

# Paper 1 - Section B – The living world – Ecosystems

## What is an ecosystem?

An ecosystem is a natural system made up of plants, animals and the environment.

- **Biotic** – These are the living parts of the ecosystem. E.g. Plants and animals
- **Abiotic** – These are the non-living parts of the ecosystem. E.g. Soil and water (environment)

Ecosystems can be any size.

- Local E.g. a pond or under a dead log. Also called a habitat.
- Global e.g. tropical rainforest. Also called biomes.

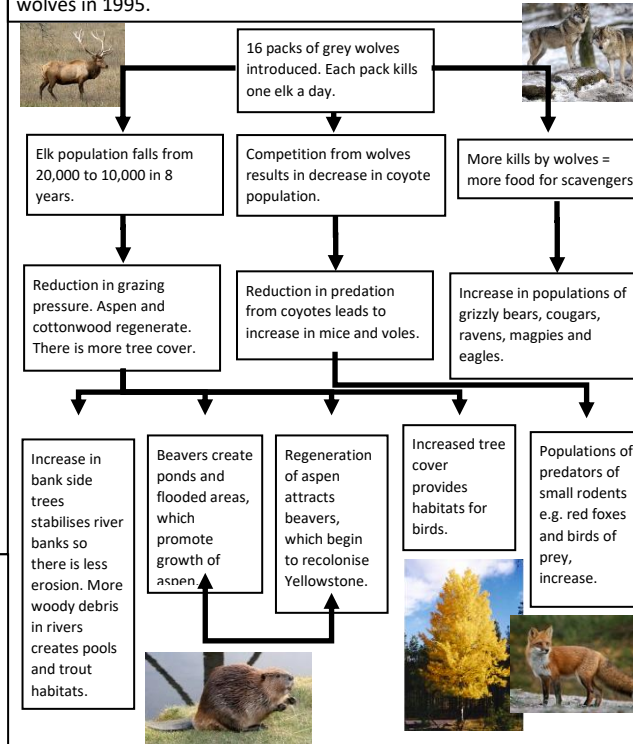
## Parts of the ecosystem.

All ecosystems are able to pass energy through one another.

Trophic Level	Source of Energy	Examples
Producers	Solar energy	Green plants, photosynthetic protists and bacteria
Herbivores	Producers	Grasshoppers, water fleas, antelope, termites
Primary Carnivores	Herbivores	Wolves, spiders, some snakes, warblers
Secondary Carnivores	Primary carnivores	Killer whales, tuna, falcons
Omnivores	Several trophic levels	Humans, rats, opossums, bears, racoons, crabs
Detritivores and Decomposers	Wastes and dead bodies of other organisms	Fungi, many bacteria, earthworms, vultures

At each (trophic) level of the food chain the number of individuals declines. This is because not all individuals in any trophic level are consumed (eaten). This means not all energy is passed up to the next trophic level.

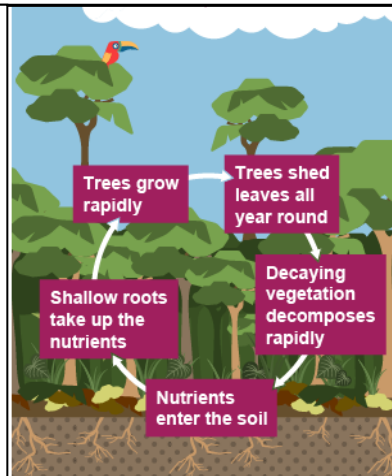
If any component within an ecosystem is changed it will have a knock-on effect on the rest of the ecosystem. An example of where this happened was in Yellowstone National Park in the USA when they reintroduced wolves in 1995.



## Nutrient Cycle

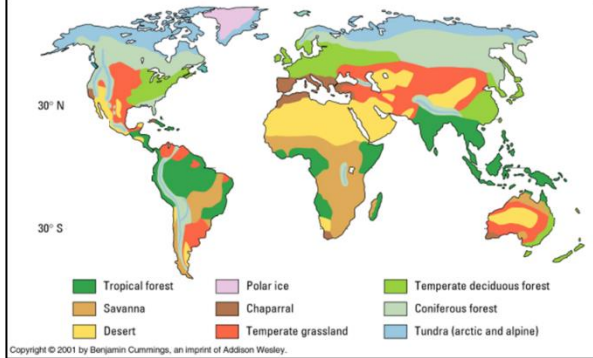
Nutrients are foods that are used by plants and animals to grow.

When plants or animals die, decomposers help them recycle the nutrients so they can be used again.



A large-scale ecosystem is called a Biome. Different Biomes are found in belts across the world. This is due to different climate characteristics due to global atmosphere circulation.

## Biomes



Biome	Key Characteristics
Tropical Rainforests	•Along equator (Asia, Africa / South America). •6% of earth's surface. •25°C – 30°C and over 250mm rain per month.
Tropical Grasslands (Savanna)	•Between equator and tropics. •20 – 30°C and between 500 - 1500 mm of rain per year. •Wet and dry seasons.
Deserts	•Tropics (Sahara and Australia). •Over 30°C and less than 300 mm per year rain. •20% of land's surface.
Deciduous forests	•Higher latitudes (W Europe, N America, New Zealand). •5 – 20°C and between 500 – 1500 mm rain per year. •4 distinct seasons. •Lose leaves in the winter to cope with the cold.
Coniferous forest (Taiga)	•60°N (Scandinavia / Canada). •Cone bearing evergreen trees. •No sunlight for part of the year.
Tundra	•Above 60°N (Arctic Circle). •Less than 10°C and less than 500mm per year rain. •Cold, icy and dry means 2 month growing season.

## A small-scale ecosystem – Epping Forest, London

Epping forest is a 2400 hectare area of ancient wood land found in the North East of London.

In Epping Forest more cattle grazing has been introduced into the ecosystem (ecosystem restoration) to encourage growth of flora (vegetation) such as trees (e.g. oak) as these declined from 1976-1988 due to extreme weather causing drought. The oak is eaten by animals, increasing or maintaining the number of species in the forest.

Grazing allows more flowers to flourish than mowing the grass would. Low-growing species such as Birds-foot Trefoil only thrive where the dead grass stems regularly removed (by cows) and hooves create bare ground. This also grown the sparrow hawk population due to the increase in prey.

# Paper 1 - Section B – The living world – Tropical Rainforests

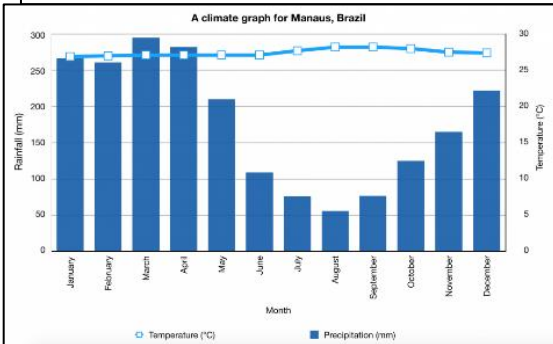


## Tropical rainforest Locations

Tropical Rainforest are found along the equator due to the higher heat and rainfall that is found along here (Global atmospheric circulation).

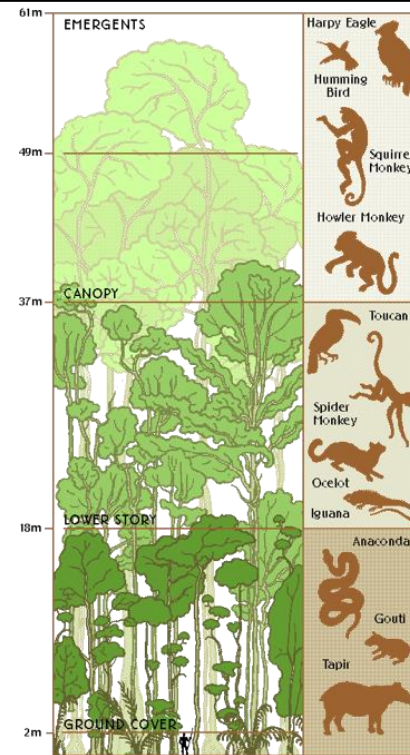
## Tropical rainforest climate

As a result, they have a high temperature (ranging from 20-30°C) and a high amount of rainfall (over 2000mm) all year round. This is known as a humid climate. This means that rainforests only have 1 season per year.



## Plant adaptations

- Up to 75% of light is lost from on the lowest layer due to dense vegetation. Competition for light causes trees to grow fast, tall and straight. **Buttress roots** support these tall trees by growing above the ground to offer additional support.
- Plants on the forest floor are shade tolerant and able to cope in the darker conditions. The Fan palm also has a large leaves to increase its ability to photosynthesise.
- Lianas** wrap themselves around other trees to gain access to light. This allows them to grow towards the sunlight quicker and helps them survive.
- Plants have **drip tips** which gets rid of access water.



## Animal adaptations

- Spider monkeys** have a prehensile tail that allows them to cling to branches and offer better balance.
- Poison dart frogs** are a bright colour to warn predators away. This prevents them from being eaten.
- Jaguars** have spotted fur. This camouflages them the forest floor and allows them to better hunt prey.
- The **harpy eagle** has a shorter than normal wingspan that allows them to easier fly between the trees in the rainforest.
- Insects like the **leaf butterfly** use mimicry to blend into their surroundings and hide from predators.

## Interdependence of climate, water, soils, plants, animals

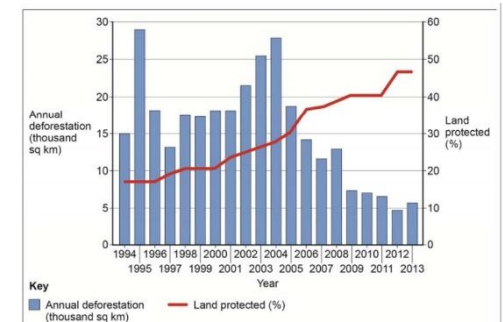
Small changes to biotic and abiotic factors can have serious knock on effects

- Biomass is the largest nutrient store and the biggest transfer is from soil to biomass
- Fertility s quickly lost from the soil if trees are cut down
- Poor soils due to leaching (the washing away of nutrients)
- Thick litter layer. Rapidly breaks down due to climate
- Warm humid climate means rapid plant growth

## Deforestation

Deforestation is the large scale cutting down of trees.

The rate of deforestation around the world is slowly decreasing. But some countries, like Indonesia, have increased in recent years.



# Paper 1 - Section B – The living world – Tropical Rainforests

## The Amazon rainforest

The Amazon is found in South America and is spread across 9 different countries (the largest amount being found in Brazil).

1 in 10 species on the planet is found in the Amazon rainforest

## Impacts of deforestation

### Economic development

- Brings in jobs and income
- Destroys resources in the long term
- Livelihoods of locals destroyed
- 2008 \$6.9 billion from cattle
- Rubber tappers lost jobs
- Mercury from gold mining poisons fish

### Soil erosion

- Land left unprotected from heavy rain leads to landslides and flooding
- Nutrients are washed away decreasing nutrients in the soil
- Rivers silt up

### Contribution to climate change

- Trees cut down change the water cycle and make it drier and warmer
- Rainforests are the lungs of the earth (the amazon produces 20% of the worlds oxygen) and so when deforested there is ore carbon dioxide in the air and less oxygen. Burning also releases carbon to the air (Greenhouse effect)

### Others

- Loss of biodiversity - 137 species a day
- Loss of indigenous tribes (90 since 1990)
- Tribal people moving to towns and cities and have drugs and alcohol issues. Loss of indigenous knowledge
- Conflicts between developers and indigenous people

Causes of deforestation	Definition and facts
Commercial farming	Farming (Cattle and crops) to sell produce for a profit (\$6.8 billion made from cattle farming in 2008) Causes 80%+ of all deforestation in the amazon rainforest as people cut down trees to make space to graze cows.
Logging	The business of cutting down trees and transporting the logs to sawmills. Selective logging and clear felling. Teak and Mahogany worth the most
Mineral extraction	The removal of mineral resources from the earth. Gold, Bauxite, Oil and gas. Pollutes rivers and air Today, around 50,000 hectares of land are used for gold mining.
Subsistence farming	A type of agriculture producing food and materials for the benefit only of the farmer and his family
Road Building	Rainforest is cut down to make way for roads. 4000km long Trans Amazonia Highway built 1970s. Opened up rainforest
Energy Development	Vast areas of the rainforest are cut down to make way for Hydroelectric power stations The Balbina dam flooded 930miles <sup>2</sup> once fully built.
Settlements	Government resettled poor citizens and gave them land. Trees are cut down to make space for this.

## Importance of the rainforest

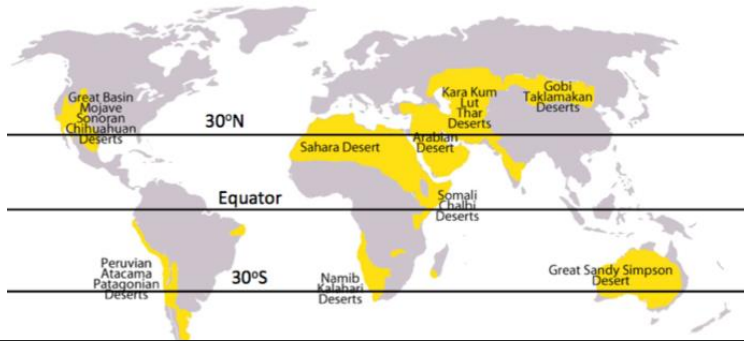
The Tropical rainforest is important for the following reasons

- **Medicine** : Around 25% of all medicines come from rainforest plants
- **People** : Indigenous (people who have always lived in an area) people live in harmony with the rainforest. This is their home.
- **Biodiversity** : Tropical rainforests contain half all the plants and animals in the world.

## Sustainable management of the tropical rainforest

STRATEGY	KEY FACTS
<b>Selective logging and replanting</b>	<ul style="list-style-type: none"> <li>• Only fell fully grown trees on 30 – 40-year cycle</li> <li>• Replanting – collect seeds from primary forest; grow in nurseries and replant</li> <li>• Forest Stewardship Council (FSC) – Shows the trees have come from a source where they are replanted meaning you do not lose the overall amount.</li> </ul>
<b>Conservation and education</b>	<ul style="list-style-type: none"> <li>• Education of local's key – less likely to cut down trees if they know the importance.</li> <li>• Conservation - The Tumucuwobi national park is 3 million Km<sup>2</sup> of protected land where deforestation cannot take place.</li> </ul>
<b>Ecotourism</b>	<ul style="list-style-type: none"> <li>• Minimises damage to environment and benefits locals</li> <li>• Small visitor numbers</li> <li>• Waste and litter disposed of properly</li> <li>• Locals employed so get paid via tourism rather than to cut down trees.</li> </ul>
<b>International agreements about use of tropical hardwoods</b>	<ul style="list-style-type: none"> <li>• International Tropical Trade Agreement 2006 and 2011 – restricts trade in hardwood from rainforests</li> <li>• Needs to be felled from sustainably managed areas and stamped with registration numbers</li> </ul>
<b>Debt reduction</b>	<ul style="list-style-type: none"> <li>• Debt for nature swaps – in 2010 USA converted debt of \$13.5 million from Brazil and used the funds to protect the rainforest</li> <li>• HICs wipe off debts of LICs to protect the rainforest.</li> </ul>

# Paper 1 - Section B – The living world – Hot Deserts



## Hot Deserts Locations

Hot Deserts are mostly found in dry continental interiors, away from the coasts and in a belt that is approximately 30°N (tropical of cancer) and 30°S (tropic of Capricorn) of the equator. The world's biggest hot desert is the Sahara and our case study example is the **Thar Desert**

## Hot Desert climates

Hot Deserts are areas that receive less than 250mm of water per year. The resulting dryness is known as an arid environment and is the main factor for life in hot deserts. This dryness is caused by high pressure (descend air) that contains little to no moisture. The temperature can be as hot as 40°C and as low as 0°C at night (due to no cloud cover)

## Plant adaptations

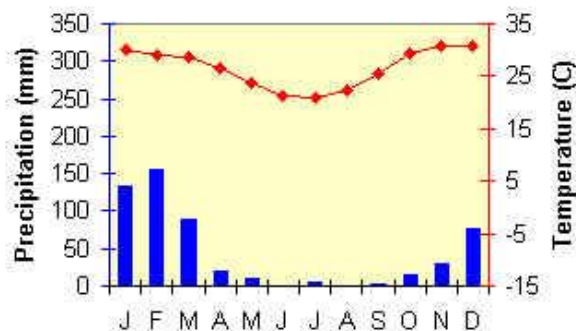
- Due to the lack of water many plants have learnt to store water in their roots, stems and leaves. These are known as **succulents**.
- **Cacti** are well adapted to living in hot deserts. They can have deep roots (7-10m) that allow them to collect water from underground sources.
- They also have spikes which help prevent trans-evaporation (loss of water) due to their small surface area.
- The **Joshua tree** is another well suited desert plant. It has shallow roots that spread out over a wide distance to quickly absorb any water that gets into soil after small amounts of rain.
- It also has waxy leaves to reduce water loss.



## Animal adaptations

- **Camels** have a hump on their back which stores fat. This supplies it with energy as it can as food can often be hard to find in deserts.
- **Camels** feet are wide so they can walk on sand more easily. Their huge feet help them to walk on sand without sinking into it.
- **Camels** have thick lips so they can eat the prickly desert plants without feeling pain. This allows them to access the water stored within these succulents.
- The **Fennec fox** has large ears that help get rid of excess body heat on hot days in the desert, keeping it cooler.
- They are nocturnal (they are awake at night) as it is not as hot making it easier to hunt.

## Daly Waters, Australia



## The interdependence of desert climate, water, soils, plants, animals and people.

- People are dependent upon their animals in deserts, for food, milk and as use as pack animals.
- Plants rely upon soils for their nutrients, the soils rely upon plants to provide extra nutrients through dead vegetation and fixing chemicals from the air into the soil.
- Plants also help soils retain more water, by providing shade from the searing desert sunlight.
- Plants also tie the soil together, preventing soil erosion and excessive leaching of nutrients in wetter periods.

## Desert soils –

- Tend to be sandy or stony with little organic (living) matter due to the lack of leafy vegetation.
- The soil is often very dry but can rapidly soak up water when it rains.
- This then leads to evaporation which draws up salts to the surface.
- This then makes it even harder for anything to grow.
- Desert soils are not fertile.

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## The Thar Desert – Location

The Thar Desert is found in south Asia between Pakistan and India. It is one of the major hot deserts of the world with the highest population density.

## Development opportunities

Despite having an extreme climate, the Thar Desert can provide development opportunities. These include:

- **Mining** - The desert has valuable reserves of minerals such as Gypsum and phosphorite. This produce income for people who work here and money for people selling these items.
- **Energy generation** - The Jaisalmer Wind farm is the largest in India. It has 75 wind turbines that produce 60MW of Energy. This provides electricity for people in the local towns or cities who are now able to work in more factories and have a better quality of life.
- **Farming** - irrigation in the Thar Desert has allowed crops such as wheat and cotton has created many jobs and generated income for the local economy.
- **Tourism** - the Thar Desert National Park attracts many visitors who explore the desert with local guides on camels. Tourism is an important source of income and creates many jobs for local people.

## Challenges of development

Development in the Thar Desert includes many challenges such as:

- **Extreme temperatures** - Temperatures in the Thar Desert can exceed 50°C in the summer months. It is hard for people to farm, work in mines or as tourist guides during these months as it is simply too hot. This makes development difficult.
- **Water supply** - the supply of water to the Thar Desert is limited, with only 120-240 mm of rain falling per year. Without water the development of mining, farming and tourism and therefore the economy would not be possible.
- **Inaccessibility** - the desert covers a huge area of 200,000 sq km. Most of the desert is inaccessible due to the extreme environmental conditions (sand blowing overcovering roads) and poor **infrastructure**. Beyond the city of Jaisalmer, development is limited.

## What is Desertification –

Desertification is when the land slowly becomes unusable. This is often found on the fringes of deserts and is a major worldwide **environmental problem**. A good example can be found in the Sahel region of Africa.

## Causes of desertification -

- **Removal of wood** - In developing countries, people use wood for cooking. When the land is cleared of trees, the roots of the trees no longer hold the soil together. Wind or rain than removes the soil (**soil erosion**).
- **Overgrazing** - An increasing population results in larger desert areas being farmed. Sheep, cattle and goats are overgrazing the vegetation and eat all the roots. This leaves the soil exposed to **soil erosion** as there is nothing holding the soil together.
- **Population growth** - The population in some desert areas is increasing. An increased population means more removal of wood and larger areas being farmed to feed all the people.
- **Climate change** - The global climate is getting warmer. In desert regions conditions are not only getting warmer but drier too. This causes more vegetation to die which leads to the soil being exposed and soil erosion occurring.

**All of the above points lead to desertification as without soil, the land cannot be used.**

## Strategies to reduce desertification -

- **Planting trees** – **The great green wall of Africa** is a project that is planting trees in 11 countries along an 8000km strip. This is to allow the roots to bind the soil together and prevent soil erosion.
- **Soil management** – **Crop rotation** is when you plant different crops every year. This allows the soil to get back the nutrients lost when growing the crop. This allows the soil to stay alive which reduces vegetation dying.
- **Appropriate technology** – **'Magic Stones'** are used in Burkina Faso. Lines of stones are used in fields to reduce soil erosion by trapping any soil that may have been washed or blown away. This allows the soil to used again and again.