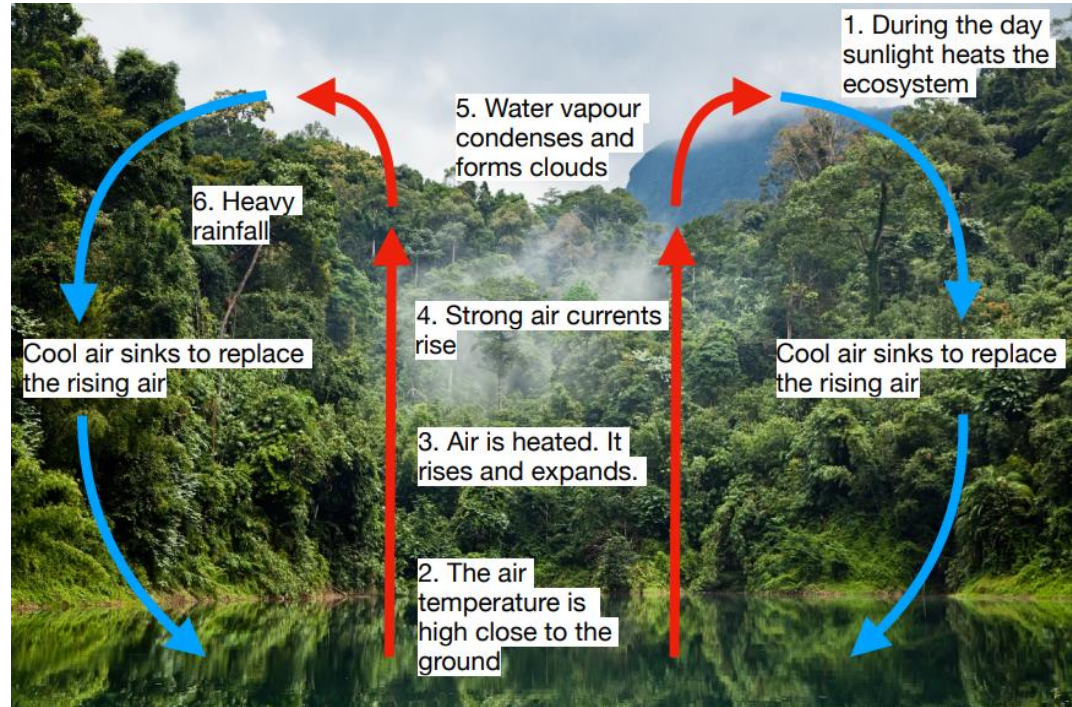
A climate graph for Manaus, Brazil



Average temperatures are around 27 degrees Celsius. Rainfall is over 2000mm throughout the year/



Water Cycle and Rainfall



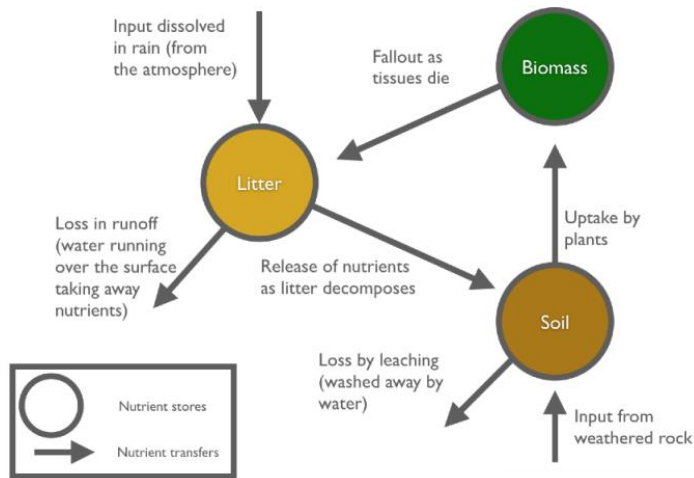
Keywords

Climate/ vegetation/ soil/ biodiversity/ evapotranspiration/ interception/ precipitation/ drip flow/ surface storage/ stores/ flows/ emergent/ canopy/ under canopy/ shrub layer/ photosynthesis/ epiphytes

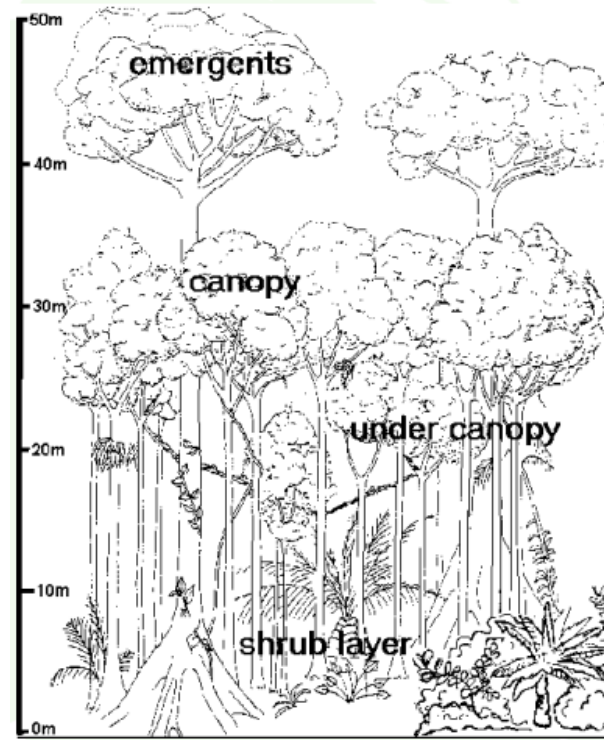
Vegetation Adaptions

- Competition for light causes trees to grow fast. They are tall and straight. Buttress roots support these tall trees as they have shallow roots because nutrients are only in the top layer of soil because they are rapidly taken up by trees and other vegetation
- Plants on the forest floor are shade tolerant and able to cope in the darker conditions
- Epiphytes grow high up on the branches of trees to gain access to the light
- Lianas wrap themselves around other trees to gain access to light
- Leaves are thick and waxy and have drip tips so water does not gather and cause algae to grow which can stop photosynthesis from happening
- The bark of some trees is very smother which makes it very difficult for other plants to climb up them (the strangler fig can completely cover a tree and cause it to die!)

The nutrient cycle



Vegetation Structure



Emergents are the tallest trees and are usually over 50 metres tall. The Kapok tree is an example of an emergent.

The sea of leaves blocking out the sun from the lower layers is called the canopy.

The canopy contains over 50% of the rainforest wildlife. This includes birds, snakes and monkeys.

Lianas (vines) climb to the canopy to reach sunlight.

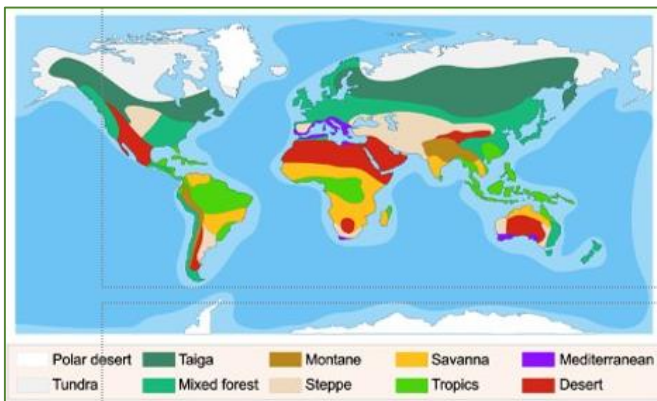
Epiphytes, or air plants are also found in this layer. An epiphyte is an organism that grows on the surface of a plant and gets its moisture and nutrients from the air, rain, water or from debris gathering around it.

The **under canopy** mainly contains bare tree trunks and lianas. Lianas are vines that climb the vegetation in a bid to reach sunlight.

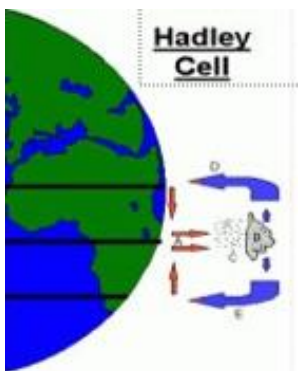
The **shrub layer** has the densest plant growth. It contains shrubs and ferns and other plants needing less light. Saplings of emergent and canopy trees can also be found here.

The **forest floor** is usually dark and damp. It contains a layer of rotting leaves and dead animals called litter. This decomposes rapidly (within 6 weeks) to form a thick humus, rich in nutrients. Below the rich top soil the soil lacks nutrients. This is because nutrients are rapidly absorbed by vegetation.

DISTRIBUTION



Climate explained



- A. As you would expect, temperatures at the equator are highest. Warm air rises containing evaporated moisture
- B. The air cools, condenses and forms clouds
- C. Heavy equatorial rainfall occurs (like in the rainforest)
- D. The cool, dry air then begins descending. The air warms up. Any remaining moisture in the air is held as water vapour (invisible)

Because the tropics are largely cloudless they get very hot during the day. There are few clouds to insulate these areas during the night. Therefore, temperatures drop to very low levels overnight.

Distribution described

Deserts are mainly found around the Tropics of Cancer and Capricorn, between 15° and 30° north and south of the equator. The main temperate deserts are found in the middle latitudes. Deserts are found in North Africa, central Australia and towards the south west of the USA. Deserts are often found on the west coast of continents.

Distribution explained

Hot air rises at the equator, where the land receives the greatest amount of the sun's radiation. Most of the world's deserts are located near 30 degrees north latitude and 30 degrees south latitude, where the heated equatorial air begins to descend. The descending air is dense and begins to warm again, evaporating large amounts of water from the land surface. The resulting climate is very dry.

Other deserts are located in the rain shadows of mountain ranges. As moist air passes over a mountain range, it expands and cools, precipitating most of its moisture as it rises. As it sweeps down the other side of the mountain range, it warms and compresses, causing high evaporation rates and shedding little rain. Many of the deserts in the south western United States are the result of rain shadows.

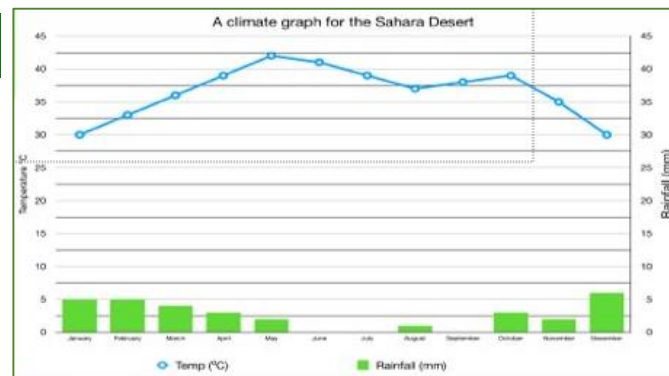
A few deserts, such as the Gobi Desert in China, are simply a result of being located far from the Ocean, from which most atmospheric moisture is drawn. The moisture is precipitated before it can reach these interior areas.

Deserts can form even on tropical coasts beside cold ocean currents, such as the west coast of South America. The currents cool the air, which then rises and warms as it moves over land, drawing up moisture that is later precipitated as the air moves further inland.

Climate

Deserts have extreme temperatures. During the day the temperature may reach 50°C, when at night it may fall to below 0°C. This means the desert has a high diurnal range (difference between the highest and lowest temperature within a day).

Deserts have less than 250mm of rainfall per year. The rain can be unreliable. Several years can pass between rainfall events.

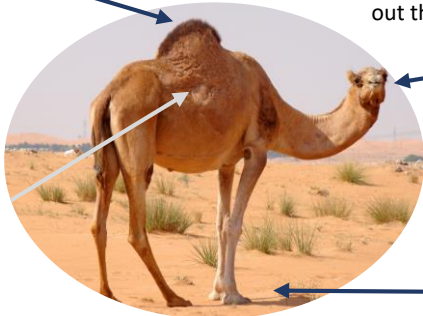


Soil

Desert soils are thin, sandy, rocky and generally grey in colour. Desert soils are very dry. When it does rain they soak up the water very quickly. The surface of the soil may appear crusty. This is due to the lack of rainfall. As it is so hot water is drawn up to the surface of the soil by evaporation. As the water evaporates, salts are left behind on the surface of the soil. Soils are generally infertile due to the lack of litter.

Animal adaptations

Fat is stored in the hump of the camel. This provides energy in times of food shortage in the desert. They don't store water in their humps!



Camels have two rows of eyelashes which are long, and slit-like nostrils which help keep out the sand being blown around the desert

Thick fur on the top of the body for shade, and thin fur elsewhere to allow easy heat loss in high desert temperatures

Large padded feet which allow them to spread their weight on the sand

The desert fox is nocturnal. It also sleeps underground during the day when temperatures are high and comes out at night when it is cooler and more comfortable



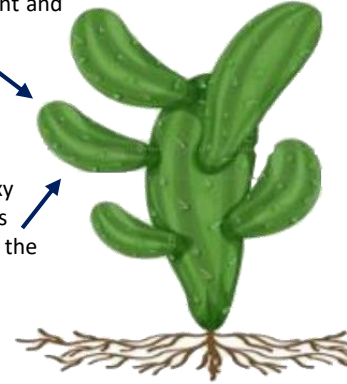
The desert fox has large ears which allow it to radiate body heat and help keep cool in the hot desert environment

The fox's feet are effective shovels for frequent digging – fennec foxes live in underground dens

The fox's feet are hairy, which help them perform as snowshoes and protect them from the extremely hot sand

Vegetation adaptations

Cacti are succulent plants, meaning they store water. They need to store water as rainfall is infrequent and unreliable



Cacti have needles which helps to reduce moisture loss and deters animals from eating the plant

The surface has a waxy coating which reduces water loss and avoids the plant drying out

Cacti have shallow roots that sit just below the surface of the earth and are up to 1m wide (heavy lateral branching). This is because it does not rain very often so the roots can absorb as much water as possible

The large umbrella-shaped crown enables the tree to capture the maximum amount of sunlight, with the smallest leaves. It also provides shade for the soil below which helps reduce evaporation



Small leaves reduce water loss through transpiration in the hot climate

Acacia trees have developed short, fat trunks that act as reservoirs for excess water. This enables them to thrive during periods of no rainfall

Deep roots (up to 50m) allow the acacia tree to reach water deep underground enabling them to survive drought conditions