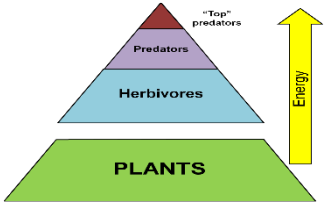
What is an Ecosystem?

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	**Plant life** occurring in a particular region or time.
Fauna	**Animal life** of any particular region or time.



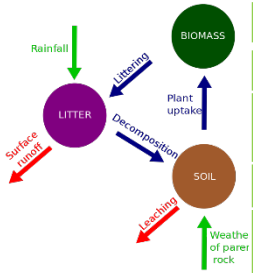
Food Chains

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

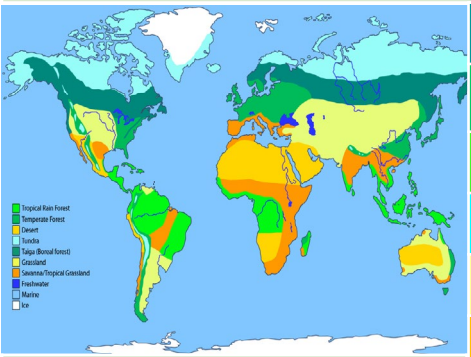
Plants take in those nutrients where they are built into new organic matter. Nutrients are taken up when animals eat plants and then returned to the soil when animals die and the body is broken down by decomposers.

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

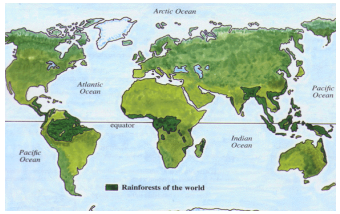
A biome is a large geographical area of distinctive plant and animal groups, which are adapted to that particular environment. The climate and geography of a region determines what type of biome can exist in that region.



Coniferous forest
Deciduous forest
Tropical rainforests
Tundra
Temperate grasslands
Tropical grasslands
Hot deserts.

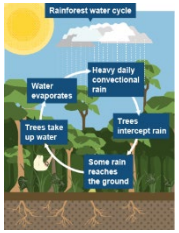
The most productive biomes – which have the greatest biomass- grow in climates that are hot and wet.

Tropical Rainforest Biome



Distribution of Tropical Rainforests

Tropical rainforests are centred along the Equator between the Tropic of Cancer and Capricorn. 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.



Convectional rainfall

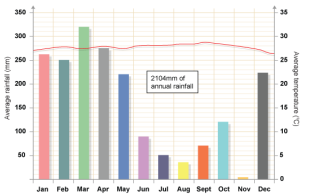
1	The roots of plants take up water from the ground and the rain is **intercepted** as it falls.
2	As the rainforest heats up, the water evaporates into the atmosphere.
3	Finally, the water condenses and forms clouds to make the next day's rain.

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



Topic 4

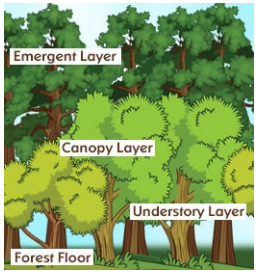
Sustaining Ecosystems

Interdependence in the rainforest

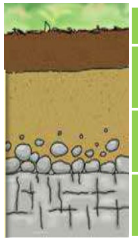
A rainforest works through interdependence. This is where the plants and animals depend on each other for survival.

Layers of the Rainforest

Emergent	Highest layer with tree reaching 50 metres.
Canopy	Most life is found here as It receives high level of rainfall and sunlight.
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
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.

Tropical Rainforest Biome

Adaptations to the rainforest

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.

Rainforest inhabitants

Many tribes have developed sustainable ways of survival, such as shifting cultivation.
The forest provides inhabitants with…

- Food through hunting and gathering.
- Natural medicines from forest plants.
- Homes and boats from forest wood.

Effects of Human Activity on the Rainforest

Logging

- 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.

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.
- Has caused negative relationships between the government and tribes
- Tourism has affected wildlife (apes) by exposing them to human diseases.

Benefits of the rainforest

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 Costa Rica

Location & Background

Costa Rica is a small country in Central America.
It is home to 6% of the world's biodiversity.
The country attracts 6 million tourists a year.

Ecotourism

Ecotourism is tourism that is directed towards the natural environments & conservation. Monteverde is a popular ecotourism destination in the country.

Advantages

- 80 new businesses have open in Monteverde.
- 400 full-time and 140 part-time jobs directly related to tourism in Monteverde.

Disadvantages

- Land prices have increased.
- Deforestation to clear areas for tourism industry.

Threats to the Costa Rican Rainforest

- 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 1990, 32,000 hectors of forest were cut down each year – devastating the fragile ecosystem.

Rainforest Management

- Government created 28 National Parks with 24% of the country's land protect.
- Laws and enforcement meant that deforestation had fallen from 1.8 to almost zero by 2005.
- Agroforestry encourages growing trees and crops together to create better farming conditions.
- Afforestation has led to the replanting of trees to replace original forest that have been lost.

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.

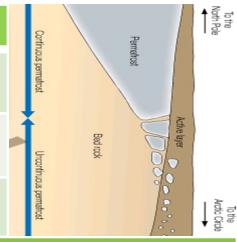
Flora (Plants)	Fauna (Animals)
There are very few plants in polar areas – some lichens, mosses and grasses along the coastal areas.	Relatively few species of animals. Polar Bears, Penguins and marine mammals like whales, seals and walrus are examples.

Climate Change on Polar Regions

Scientific reports outline the effect global warming is having on these regions. Ice sheets and glaciers are melting at an alarming rate leading to fears of rising sea levels. Thawing of permafrost is increasing methane emissions and the decline of Arctic ice is creating waves that are capable of causing unseen coastal erosion.

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

- Arctic holds a large amount of untapped oil and gas.
- Oil spills would threaten ecosystems as clean up operations would be slow.

Whaling

- 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

- 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 might damage ecosystems.

Tourism

- The tourism industry is steadily growing within polar regions.
- Travel by tourists have increase emissions further.
- Wildlife may become disturbed by tourists getting up close.

Case Study: Small Scale Sustainable Management: Union Glacier, Antarctica

Location & Background

Located in the southern Ellsworth Mountains and is a key logistic hub for expeditions and research.

Features and Activities

- The locations has good facilities such as a dining room, electricity supply and transport.
- Tourists and can enjoy several activities such as ski tours, wildlife viewing and mountaineering.

Sustainable Management

- 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.

Case Study: Global Scale Sustainable Management: The Antarctic Treaty System

Background

Signed by 50 nations in 1961, the Treaty sets aside Antarctica as a scientific reserve, establishes freedom of scientific investigation and bans military activity.

Basic Principles of the Antarctic Treaty

- 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.

Successful?

Stayed in place for 50 years with more countries signing up to enforce strict controls and improve its stability.