ECOSYSTEMS

Ecosystem's Components

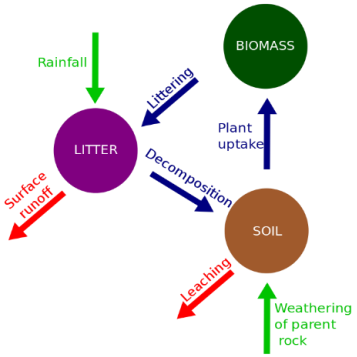
Abiotic	These are **non-living**, such as air, water, heat and rock.	
Biotic	These are **living**, such as plants, insects, and animals.	
↳	**Flora**	**Plant life** occurring in a particular region or time.
	Fauna	**Animal life** of any particular region or time.

What is an Ecosystem?

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

Nutrient cycle

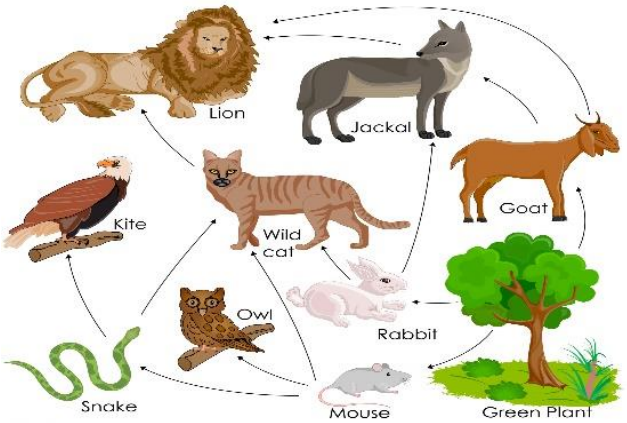
Plants take in **nutrients** to build into new organic matter. Nutrients are taken up when animals eat plants and then returned to the soil when animals die and the body is broken down by **decomposers**.



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.

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.

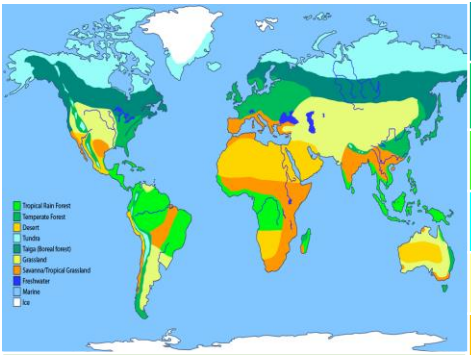


Food Web and Chains

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.

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**.

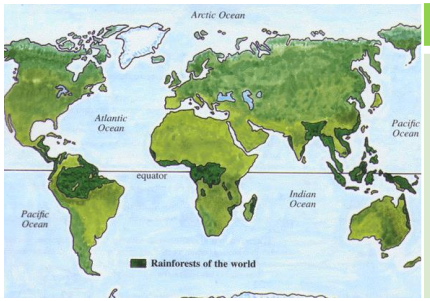
Tropical Rainforest Biome

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

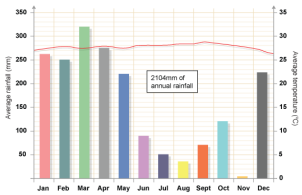
The **hot, damp conditions** on the forest floor allow for the **rapid decomposition** of dead plant material. This provides plentiful nutrients that are easily absorbed by plant roots.

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.



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.

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.

Agriculture

- 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

- **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

- **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

- 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

- **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.

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:

- **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

Layers of the Rainforest

Emergent	Highest layer with trees reaching **50 metres.**
Canopy	80% of life is found here as It receives **most of the sunlight and rainfall.**
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.**

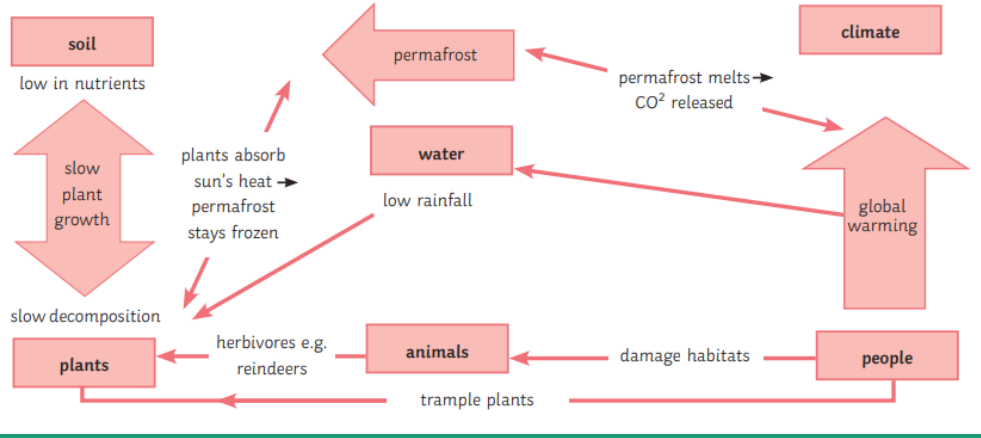
Climate of Tropical Rainforests

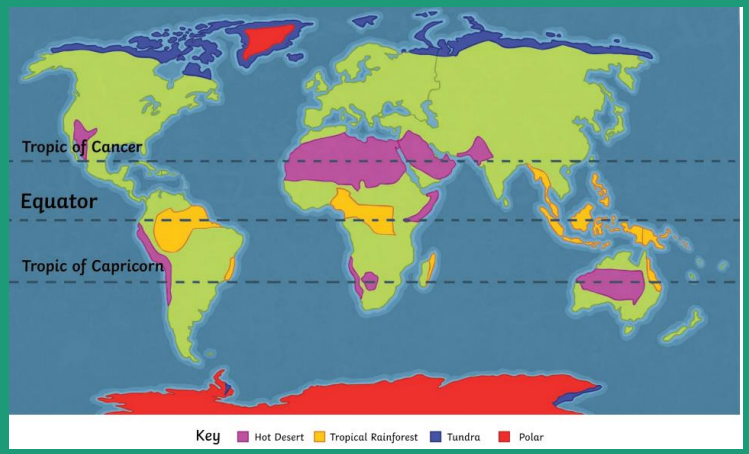
- Evening temperatures rarely fall below **22°C.**
- Most afternoons have heavy showers.
- At night with no clouds insulating, temperature drops.

Cold Environments

The Interdependence of Climate, Water, Soils, Plants, Animals and People

Climate, water, soil, plants, animals and people have a fragile and interdependent relationship (they depend on each other). For example:





Issues Relating to Biodiversity

- Cold environments have a very low species biodiversity (especially in Antarctica).
- Low biodiversity means changes to one species can easily impact other species e.g. if lichen does not grow one year, reindeer will starve.
- Global warming is affecting biodiversity in two ways:

1. Some species are migrating towards the poles. They may become predators of the original inhabitants e.g. the red fox is stronger than the native Arctic fox.
2. Species that are adapted to cold environments may lose their natural habitats. The lemming population is declining in some areas due to changing conditions in their snowy habitat. This also results in less food for the Arctic fox, a natural predator of lemmings.

The Value of Cold Environments and Why They Should Be Protected

- Tundra is very fragile; small changes will destroy plant and animal life. Plant growth is very slow; it takes a long time for Tundra to recover from any changes.
- Polar ice is melting. This provides hunting ground for predators (e.g. polar bears) which is being lost and these species face extinction.
- Melting polar ice causes sea levels to rise and can change the temperature of the oceans.
- Oil spills can destroy habitats and kill animals e.g. the Exxon Valdez oil tanker spilt between 257,000 to 750,000 barrels of oil when it ran aground in Alaska's Prince William Sound. Up to 250,000 seabirds, 2,800 sea otters, 300 seals and over 200 bald eagles were killed. The spill damaged over 1000 miles of Alaska's coastline.
- Tundra traps CO^2 in the permafrost. This is because the cold temperatures do not allow plants and animals to rot when they die, storing CO^2 in the ground. This CO^2 is released if the permafrost thaws, which could cause global warming.
- Tundra is a valuable wilderness area which should be conserved to protect the unique biodiversity found there.

Animal Adaptations

Animals adapt to find food and the harsh climate.

- Animals must be well insulated with a thick layer of blubber (e.g. seals). The musk ox keeps warm with its long, thick and hollow hairs which trap air close to the skin, insulating its body.
- Some animals huddle together to conserve heat (e.g. penguins) during the long winters.
- Many animals hibernate to survive the winter (e.g. Arctic ground squirrels line their burrows with insulators like musk ox hair, leaves, and lichens before winter. While they sleep, body temperatures drop to just above freezing, and breathing and heartbeat slows down to conserve energy).
- Some animals migrate to warmer areas in winter (e.g. caribou spend the summer months grazing in the tundra and migrate to warmer areas in winter.)
- Many animals are camouflaged to protect themselves from predators (e.g. Arctic hares are white to blend in to the snow.)

Plant Adaptations

- Plants adapt to cope with the low temperatures, rainfall and high winds.
- Plants are small and round to survive high winds.
- Plants become dormant (stop growing) to survive the dark and cold winters.
- Most plants have shallow roots because of the thin soil and permafrost.
- Small leaves reduce the amount of water lost through transpiration.
- Plants can only grow in temperatures above 6°C and adapt to the short growing season (50-60 days) during the summer when the sun shines 24 hours a day.
- During summer the soil may be water-logged so plants must adapt to survive.
- Plants reproduce by growing runners and bulbs, rather than seeds. This is due to the high winds and short growing season.

Strategies to Balance the Needs of Economic Development and Conservation

Cold environments need sustainable management strategies, which allow development but do not damage the area for future generations:

Use of Technology – modern building methods can reduce the impact on the environment e.g. building on piles or stilts to prevent buildings thawing the permafrost.

Role of Government – governments must regulate development to prevent irreversible damage to the environment e.g. Russian and Canadian Biodiversity Action Plans (BAP) are internationally recognised programmes which protect/restore threatened habitats.

Laws/Acts can protect wilderness areas, for example the 1964 Wilderness Act protects large areas of Alaska from development.

International Agreements – agreements between countries to protect our planet, for example:

- Antarctic Treaty (1959) prevents large cruise ships (over 500 passengers) and nuclear testing in Antarctica.
- Kyoto Protocol (2005) has been signed by most countries to reduce global warming. This is important for the protection of tundra as global warming threatens this fragile ecosystem.

Conservation Groups – campaign for the protection of fragile ecosystems. In November 2017, Greenpeace took the Norwegian government to court over their plans to open up new areas of the Arctic to oil drilling.