

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.

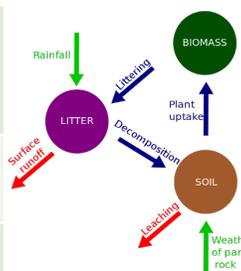


Food Web and Chains

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**.

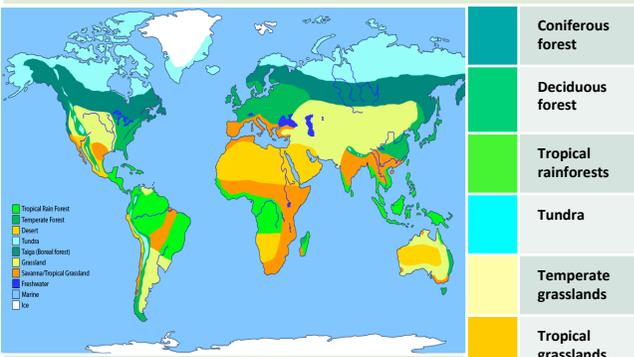


Litter This is the **surface layer** of vegetation, which over time breaks down to become **humus**.

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.



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 hoofed 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 (500-1500mm /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.

Unit 1b The Living World

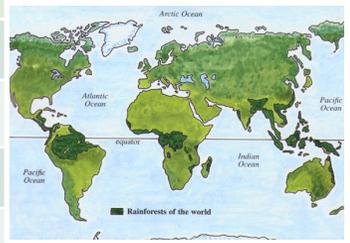


Tropical Rainforest Biome

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**.

Interdependence 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.



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.

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

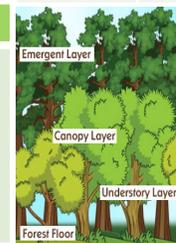
- Evening temperatures rarely fall below **22°C**.
- Due to the **presence of clouds**, temperatures rarely rise above **32°C**.
- Most afternoons have heavy showers.
- At night with no clouds insulating, temperature drops.

CASE STUDY: UK Ecosystem: Epping Forest, Essex



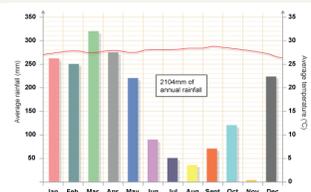
This is a typical English lowland deciduous woodland. **70% of the area** is designated as a **Site of Special Scientific Interest (SSI)** for its biological interest, with **66%** designated as a **Special Area of Conservation (SAC)**.

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.	



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 .



Tropical Rainforests: Case Study Amazon



The Amazon is located in the north of South America. The majority of it (around 60%) is located in Brazil. The rest of it can be found in Peru, Colombia, Ecuador, Bolivia, Venezuela, Guyana, Suriname and French Guiana.

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.

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**.

What are the causes of deforestation?

Logging

- 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.

Mineral Extraction

- **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.

Energy Development

- The **high rainfall** creates ideal conditions for **hydro-electric power (HEP)**.
- The **building of dams** is key for creating energy in this developing country, however, both people and environment have suffered.

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

Cold Environment: Case Study Svalbard



Svalbard is a group of islands off the coast of Norway, in the Arctic Ocean. Much of Svalbard experiences a polar climate, with glacial ice covering 60% of the land. The rest of the land is frozen tundra.

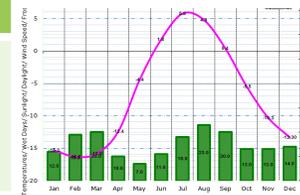
Distribution of cold environments

Most of the world's cold environments are located around the Arctic and Antarctic ice sheets. They are made up of polar and tundra regions, as well as alpine environments in mountainous areas.



Svalbard Characteristics

- Population of about 2700, mainly in the main town of Spitzbergen.
- There are more polar bears and snowmobiles than people.
- No arable farming and no trees – it's just too cold.



Adaptations to cold environments

Polar bear

- Have **thick fur** and an **insulating layer of fat** to retain heat.
- Have a **black nose** and **foot pads** to absorb sunshine.

Bear berry

- **Small waxy leaves** to help retain water.
- Very **low-growing** and **thick bark** for stability in windy conditions.

What is special about cold environments?

- Many indigenous people live a traditional life here, depending on wildlife to survive by hunting and fishing.
- Provide habitats for many birds, animals and plants.
- Unpolluted and unspoilt, they are important outdoor laboratories for scientific research such as climate change
- Their beauty and potential for adventure activities attract tourists who bring economic benefits.
- They provide opportunities for forestry and fishing.

Opportunities and challenges in Svalbard

Opportunities

- **Mineral extraction** – Rich reserves of coal. **Over 300 people employed in the mines.**
- **Energy** – Coal is burned to generate electricity to provide all of the island's energy needs. **There is scope to develop renewable geothermal energy.**
- **Fishing** – The Barents Sea south of Svalbard is one of the richest fishing grounds in the world with **150 species.**
- **Tourism** – increasing numbers visit to explore the extreme natural environment. **Provides 300 local jobs.**

Challenges

- **Winter temperatures below -30°C make it difficult to work outside for long periods, with a risk of frost bite.**
- **The frozen ground has to be protected from melting so heated water and sewage pipes are built above ground.**
- **Svalbard can only be reached by plane or ship. There are few roads so people mostly use snowmobiles.**
- **Global warming is leading to the melting of icecaps and permafrost making homes and buildings unstable.**

Cold environments under threat

Fossil fuels

In order to extract resources roads and buildings are built on the fragile tundra.

Oil-spills

Oil transported through pipelines may leak leading to the pollution of rivers and killing of trees and habitats.

Minor developments like constructing footpaths can have serious long-term effects on an ecosystem.

Climate Change

Reduced rainfall and rising temperatures have meant ice caps are melting, destroying habitats.

Off-road vehicles

Off-road vehicles are used by tourists to access the wilderness, leaving tire tracks and damaging permafrost.

Tundra vegetation takes a long time to establish and to recover from human-caused fires, oil spills and pollution.

Strategies to reduce risks

- **Technology** – Oil pipelines are raised, insulated and protected from earthquake damage.
- **Governments** – Laws to protect and preserve environments.
- **International agreements** – countries agree to protect the environment from economic development and control tourism.
- **Conservation groups** – provide scientific information, expertise and resources to communities, companies and governments.