

What is an Ecosystem?

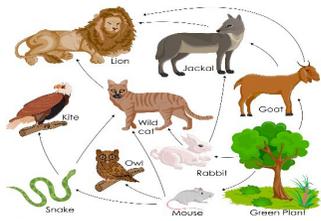
An ecosystem is a system in which organisms interact with each other and with their environment.

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.

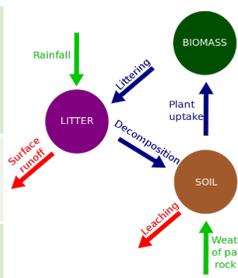


Food Web and Chains

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**.

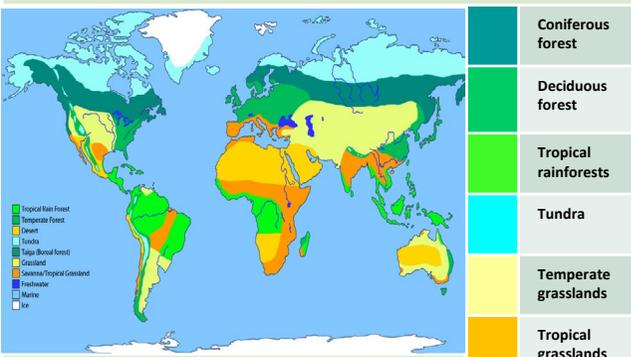


Litter This is the **surface layer** of vegetation, which over time breaks down to become **humus**.

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 (500-1500m /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.

Unit 1b



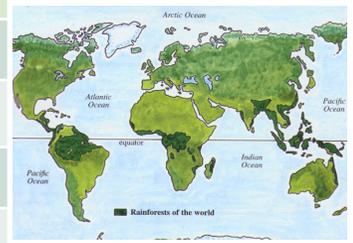
The Living World

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

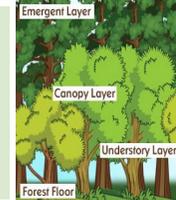


This is a typical English lowland deciduous woodland. **70% of the area** is designated as a **Site of Special Scientific Interest (SSI)** for its biological interest, with **66 %** designated as a **Special Area of Conservation (SAC)**.

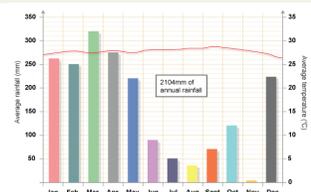
Components & Interrelationships

Season	Flora	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 .
Summer	Broad tree leaves grow quickly to maximise photosynthesis .	- Visitors pick fruit and berries, helping to disperse seeds . - Trees cut down to encourage new growth for timber .
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



Layer	Description
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 .



Adaptations to the rainforest		Rainforest inhabitants
Spider monkey	Long strong limbs allow it to move through canopy	Many tribes have developed sustainable ways of survival. The rainforest provides inhabitants with <ul style="list-style-type: none"> • Food through hunting and gathering. • Natural medicines from forest plants. • Homes and boats from forest wood.
Drip Tips	Allows heavy rain to run off leaves easily .	
Lianas & Vines	Climbs trees to reach sunlight at canopy.	

Issues related to biodiversity

What are the causes of deforestation?

Why are there high rates of biodiversity?	Logging	Agriculture
<ul style="list-style-type: none"> • 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. 	<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. 	<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.

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**.

For more information on Case studies see your Case Study booklet for:

- 1) **Epping Forest- UK small scale ecosystem**
- 2) **Amazon- Tropical rainforest**
- 3) **Alaska- Cold environment**

Cold Environments

Distribution of Cold Environments

All of the world's tundra is found in the northern hemisphere (Antarctica is polar ice). Tundra is found within the Arctic circle (66°N). Polar ice ecosystems are found near the north pole (90°N) and the south pole (90°S).

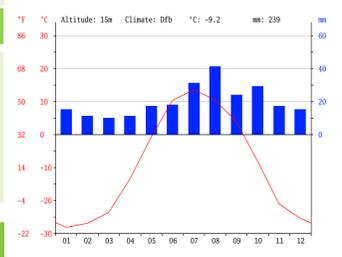


Major characteristics of Cold environments

Soil: Polar areas are covered in ice sheets. There is no soil. In tundra areas there is a thin layer of acidic soil that is not very fertile. Underneath that is a layer of sub-soil that remains frozen (permafrost).
Biodiversity issues: 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**.

Climate

Polar areas are very cold (never normally more than 0°C) with winters normally below -40°C. Tundra areas are cold. The summer maximum temperature is 10°C, and the winter temperature can reach -50°C. Clear seasons
 Rainfall is low. Less than 100mm in polar areas and less than 380mm in tundra areas. Precipitation is mainly snowfall.

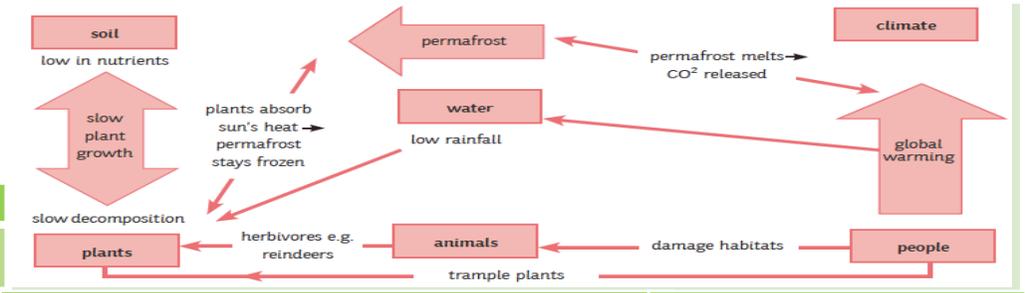


Adaptations to Cold environments

Plants e.g. Bearberry, mosses & lichens
 Plants are small and round to survive high winds. Plants become dormant (stop growing) to survive the dark and cold winters.

Animals e.g. polar bears, penguins & whales
 Some animals huddle together to conserve heat (e.g. penguins) during the long winters. Animals must be well insulated and so many have a thick layer of blubber to keep warm e.g. seals and whales.

Cold environments Interdependence



Threats	Sustainable solutions
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- Due to climate change, 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.
- 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. Tundra traps CO² in the permafrost. This is because the cold temperatures do not allow plants and animals to rot when they die, storing CO² in the ground. This CO² is released if the permafrost thaws, which could cause global warming.
- Oil spills can destroy habitats and kill animals e.g. the Exxon Valdez oil tanker spill between 257,000 to 750,000 barrels of oil 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

- Cold environments need sustainable management strategies, which allow development but do not damage the area for future generations:
- 1) **Use of Technology:** modern building methods can reduce the impact on the environment e.g. building on stilts prevents thawing of permafrost
 - 2) **Role of Government:** can regulate development to prevent irreversible damage.
 - 3) **International agreements:** E.g. Antarctic Treaty (1959) prevents large cruise ships and nuclear testing.
 - 4) **Conservation groups:** Campaign for the protection of fragile ecosystems e.g. Greenpeace against oil drilling in Arctic.