

Sustaining Ecosystems

What is an Ecosystem?

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

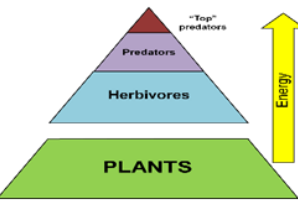
Ecosystem's Components

Abiotic These are non-living, such as air, water, heat, rock.

Biotic These are living, such as plants, insects, and animals.

Flora is plant life occurring in a particular region or time.

Fauna is all animal life of any particular region or time.



Food Chains

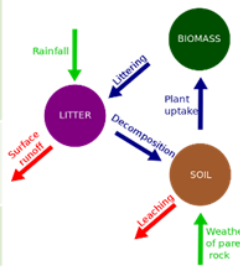
Food chains are useful in explaining the basic principles behind ecosystems. They show only one species at a particular level from where energy is transferred up to the next.

Nutrient cycle

Plants take in those nutrients where they are built 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.

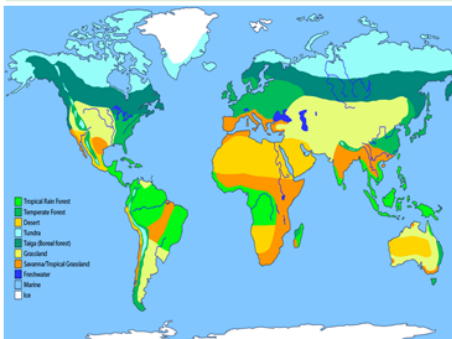
Litter This is the surface layer of vegetation, which over time breaks down to become humus.

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.

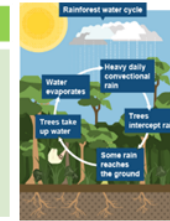
The most productive biomes – which have the greatest biomass – grow in climates that are hot and wet.

Tropical Rainforest Biome



Distribution of Tropical Rainforests

Tropical rainforests are centred along the Equator between the Tropic of Cancer and Capricorn 10° N and 10°S. 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.



Convective rainfall

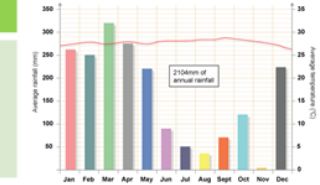
- The roots of plants take up water from the ground and the rain is intercepted as it falls.
- As the rainforest heats up, the water evaporates into the atmosphere. The trees transpire.
- Finally, the water condenses and forms clouds to make the next day's rain.

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.

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



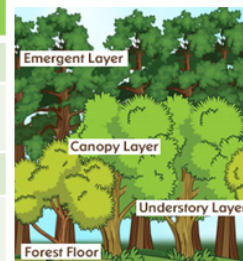
Interdependence in the rainforest

A rainforest works through interdependence. This is where the plants and animals depend on each other for survival.

Sustaining Ecosystems

Layers of the Rainforest

Emergent	Highest layer with tree reaching 50 metres.
Canopy	Most life is found here as it receives 70% of the sunlight and 80% of the light.
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.



Rainforest soil profile

Leaf Litter	Thin litter layer rapidly decomposes in heat.
Top Soil	Shallow topsoil is a mixture of decomposed organic matter and minerals.
Sub Soil	The sub-soil is deep due to weathering of rocks below.
Rock	Underlying rock weathers quickly at high temperatures to form sub-soil.

Biome's climate and plants

Biome	Location	Temperature	Rainfall	Flora	Fauna
Topical rainforest	Centred along the Equator.	Hot all year (25-30°C)	Very high (over 2000mm/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 250mm/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.

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Tropical Rainforest Biome	
Adaptations to the rainforest	Rainforest inhabitants
Sloths	Are camouflaged to forest environment.
Buttress Roots	Support tall trees & absorb nutrients.
Drip Tips	Allows heavy rain to run off leaves easily
Lianas & Vines	Climbs trees to reach sunlight at canopy.
Effects of Human Activity on the Rainforest	Benefits of the rainforest
Logging	Agriculture
<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. Has lead to violent confrontation between indigenous tribes and logging companies. 	<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	Tourism
<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. 	<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 effected wildlife (apes) by exposing them to human diseases.
	Raw Materials
	Commonly used materials such as timber and rubber are found here.
	Water
	Controls the flow of water to prevent floods/droughts regions..
	Food
	Important foods such as Bananas, pineapples and coffee are grown there.
	Health
	25% of modern medicines are sourced from rainforest ingredients.
	Energy
	Large dams generate 2/3 of Brazil's energy needs.
	Climate
	Acts as carbon sinks by storing 15% of carbon emissions.

Case Study: Sustainable Rainforest Management in Borneo – Crocker Ridge Biosphere reserve	
Location & Background	Threats to the Borneo Rainforest
Crocker Ridge is located in Borneo in Asia. It is part of Malaysia in the state of Sabah to the North of the island	<ul style="list-style-type: none"> Cattle Ranching and agricultural development by clearing land through slash & burn methods. Gold and other metal mining meant large scale soil and rock removing. This meant areas were deforested and chemicals entered water systems. By 22m hectares of rainforest lost
Ecotourism	Rainforest Management
Ecotourism is tourism that is directed towards the natural environments & conversation. Tourists come to Borneo to see the Orangutan and clouded leopards.	<ul style="list-style-type: none"> 2014 UNESCO designated the area a protected wildlife reserve. Core area – only for scientists and 200 indigenous Penan tribes to protect rainforest. Buffer zone allows ecotourism and localised industry growing coconuts, palm oil and deforestation so that locals can earn income.
Advantages	
<ul style="list-style-type: none"> Within the core area only scientists go to help protect the animals. The buffer zone provides tourist opportunities. 	
Disadvantages	
<ul style="list-style-type: none"> Land prices have increased. Deforestation to clear areas for tourism industry. 	

Polar/Tundra Regions Biome	
Distribution of Polar Regions	
Arctic	Antarctic
Is the region north of latitude 60°N around the North Pole.	A continent south of latitude 60°S around the South Pole.
Climate	
Polar areas are very cold with temperatures rarely reaching above 0 °C. Winters average below -40 °C with summers a maximum of only 10 °C. Rainfall is low throughout the year.	
Land & Sea Features	
Arctic	Antarctic
Large areas are permafrost. At sea, most of the region is frozen over.	Large and thick ice sheets. A mountain range crosses the continent.
Flora (Plants)	Fauna (Animals)
There are very few plants in polar areas – some lichens, mosses and grasses along the coastal areas.	Relatively few species of animals. Polar Bears, Penguins and marine mammals like whales, seals and walrus are examples.
Arctic soil profile	
Active Layer	Thaws in the summer. Becomes deeper towards pole.
Permafrost	Permanently frozen all year. Layer Increases further north.
Bed Rock	Low temperatures weathers rock slowly = less nutrients.
Effects of Human Activity in Polar Regions	
Oil & Gas exploration	Whaling
<ul style="list-style-type: none"> Arctic holds a large amount of untapped oil and gas. Oil spills would threaten ecosystems as clean up operations would be slow. 	<ul style="list-style-type: none"> Hunting of whales is a major industry – this led to a rapid decline in whale populations. Many countries have banned whaling, but some still continue
Fishing	Tourism
<ul style="list-style-type: none"> Has made area possible to fish large untapped stocks. The polar areas are difficult to police due to harsh conditions. Collapse of the fish stocks there might damage ecosystems. 	<ul style="list-style-type: none"> The tourism industry is steadily growing within polar regions. Travel by tourist increase emissions further. Wildlife may become disturbed by tourists getting up close.

Case Study: Small Scale Sustainable Management: Union Glacier, Antarctica	Case Study: Global Scale Sustainable Management: The Antarctic Treaty System
Location & Background	Background
Located in the southern Ellsworth Mountains and is a key logistic hub for expeditions and research.	Signed by 50 nations in 1961, the Treaty sets aside Antarctica as a scientific preserve, establishes freedom of scientific investigation and bans military activity.
Features and Activities	Basic Principles of the Antarctic Treaty
<ul style="list-style-type: none"> The locations has good facilities such as a dining room, electricity supply and transport. Tourist and can enjoy several activities such as ski tours, wildlife viewing and mountaineering. 	<ul style="list-style-type: none"> Bans mining and resource extraction. Prevents territorial disputes of the continent. Promotes scientific research and co-operation. Protects the fragile environments and its wildlife by preventing and managing waste/pollution.
Sustainable Management	Successful?
<ul style="list-style-type: none"> Strict guidelines on how tourists should behave are enforced to respect the natural environment. Solar panels used to reduce carbon emissions. All waste is carefully contained and removed. 	Stayed in place for 50 years with more countries signing up to enforce strict controls and improve its stability.