

What is an Ecosystem?

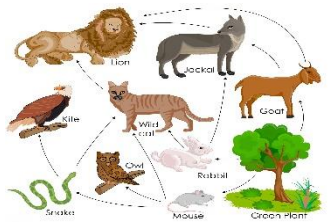
An ecosystem is a system in which organisms interact with each other and with their environment.

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. |

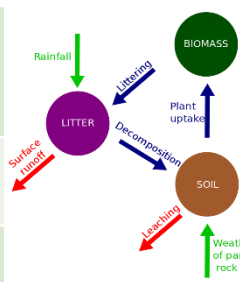


Food Web and Chains

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**.

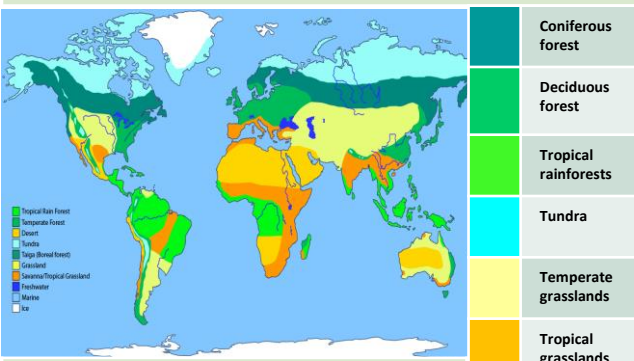


Litter This is the **surface layer** of vegetation, which over time breaks down to become **humus**.

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)**.

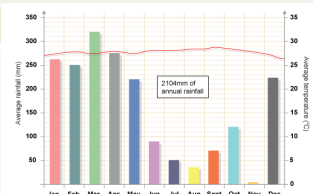
Components & Interrelationships

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

Layers of the Rainforest



| Layer | Description |
|--------------------|--|
| 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 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 | | Rainforest inhabitants |
|-------------------------------|---|---|
| Orangutans | Large arms to swing & support in the tree 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

| Why are there high rates of biodiversity? | What are the causes of deforestation? |
|--|---|
| <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. | <p>Logging </p> <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. <p>Agriculture </p> <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 | Mineral Extraction | Tourism |
|--|--|--|
| <ul style="list-style-type: none"> • 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. | <p></p> <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. | <p></p> <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. |

| Impacts of deforestation | Economic development | Energy Development | Road Building |
|--------------------------|---|--|---|
| | <p></p> <ul style="list-style-type: none"> + 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. | <p></p> <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. | <p></p> <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. |


| Soil erosion | Sustainability for the Rainforest |
|---|---|
| <p></p> <ul style="list-style-type: none"> - 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. | <p>Uncontrolled and unchecked exploitation can cause irreversible damage such as loss of biodiversity, soil erosion and climate change.</p> <p>Possible strategies include:</p> <ul style="list-style-type: none"> • 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 |


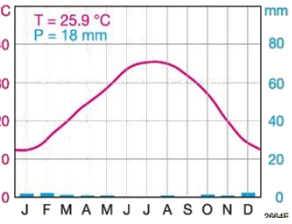
| Climate Change |
|--|
| <p></p> <ul style="list-style-type: none"> -When rainforests are cut down, the climate becomes drier. -Trees are carbon 'sinks'. With greater deforestation comes more greenhouse emissions in the atmosphere. -When trees are burnt, they release more carbon in the atmosphere. This will enhance the greenhouse effect. |

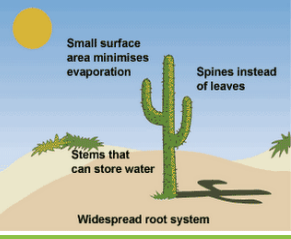

Hot Desert: Case Study Thar Desert – India/Pakistan



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 | Major characteristics of hot deserts |
|---|---|
| <p>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 worlds major deserts.</p>  | <ul style="list-style-type: none"> • 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. |

| Hot Deserts inhabitants | Climate of Hot Deserts |
|---|---|
| <ul style="list-style-type: none"> - 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. | <p></p> <p>Climate of Hot Deserts</p> <ul style="list-style-type: none"> • Very little rainfall with less than 250 mm per year. • It might only rain once every two to three years. • Temperate 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 | Desert Interdependence |
|--|---|
| <p></p> <p>Cactus</p> <ul style="list-style-type: none"> • Large roots to absorb water soon after rainfall. • Needles instead of leaves to reduce surface area and therefore transpiration. <p>Camels</p> <ul style="list-style-type: none"> • Hump for storing fat (NOT water). • Wide feet for walking on sand. • Long eyelashes to protect from sand. | <p>Different parts of the hot desert ecosystem are closely linked together and depend on each other, especially in such a harsh environment.</p>  |

| Opportunities and challenges in the Hot desert | |
|--|---|
| Opportunities | Challenges |
| <ul style="list-style-type: none"> • 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 Bhali. • Thar desert has attracted tourists, especially during festivals. | <ul style="list-style-type: none"> • 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 | | Strategies to reduce Desertification |
|---|--|--|
| <p>Desertification means the turning of semi-arid areas (or drylands) into deserts.</p> | <p>Climate Change</p> <p>Reduce rainfall and rising temperatures have meant less water for plants.</p> | <ul style="list-style-type: none"> • 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. |
| <p>Fuel Wood</p> <p>People rely on wood for fuel. This removal of trees causes the soil to be exposed.</p> | <p>Overgrazing</p> <p>Too many animals mean plants are eaten faster than they can grow back. Causing soil erosion.</p> | |
| <p>Over-Cultivation</p> <p>If crops are grown in the same areas too often, nutrients in the soil will be used up causing soil erosion.</p> | <p>Population Growth</p> <p>A growing population puts pressure on the land leading to more deforestation, overgrazing and over-cultivation.</p> | |