Geography
Paper 1

Revision resources

Year 11 Geography EDEXCEL A GCSE Topics

Paper 1: The Physical Environment (Tuesday 22/05/18)

- Topic 1 - The changing landscapes of the UK
    - Coastal landscapes and processes
    - River landscapes and processes
- Topic 2 - Weather, hazards and climate Change
- Topic 3 - Ecosystems, biodiversity and management

Paper 2: The Human Environment (Tuesday 05/06/18)

- Topic 4 - Changing cities
    - The study of a major city Birmingham
    - The study of a major city Sao Paulo
- Topic 5 - Global development
- Topic 6 - Resource management
    - Water resource management

Paper 3: Geographical Investigations: Fieldwork and UK Challenges (Monday 11/06/18)

- Topic 7: Geographical investigations - fieldwork
    - Physical Environments - Coasts
    - Human Environments - Urban
- Topic 8: Geographical investigations - UK challenges

Link to specification and exam board website:
https://qualifications.pearson.com/en/qualifications/edexcel-gcses/geography-a-2016.html

The Physical Environment - Coasts

Key Terms

Composition: what a material is made up of

Crystals: a solid material that is arranged in a regular form with definite lines of symmetry

Fossils: the remains of prehistoric organisms, such as a fish skeleton or leaf

Geology: the science that deals with the physical structure of the earth, its history and how it changes

Resistant: strong rocks which can withstand weathering and erosion

Texture: the feel and appearance of material

Alluvium: a river deposit of clay, silt and sand

Backwash: the movement of a wave back down the beach

Coastal flooding: the inundation of land close to the sea water

Coastal recession: the gradual movement backwards of the coastline, which is dividing line between the land and the sea

Dynamic landform: a landform that is changing

Fetch: the distance over which the wind blows over open water

Hard engineering: the method of coastal management involves major construction work, for example sea walls

Seasonality: a pattern of change in the UK's weather between spring, summer, autumn and winter

Soft engineering: this method of coastal management works or attempts to work with the natural processes occurring on the coastline, for example beach nourishment

Swash: the forward movement of a wave

River landscapes and Processes

Key terms

Channel shape: the width and depth of a river

Confluence: the place where two rivers meet

Discharge: the amount of water passing a specific point at a given time, measured in cubic meters per second

Long profile: a slice through the river from source to mouth that shows the changes in height of the rivers course

Mouth: where the river ends, either when it joins another river or meets the sea

Source: the start of a river

Valley profile: a slice across the river showing the changes in height across the valley

Velocity: the speed of the river

Volume: the amount of water in the river

Human causes: any occurrence that is created by humans

Interception: when trees stop precipitation hitting the ground surface

Physical causes: any occurrence that is natural

Throughflow: when water travels through soil towards a river

Urbanisation: the increase in the number of people living in towns and cities compared to the number living in the countryside

Hard engineering: the method of river management, involves major construction work eg Dams

Hydrograph: a graph showing rainfall and river discharge over a specific period of time

Soft engineering; the method of river management works or attempts to work with the natural processes occurring. Tend to be unobtrusive and do not involve major construction work eg washlands.

Coastal Processes

Waves

Coastal landscapes are shaped by waves.

Destructive waves have a high frequency, and their backwash is stronger than their swash. This results in erosion and the removal of coastal material.

Constructive waves have a low frequency, and their swash is stronger than their backwash. This results in deposition and the build-up of coasts.

Weathering

Weathering involves the breakdown of rocks in situ (in their original place).

Mechanical Weathering

Mechanical weathering breaks down rock without altering its chemical composition.

Example: Freeze-thaw weathering

1. Water enters cracks in the rock.
2. The water freezes and expands, putting pressure on the rock.
3. The ice thaws, releasing pressure.
4. Repeated freezing and thawing causes the rock to break apart.

Chemical Weathering

Chemical weathering breaks down rock by altering its chemical composition.

Example: Hydrolysis

1. Some rocks react to water because of the minerals they contain.
2. Minerals react with the acids in water, making new chemical compounds.
3. These chemical compounds break down the rock over time.

For example, feldspar in granite reacts with water to form clay.

Mass Movement

Mass movement is the downward movement of rock, mud or soil due to gravity. It typically occurs when a lot of water is present – for example, after heavy rainfall.

Sliding

Material slides quickly downwards in a relatively straight line.

Slumping

Material slides with a rotation over a curved slip plane.

Rock Fall

Rocks break apart and fall, often as a result of freeze-thaw weathering.

Erosion

Coastal erosion is the removal of sediment and rocks by waves. There are three main types:

Hydraulic Power

As waves crash against a cliff, air trapped in the cliff's cracks is compressed. The repeated force of pressure and release widens the cracks and breaks the rock apart.

Abrasion

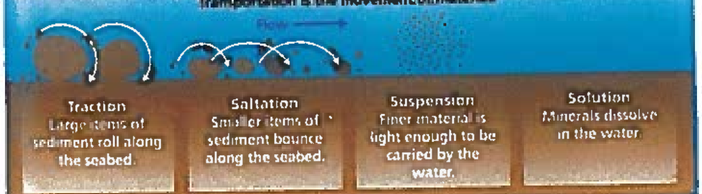
Sand, shingle and sediment are hurled against rocks by breaking waves. The rock is eventually worn down by this repeated rubbing and scraping.

Attrition

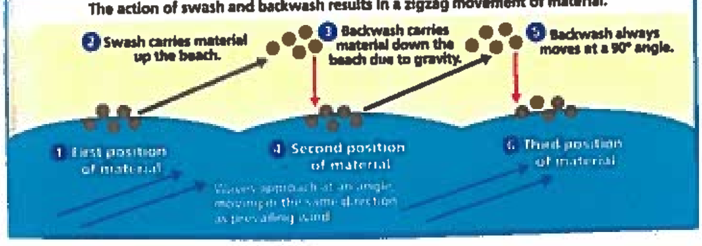
Rocks and boulders transported by waves collide and break up into smaller pieces. This wears them down into smaller and more rounded fragments over time.

Transportation

Transportation is the movement of material.



Longshore drift is a process that gradually moves beach material along the coast. The action of swash and backwash results in a zigzag movement of material.



Deposition

Deposition occurs when the sea loses energy and drops eroded material. It is most likely to happen when:

- There are low energy waves with a weak backwash
- Waves enter sheltered areas such as bays
- Longshore drift is interrupted by structures such as groynes
- There is little wind
- Tidal water becomes trapped by spits

Beaches are formed when the level of deposition is greater than the level of erosion. Waves that deposit more material than they erode are known as constructive waves.

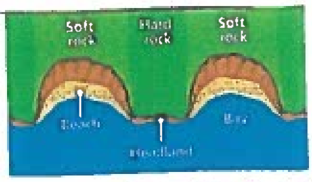
Coastal Landforms

Headlands and Bays

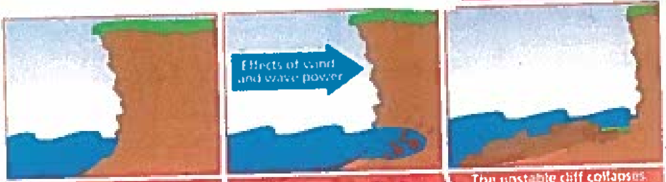
Headlands and bays form where there are alternating bands of soft and hard rock.

A discordant coastline is one where bands of soft and hard rock run at right angles to the coast, so the rocks erode at different rates. The protruding bands of isolated rock are called headlands.

The formation of headlands and bays can take thousands of years.



Wave-Cut Platforms



Waves and rocks crash against the foot of a cliff face.

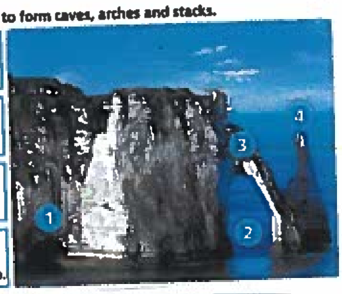
The base of the cliff is eroded away, leaving a wave-cut notch.

The unstable cliff collapses. With repeated erosion, the cliff retreats to form a wave-cut platform.

Caves, Arches and Stacks

Headlands are gradually eroded to form caves, arches and stacks.

1. Waves crash repeatedly into the headland, causing faults and joints to erode and develop into cracks and small caves.
2. Constant erosion causes the caves to get bigger until their back walls are eroded away completely, creating natural arches.
3. The arches widen as more rock is eroded away through weathering.
4. The arches eventually collapse, leaving an isolated pillar known as a stack. Further erosion of the stack will leave a shorter stump.



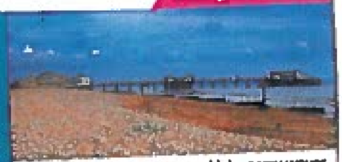
Beaches

Beaches are the areas found between high and low tide marks. Generally formed from sand or shingle, they are the most common features of deposition found on coasts.

Sandy Beaches

- These occur where there are constructive waves.
- The swash (water moving up the beach) is stronger than the backwash (water moving back down the beach) so sediment builds up on the beach.
- Small sand particles are easily carried back down the beach by the backwash so the beaches are long and shallow.

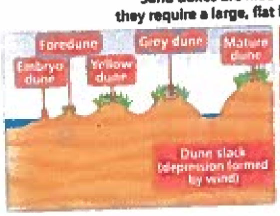
Shingle Beaches



- These occur where there are high energy waves.
- The backwash is stronger than the swash so smaller sand particles are washed away, leaving larger sediment on the beach.
- The weak swash does not move the sediment far up the beach. This creates short and steep beaches.

Sand Dunes

Sand dunes are mounds of sand that are found behind sandy beaches. To form, they require a large, flat beach, a good supply of sand, strong winds and obstacles.



1. Sand is deposited by longshore drift and blown to the top of the beach by onshore winds.
2. Obstacles, such as driftwood, block sand movement, causing deposits to build over time.
3. Vegetation (e.g. marram grass) helps to stabilise and bind the sand together, creating small embryo dunes.
4. Over time, the dune migrates inland.

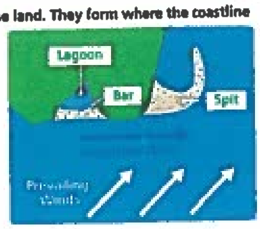
Bars and Spits

Spits are long stretches of sand or shingle that extend from the land. They form where the coastline suddenly changes shape (e.g. at river mouths or estuaries).

Sand and shingle are transported by longshore drift past the point where land ends. As the waves lose energy, material is deposited, forming a spit. Strong winds can cause the end of the spit to curve towards the land, creating a recurved end.

In the sheltered area behind the spit, vegetation can grow easily, and a salt marsh may form.

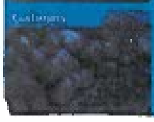
Bars form when a spit joins two headlands together, trapping the water in a lagoon behind it.



Coastal Management

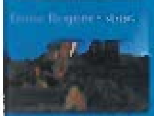
Hard Engineering

Hard engineering involves the use of man-made structures to reduce the erosive potential of waves.

Defence	Description	Advantages	Disadvantages
Sea Walls 	Walls are built at the back of beaches to reflect waves back to the sea. They are usually curved to better reflect waves.	They prevent erosion but not the movement of sediment, which can affect other areas. Well-maintained walls can last for years.	They create a strong backwash, which can erode wall foundations. They are expensive to build and maintain, and can appear unsightly.
Rock Armour 	Large boulders are placed along the coastline to absorb the power of waves.	It is highly effective at absorbing wave power. It is relatively cheap, quick to build and easy to maintain.	Boulders are often sourced from other locations and may appear unsightly next to the local geology.
Groynes 	Concrete or wooden barriers are built at right angles to the beach to prevent longshore drift, trap sediment and absorb the power of waves.	They are relatively cheap and effective at preventing erosion. They create larger beaches, which can attract more tourists.	The restriction of the movement of sediment may simply move the problems of erosion further down the coast.
Gabions 	Wire cages filled with rocks are placed at the base of cliffs to absorb wave energy.	They are cheap and easy to construct, making them a good short-term solution. They are often made from local materials.	The wire cages are ugly and can erode within 10 years. If broken, loose material can be dangerous.

Soft Engineering

Soft engineering works with the natural environment to protect coastal areas.

Beach Nourishment & Reprofiling 	Sediment is either added to the beach from elsewhere or shifted from the bottom of the beach to the top.	These processes create a wider beach, which slows waves and provides greater protection from erosion and flooding.	These processes are expensive and must be repeated regularly. Beach access may be restricted during construction.
Dune Regeneration 	Dunes are created or restored by adding more sand (nourishment), building fences or planting vegetation.	Dunes form an effective barrier between land and sea, and they help maintain natural habitats.	This method is expensive and requires a lot of maintenance.

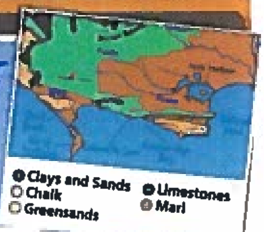
Managed retreat (or coastal realignment) allows land to become naturally flooded, creating an area of marshland or mudflats that protects inland areas. This is a cheap, natural option. However, large areas of agricultural land may be lost, and inhabitants relocated at a high cost.

Coastal Landforms: The Dorset Coast

The landforms of the Dorset coast have been formed over 8,000 years by the action of marine processes on the coast's unique alternating bands of hard rock and soft rock.

Fact File

- Dorset is located on the south-west coast of England.
- On its south coast the layers of rock run parallel to the coast, forming a smooth, concordant coastline.
- On its east coast alternating layers of hard and soft rock run at right angles to the coast, forming a discordant coastline with a wide variety of landforms.



Kimmeridge Bay (Wave-cut Platforms)

The cliffs at Kimmeridge Bay have extensive wave-cut, dolerite platforms, which slope gently down to the sea.

The wave-cut platforms formed where destructive waves eroded the cliff face, causing undercutting between the high and low water marks.

Lulworth Cove (Bay)

At Lulworth Cove, waves broke through a weakness in the limestone to expose softer clays and greensand rocks.

These softer rocks eroded more quickly than the surrounding harder rocks to form this large bay.

Ballard Head (Caves, Arches and Stacks)

Ballard Head is a resistant chalk headland. Both sides of the headland were eroded by waves to form caves and arches.

Over time, some arches collapsed and formed isolated stacks several metres high. These are known as Old Harry Rocks. Further erosion caused these stacks to collapse, forming stumps.

Chesil Beach (Bar)

Chesil Beach is an example of a sand and shingle bay bar, formed by the deposition of sediment through longshore drift.

It stretches across the mouths of several bays and joins the Isle of Portland to the mainland.

Coastal Management: Holderness

Holderness Fact File

- The Holderness coast is located in north-east England.
- It is one of the fastest eroding coastlines in Europe. It loses an average of 2 metres of land to erosion each year.
- Its made up of soft boulder clay, which is very easily eroded.
- Strong prevailing winds create longshore drift which moves eroded material south along the coast. This leaves large areas of coastline exposed to erosion.


English seaside resort

Why Are Coastal Management Schemes Needed?

Large areas of the Holderness coast (e.g. Hornsea and Bridlington) are at threat from erosion, putting many businesses and homes at risk.

Coastal erosion is also threatening to damage large areas of farmland and infrastructure, including main roads and the gas terminal at Easington, which supplies 25% of the UK's gas.

What Coastal Management Schemes Are Being Used?

Various management strategies have been used to protect the Holderness coastline.

In 1991, £2 million was spent on a coastal protection scheme at Mappleton to reduce coastal erosion. Rock armour was installed to absorb wave energy, and groynes were built to prevent longshore drift and to build up the beach.

In Bridlington, a popular tourist destination, a 4.7-km long sea wall was built to protect the seafront from erosion.


Bridlington sea wall


Wooden groynes

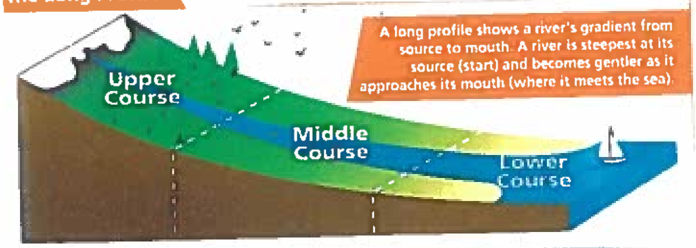
Effects and Conflicts

- Coastal management schemes have helped protect many key areas in Holderness from erosion, including the Easington Gas Terminal, the B1242 road and the towns of Mappleton and Bridlington.
- Because of the high cost of building and maintaining coastal defences, only the most valuable locations are being protected. This leaves large areas vulnerable to damage.
- The groynes at Mappleton have prevented the movement of sediment down the coast through longshore drift. However, in doing so, this has increased the rate of erosion and subsequent loss of land further south of Mappleton.
- Unprotected areas of coastline are being eroded quicker than protected areas, causing bays and headlands to form. Headlands in unprotected areas become more exposed and increasingly difficult and costly to protect.

River Valleys

The Long Profile

A long profile shows a river's gradient from source to mouth. A river is steepest at its source (start) and becomes gentler as it approaches its mouth (where it meets the sea).



The Cross-Profile

The processes of erosion, transportation and deposition shape river channels and valleys. The cross-profile of a river shows a simple cross-section at certain points of its course.

Cross Profile	Features	River and Valley Characteristics
Upper course	Waterfalls, gorges, interlocking spurs, large rocks and boulders	- The river flows downhill due to gravity. This creates friction and results in lots of vertical erosion. - The river channel is narrow and shallow. - The valley is V-shaped with steep sides.
Middle course	Meanders, floodplains, smaller pebbles and rocks	- Lateral erosion increases as the river becomes less steep. - The river channel is wide and deep. - The valley is V-shaped with shallow sides.
Lower course	Meanders, oxbow lakes, floodplains, levees and fine sand particles	- A lot of lateral erosion occurs. - The river channel is very wide and deep. - The valley sides are wide and almost flat. - Deposition is most evident here.

Why does a river's velocity increase downstream despite its gradient getting shallower?

The velocity of a river is determined by more than just its gradient. The shape of its channel, the volume of water that it carries and the sediment it contains also affect its velocity.

In the upper course, a river carries a small amount of water and has a narrow, shallow and rough channel, which results in lots of friction and slows the flow of water.

Downstream, as tributary streams join the river, the volume of water increases. This combined with the wider, deeper and smoother channel (which creates less friction) increases the river's velocity.

Rivers: Erosional Landforms

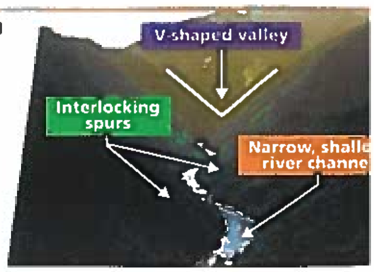
Interlocking spurs, waterfalls and gorges are all formed through processes of erosion. They are usually found in the upper course of a river.

Interlocking Spurs

In the upper course of a river, water and the material it carries cut into the river bed, creating a steep-sided V-shaped valley.

The river is not powerful enough to erode laterally through areas of hard rock, so it winds and bends around these rocks.

The winding path of the river creates a winding valley of interlocking spurs.



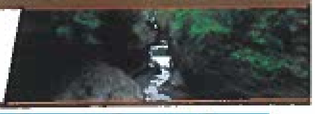
Waterfalls and Gorges

Waterfalls form where there are rocks of varying hardness and density. Softer, less dense rock is eroded away faster than the overlying hard rock.

1. Soft rock is eroded easily through hydraulic action and abrasion, enabling the river to cut down into the channel.
2. Over thousands of years, the river continues to erode the soft rock and a plunge pool develops.
3. The overlying hard rock (cap rock) is undercut and left unsupported until it eventually collapses.
4. The falling hard rock causes further erosion through abrasion, and the waterfall begins to retreat upstream.

Gorges

As erosion continues, the waterfall retreats upstream, leaving a steep-sided valley downstream. This is known as a gorge.



Fluvial Processes

Erosion

Erosion involves the wearing away of land. It occurs most rapidly when a river is in flood, as this is when it has the most energy.

There are four main types of erosion.

Hydraulic Action – The force of the river compresses air trapped in cracks in the banks. The increased pressure weakens and gradually wears away the banks.

Abrasion – Rocks carried by the river rub and scrape along the river bed and banks, wearing them down.

Solution – Where water is slightly acidic, it dissolves certain types of rock on the river bed and banks (e.g. limestone) and carries them as the water flows.

Attrition – Rocks carried by the river collide with each other and break into smaller pieces.

Lateral erosion occurs when riverbanks are eroded, making the river channel wider. This is most common in the middle and lower courses.

Vertical erosion occurs when the river bed is eroded, making the channel deeper. This is most common in the upper course.

Transportation

Transportation is the movement of eroded material.

Traction – Large rocks and boulders roll along the river bed.

Saltation – Smaller rocks and boulders bounce along the river bed.

Suspension – Finer, lighter material is light enough to be carried in the water.

Solution – Minerals (e.g. rock salt) dissolve and are carried along by the water.

Deposition

Deposition occurs when a river loses energy and drops eroded material (sediment).

A river will deposit its load along its course wherever its energy drops; for example, on the inside bend of a meander, in areas of shallow water and at the mouth of rivers.

When a river loses energy, the heaviest rocks and boulders are deposited first, and the lightest materials are deposited last.

Rivers: Erosional and Depositional Landforms

Meanders

When a river gets nearer to the sea, large bends called meanders develop as lateral erosion occurs. Different processes occur on either side of a meander.

Deposition

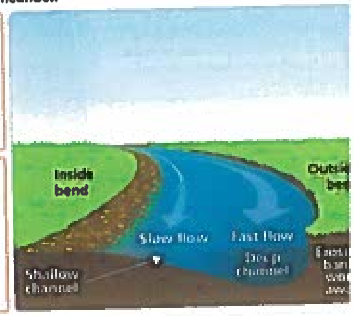
Deposition takes place on the inside bend, where the river flows slowly. The shallow channel creates greater friction, which slows the river down.

Sand and shingle are deposited on the inside of the river bend, forming slip-off slopes.

Erosion and Transportation

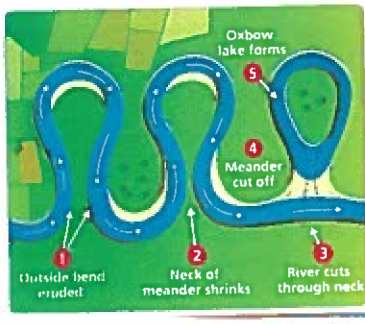
Erosion and transportation take place on the outside bend, where the river flows fast. The deeper channel creates less friction, which enables the water to flow quickly.

Over time, erosion causes the riverbanks to be undercut and worn away, forming river cliffs.



Oxbow Lakes

Oxbow lakes are formed from meanders. However, they are only found in the lower course of a river, where deposition becomes the dominant process.



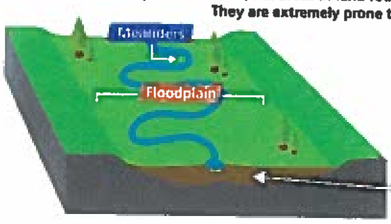
1. Erosion on the outside bend of a meander causes the neck of the meander to become narrower.
2. The neck of the meander continues to narrow until the river eventually breaks through to form a new river channel.
3. The river now flows along the shortest course, bypassing the loop.
4. As sediment is deposited on the riverbanks, the meander becomes sealed off.
5. An oxbow lake forms.

Rivers: Depositional Landforms

Floodplains, levees and estuaries are all examples of depositional landforms. They are usually found in the middle and lower courses of a river.

Floodplains

Floodplains are wide, flat areas of land found on either side of a river. They are extremely prone to flooding.



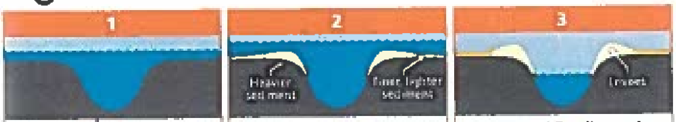
When a river floods, material being carried by the river is deposited on the floodplain. Over time, this raises the height of the floodplain.

Floodplains are also made wider due to the migration of meanders.

The soil in floodplain areas is very fertile. This is due to the deposition of alluvium (silt) by the river.

Levees

Levees are naturally raised river banks that form when a river repeatedly floods and deposits sediment.



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When a river floods over its banks, the water spreads out and slows down. As it does so, it loses energy and deposits the material it has been carrying.	Heavier material is deposited first, closest to the channel. Finer, lighter material is carried further over the floodplain.	Repeated flooding and deposition forms raised levees along the edges of the channel.

Estuaries

Estuaries are found where the tidal mouth of a river meets the sea. Most were formed at the end of the Ice Age, when the sea levels rose and caused widespread coastal flooding.

Estuaries are flooded daily by the tides as they rise and fall. At high tide, the incoming tide meets the outflowing river and reduces its velocity. This causes the river to deposit its sediment (sand and silt) over the floor of the river valley.

Repeated flooding causes layers of sediment to build up over time, creating wide mudflats and salt marshes, which become exposed at low tide.

Flooding

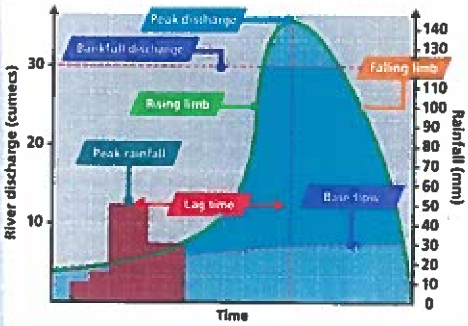
Factors Affecting Flood Risk

The speed at which precipitation reaches a river greatly affects flood risk. Any factor that causes precipitation to reach a river faster (through surface run-off) and to rapidly increase the river's discharge heightens flood risk.

Physical Causes	Precipitation	Prolonged, intense rainfall can saturate soil. Excess rainwater then flows to rivers as surface run-off and increases river discharge. Heavy rainfall and sudden snow melt can also cause high levels of surface run-off if the infiltration rate is too slow.
	Geology	Water cannot pass through impermeable rock, such as clay, granite and slate. Instead, water runs over the rock quickly and into the river, increasing flood risk.
	Relief	Areas with steep slopes have high levels of surface run-off because precipitation cannot infiltrate (soak through) the soil. Low-lying, flat floodplains are also highly susceptible to flooding.
Human Causes	Land Use	Impermeable materials and drainage systems used in urban areas increase surface run-off resulting in a greater flood risk. Deforestation reduces the amount of vegetation able to intercept rainwater.

Hydrographs

River discharge is the quantity of water that passes a given point in a river within a given time. It is measured in cumecs (m^3/s), or cubic metres per second. Hydrographs can be used to show how a river's discharge changes in response to precipitation.



Peak Rainfall
The greatest rainfall during the period

Rising Limb
An increase in river discharge

Falling Limb
A decrease in river discharge

Lag Time
The time difference between peak rainfall and peak discharge

Lag time gives people time to prepare for floods. High levels of surface run-off shorten the lag time and increase peak discharge, resulting in a high flood risk. High infiltration rates increase the lag time and reduce peak discharge, lowering flood risk.

Flood Management

Different management strategies can be used to protect river landscapes from the effects of flooding.

Hard Engineering

Hard engineering involves the use of man-made structures to control the flow of a river and prevent flooding. They are an expensive, but effective flood management option.

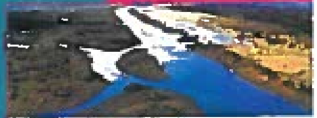
Dams and Reservoirs

Dams are walls built across rivers to trap water, forming an artificial lake, or reservoir.

✓ Reservoirs store and regulate the flow of water. They can be used as a source of drinking water and to generate hydroelectric power.

✗ Dams are very expensive and can flood large areas of land, damaging habitats and displacing many people. They can also prevent the transportation of eroded material, reducing the fertility of farmland downstream.

River Straighteni

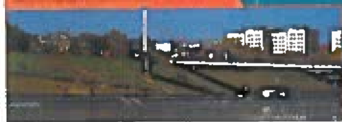


River straightening involves cutting out meanders to create straighter, wider and deeper river channels.

✓ Because of less friction and the shortene river length, water flows out of an area more quickly, reducing the risk of floodi in that area.

✗ Flooding is more likely to occur downstream as water is carried there m quickly and the fast-flowing water caus greater erosion.

Embankments



Embankments are artificially raised banks built alongside rivers.

✓ The raised banks enable rivers to hold more water, protecting surrounding towns and cities.

✗ Embankments are expensive and can be unsightly. Devastating floods can result if an embankment fails or if the water level rises above the level of the banking.

Flood Relief Chann

Flood relief channels are used to divert wat away from urban areas or to redirect water the river level becomes too high.

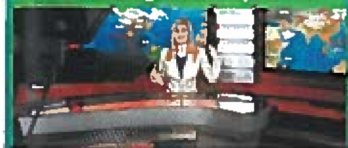
✓ Urban areas are at less risk from floodin because water is diverted away.

✗ Flood relief channels are costly, and sho river discharge increase significantly, th could overflow and cause severe floodi

Soft Engineering

Soft engineering involves managing natural river processes to reduce the flooding risk.

Flood Warnings and Preparation



Flood alert information is issued by agencies such as the Environment Agency so people can plan and prepare for flooding.

✓ Warnings are cheap and give people time to evacuate and protect their homes and possessions. This can also give property owners time to reinforce their buildings to make them more flood-resistant.

✗ Warnings do not stop flooding and are only effective if people are aware of the warnings and take action.

Flood Plain Zoni

Flood plain zoning restricts building on floo plains and areas at risk from flooding.

✓ With no impermeable surfaces such as concrete or tarmac, the risk of flooding i flood plains is reduced. Also, there are n buildings that could be damaged should flood occur.

✗ Flood plain zoning restricts industrial an urban development, which can increase housing shortages. It has no effect on existing high-risk urbanised areas.

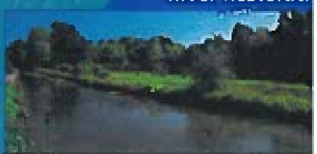
Planting Trees

Trees are planted in river valleys to increase the interception and absorption of rainwater, which reduces surface run-off.

✓ Planting trees is a low-cost, environmentally friendly way to reduce surface run-off. It also increases natural wildlife habitats and reduces soil erosion.

✗ Tree planting requires a lot of space and reduces the amount of land available for farming.

River Restorati



River restoration involves removing hard engineering strategies to allow rivers to ret to their natural state.

✓ River restoration increases water storage reducing the risk of flooding downstrean It also makes the river more aesthetically pleasing and increases biodiversity.

✗ River restoration can lead to a loss in agricultural land and cause major floodin if done near high-value, built-up areas.

Human and Physical factors affecting the shape of River Ouse

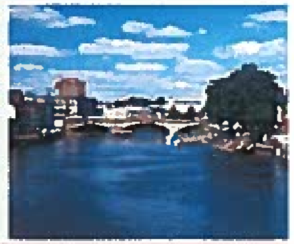
Background
Main drainage basin for North Yorkshire
Tributaries include Nidd, Foss and Derwent

Relief
Steep valleys in upper course make the river's velocity faster.
Flat land in Vale of York creates a slower velocity

Vegetation
Moorland in upper course.
Deciduous woodland in lower course.

Industry
Limestone quarrying in upper course increasing steepness of slope.

Geology
Shale, sandstone and limestone in upper course.
Shale and sandstone eroded faster by corrasion.
Different banding of rocks create waterfalls e.g. Hadraw Force.
Shale and sandstone more permeable so there is increased infiltration slowing down the rate at which water enters the channel.
Lower course – rock is impermeable so increased rate of flooding as water enters river faster.



Agriculture
Large areas cleared for farming.
1960'-1970's drainage systems put in by farmers has increased flood risk further downstream

Human development
1980's and 1990's large scale urbanisation around Clifton Moor in the lower course of the river. As this has made the area more impermeable it has increased the flood risk

Weather Hazards and Climate change

Key Terms

Atmosphere: the gases that surround the earth

Depression: a low pressure system that produces clouds, wind and rain

Global Atmospheric circulation: the movement of air which transports heat from tropical to polar latitudes

Hemisphere: a half of the earth. Northern hemisphere is above the equator, and the southern hemisphere is in the south

ITCZ: Inter Tropical Wind Zone

Latitude: the distance north and south of the equator. It is measured in degrees with the maximum being 90 degrees North or South

Ocean Current: a continuous, directed movement of ocean water. The currents are made from forces acting on the water such as the wind, different temperatures and the earth's rotation

Trade Winds: a wind that blows steadily from the tropics towards the Equator. In the northern hemisphere it is from the northeast and in the southern hemisphere from the southeast

Troposphere: the lowest layer of the atmosphere. It is thicker at the equator 20km's at the equator compared to 10km's at the poles

Weather: the day to day changes in temperature and precipitation

Precipitation: any form of moisture that reaches the earth, rain, snow etc

Maritime: influenced by the sea

Annual temperature range: difference between the highest and the lowest temperatures

Total annual rainfall: the sum of the rainfall for the year

Ice fairs: amusements held on the River Thames during the little ice age

Prevailing wind: the direction that the wind usually blows – in the UK from the SW

Source region: a large area of the Earth's surface where the air has a uniform temperature and humidity

Climate graphs: graphs which show temperature as a line at the top and rainfall in bars beneath on the same graph

Non - frontal system: weather systems that do not contain a warm or a cold front and usually associated with mid-latitude low-pressure weather systems which bring rain

Source region: where tropical cyclones start their development

CERF: the United Nations' Central Emergency Response Fund

Humanitarian aid: help given after a natural disaster to save lives and reduce suffering

FEMA: the USA's Federal Emergency Management Agency

Drought: a period of below - average precipitation resulting in prolonged shortages in water supply

Irrigation: the artificial watering of land for farming

Nomadic herdsmen: people raising animals for their own food; they move around and have no fixed land

Pastoral farming: the rearing of sheep, cattle, pigs or any other animals on a farm

Savannah ecosystem: an area of grassland which has a few shrubs and trees; it can be found in tropical areas

Enhanced greenhouse effect: also called climate change or global warming, it is the impact on the global climate

Fossil fuels: a naturally occurring fuel such as coal, oil, gas

Methane: fossil methane provides approximately 30% of methane released into the atmosphere and is a greenhouse gas

Global Atmospheric Circulation

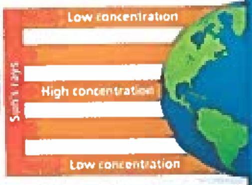
Large-scale wind circulations occur over the Earth's surface. These circulations result from differences in air pressure due to the unequal heating of the Earth's surface.

Wind is caused by differences in the atmospheric pressure. When there is a difference, air moves from an area of high pressure to an area of low pressure, resulting in winds. The greater the difference in pressure, the stronger the winds.

Towards the poles, the Sun's energy spreads over a large area, resulting in low temperatures and low pressure.

At the Equator, the Sun's energy is concentrated over a small area, resulting in high temperatures and low pressure.

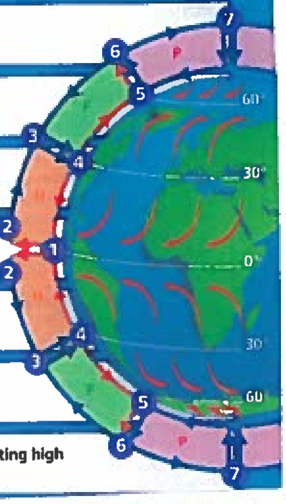
This difference in air pressure on the Earth's surface causes global patterns of air circulations (cells) from areas of high pressure to areas of low pressure.



Global Atmospheric Circulation Model

There are three convection cells in each hemisphere: Hadley, Ferrel and Polar cells.

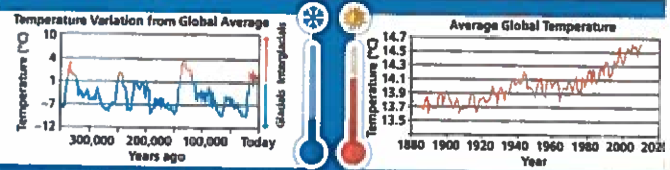
1. Warm air rises from the Equator, creating a belt of low pressure. As the air rises, it cools.
2. The resulting condensation creates clouds and rain that move north and south of the Equator.
3. At 30° north and south of the Equator, the cold, dry air sinks, creating high pressure and clear skies.
4. When the sinking air reaches the Earth's surface, it moves either back to the Equator or towards the poles.
5. At 60° north and south of the Equator, the surface air meets colder air from the poles, which causes it to rise, creating a belt of low pressure.
6. The air rises and cools. At a high level, this moves either back to the Equator or towards the poles.
7. At the poles, the cool air sinks to the Earth's surface, creating high pressure. The air then moves back towards the Equator.



Climate Change

Climate, the weather in an area over a long period of time, is always changing.

During the last 2.6 million years, or the Quaternary period, global temperatures have been gradually falling, with the Earth's climate alternating between glacial and interglacial states.



During the Quaternary period, glacial episodes have typically lasted 100,000 years. Interglacial periods are much shorter and typically last 10,000 years.

The Earth is currently in an interglacial state, which began approximately 11,500 years ago. Over the last century, global temperatures have increased sharply, leading to global warming.

Evidence for Climate Change

There are various methods scientists can use to work out how climate has changed over time.

Sediment Cores – The remains of organisms in ocean sediments can be analysed to identify environmental conditions, and in turn temperatures, from the last 5 million years.

Tree Rings – A tree grows a new ring every year. In warmer, wetter years, tree rings are thicker. Therefore, tree rings can reveal evidence of temperature and weather changes over the past 10,000 years.

Ice Cores – Scientists can analyse the gas levels in ice cores to determine how temperatures have changed over 400,000 years.

Temperature Records – Since the mid-19th century, global temperatures have been measured using a thermometer. This gives accurate short-term data to track changes in temperatures.

Pollen Analysis – Pollen from plants is preserved in lake beds and bogs. Analysis of pollen can help identify plants that grew in the past and the periods and climates in which they grew.

Historical Records – Sources such as the Frost Fair drawings, farm produce audits, written descriptions and even cave paintings can reveal information about the climate in a given place and time.

Climate Change: Causes & Effects

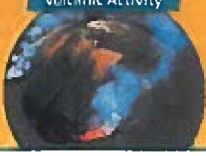
Natural Factors

There are several possible natural causes of climate change.

Orbital Changes

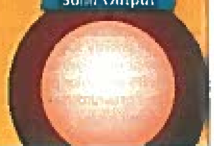
The Earth's orbit changes from circular to elliptical, which affects its distance from the Sun. When the orbit is more circular, the Earth's temperature is likely to increase, as the Earth is closer to the Sun. When the orbit is elliptical, the temperature is likely to decrease, as the Earth is further from the Sun.

Volcanic Activity



Volcanic eruptions release particles of SO_2 and CO_2 into the atmosphere. The SO_2 particles reflect the Sun's rays, reducing temperatures in the short term. Conversely, CO_2 is a greenhouse gas; it traps the Sun's heat, resulting in warmer global temperatures.

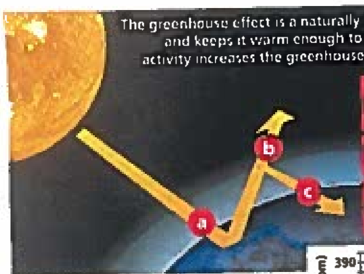
Solar Output



The Sun's solar energy output varies over time, which could result in changes to the Earth's climate. However, over the last 50 years, the Sun's energy output has declined slightly, despite the rise in global temperatures. Therefore, many people reject this theory.

Human Factors

The greenhouse effect is a naturally occurring phenomenon that insulates the Earth and keeps it warm enough to sustain life. However, it is believed that human activity increases the greenhouse effect, resulting in higher global temperatures.



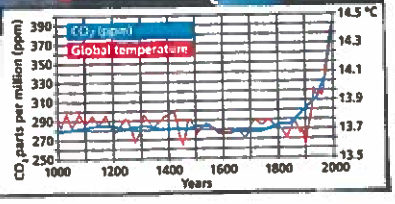
a. When the Sun's solar radiation reaches the Earth's surface, most of it is absorbed, but some is reflected into the atmosphere.

b. Some of this solar energy passes through the atmosphere and back into space.

c. Some of it is trapped by greenhouse gases, such as methane and CO_2 in the atmosphere.

Several human activities increase the levels of greenhouse gases in the atmosphere, trapping more of the Sun's solar energy.

This graph shows the correlation between the average global temperature and the level of CO_2 in the atmosphere over time.



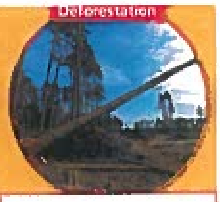
Fossil Fuels

Fossil fuels such as oil, gas and coal are burnt to generate energy for transportation, manufacturing and electricity production. However, the process of burning fossil fuels releases CO_2 into the atmosphere and is the main source of greenhouse gas emissions.

Agriculture

Agriculture, especially livestock and rice farming, produces huge amounts of the greenhouse gas methane. It is released by animals during digestion and by matter decomposed by microbes in flooded rice paddy fields.

Deforestation

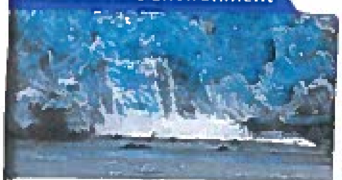


Trees absorb CO_2 through photosynthesis. Therefore, clearing trees results in less CO_2 being removed from the atmosphere. This is worsened by the burning of fossil fuels, which also releases greenhouse gases into the atmosphere.

Effects of Climate Change

Climate change has a significant effect on both the environment and people.

Effects on the Environment



Warmer global temperatures will cause glaciers and ice sheets to melt, leading to rising sea levels and the loss of polar habitats.

Rising sea levels will result in low-lying coastal areas flooding more frequently or even becoming permanently submerged in water.

Many species of plants and animals are at risk of becoming extinct as their habitats are altered or damaged by climate change. For example, many of the world's coral reefs, which support a diverse range of marine life, are at risk of bleaching and destruction due to rising sea temperatures.

Warmer temperatures and higher sea levels will lead to more extreme weather events and a change in precipitation patterns.

Effects on People

As global temperatures rise, people in already hot regions will be at increased risk of developing heat-related health problems.

Many coastal areas at risk of flooding and areas that experience extremely high temperatures may become uninhabitable. This could lead to mass migration and overcrowding.

Although agriculture in some areas may benefit from warmer temperatures, many areas will become hotter and drier. This will result in drought, desertification and declining crop yields.

Drought and reduced crop yields will cause food and water shortages in many areas.

Tropical Storms

Tropical storms are extreme low-pressure weather systems that cause severe winds and torrential rain.

Global Distribution of Tropical Storms

Conditions required:

- **Ocean Temperature:** >26°C
- **Water Depth:** 60-70 m
- **Location:** Between 5° and 30° north and south of the Equator
- **Season:** Late summer, Early autumn

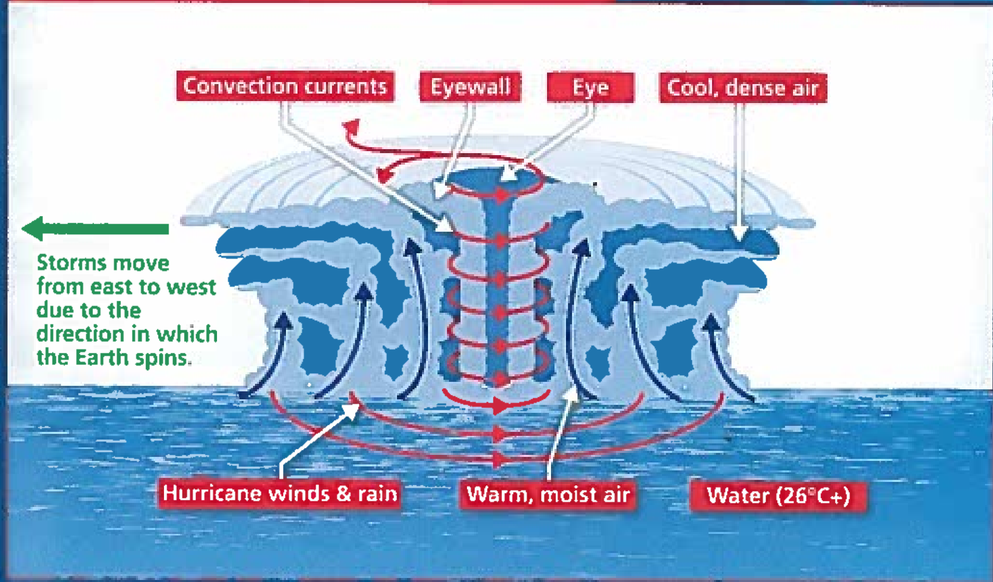
Tropical storms cannot form more than 30° north or south of the Equator as the water is not warm enough and the Coriolis force (spin) not great enough.

Tropical storms have different names depending on their geographical location: they are known as **cyclones** in the Indian and South Pacific Oceans, **hurricanes** in the Atlantic and Eastern Pacific Oceans and **typhoons** in the west of the North Pacific Ocean.

Formation of Tropical Storms

1. Warm, moist, unstable air above the ocean rises, creating an area of low pressure below.
2. Surrounding cooler air is drawn into the area of low pressure, causing winds.
3. The cool drawn-in air now warms up and takes on moisture, causing it to rise.
4. The large mass of rising, warm air cools and condenses, forming large cumulonimbus clouds and heavy rain.
5. Latent heat released during condensation helps to power the storm.
6. As more air is drawn into the area of low pressure, the Earth's rotation causes wind to spiral into the storm's centre, or eye.
7. Colder, drier air sinks into the centre (eye) of the storm, creating calm conditions. Prevailing winds then push the storm towards land.
8. The storm continues to get bigger and stronger until it reaches land or colder seas. Landfall and friction slow the storm down.

Structure and Features of Tropical Storms



The Coriolis Force

Due to the Earth's curved surface and rotation, the Coriolis force causes winds to bend and cyclones to spin.

In the northern hemisphere, the winds curve to the right, causing storms to swirl in a clockwise direction. In the southern hemisphere, the winds curve to the left, causing storms to swirl in an anticlockwise direction.

Climate Change and Tropical Storms

Climate change is heating the world's oceans and causing sea levels to rise. What effect does this have on the distribution, frequency and intensity of tropical storms?

Frequency: It is thought that the frequency of tropical storms may remain the same or decrease as the Earth gets warmer. However, it is believed that more storms will be classed as severe (category 4 or 5) and last for a longer time.

Intensity: Evidence shows that as sea temperatures rise, storms will become more intense. The increased heat energy powers the storms, bringing higher rainfall and stronger winds. Rising sea levels place coastal areas at greater risk of flooding from tropical storms.

Distribution: As sea temperatures rise, more of the world's oceans will heat to above 27°C. Tropical storms may therefore be able to develop in areas further north or south of the Equator.

Tropical Storms: Effects & Responses

Tropical storms can have a major impact on people and the environment. As with any natural disaster, people must be prepared and ready to respond quickly.

Effects of Tropical Storms

A tropical storm and its associated strong winds and heavy rainfall are likely to have many effects on a location, including flooding, landslides and storm surges.

Primary Effects (Immediate Impacts)

- High rainfall and storm surges lead to flooding, particularly in coastal regions and flood plains.
- Buildings and transport links are destroyed by flooding and high winds.
- People are injured and killed by flooding and debris.
- Water supplies are contaminated by overflowing sewage.
- Electricity cables and communications networks are destroyed by flooding and high winds.
- Food shortages can result from the destruction of crops and livestock.
- People are displaced or made homeless.

Secondary Effects (Long-Term Impacts)

- Disease spreads easily because of contaminated water and poor sanitation.
- Food shortages can result from the destruction of crops and livestock.
- Damage to infrastructure such as roads and power supplies may take a long time to repair.
- The loss of tourism and trade can damage the region's economy.
- Heavy rainfall can trigger landslides, causing further devastation.

The severity of a tropical storm's effects will depend on the storm's size, strength and location. If the location is densely populated, has a poor infrastructure or a poorly prepared population, the effects are likely to be more severe. The area is said to be vulnerable.

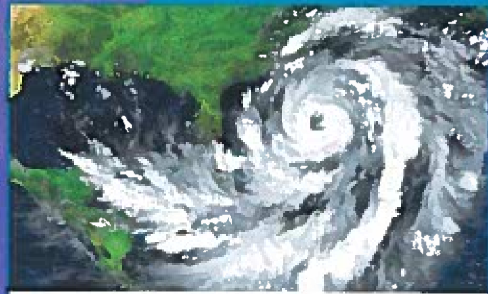
Responses to Tropical Storms

Some effects of tropical storms must be met with an immediate response. Others can be dealt with in the long term.

Immediate Responses

- Evacuate anybody at risk before the storm, potentially to higher ground.
- Rescue any survivors and treat injuries.
- Prevent the spread of disease by recovering any dead bodies.
- Set up temporary shelters for the homeless.
- Provide temporary supplies of food, water and electricity, as well as communications, to those in need.
- Send aid workers, supplies, equipment and financial help to the people affected.

Long-Term Responses



- Rehouse those who have lost their homes.
- Repair or rebuild damaged buildings.
- Improve structural design to help protect buildings against future storms.
- Improve forecasting and warning systems.
- Improve flood defence systems.
- Boost the economy by promoting investment in the area. If the area is suitable, tourism can also create jobs and business opportunities.
- Restore water, energy and gas supplies, and reconnect communication links.

The Three Ps: Prediction, Protection and Planning

Tropical storms can be predicted, so having effective prediction, planning and protection systems can significantly reduce the effects of storms.

Prediction
- Scientists use technology to predict when and where a storm is likely to occur.
- Hurricane warnings give people advice on the necessary actions to take (e.g. evacuation).

Protection
- Buildings can be constructed from reinforced concrete or built on stilts to protect against winds and flooding.
- Flood defences (e.g. levees and sea walls) can be built along rivers and coasts.

Planning
- Disaster kits can be provided for people in high-risk areas.
- Evacuation routes can help to get people away from danger quickly.

Tropical Storms: Typhoon Haiyan

Typhoon Haiyan is one of the most intense tropical cyclones on record. In 2013, it caused widespread devastation to large areas of South East Asia, particularly the Philippines.

Timeline

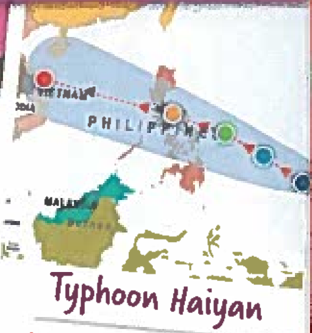
3rd November A low pressure system develops into a tropical depression over the Western Pacific Ocean.

5th November Fuelled by high sea surface temperatures, the depression develops into a small typhoon.

6th November Rapid intensification continues and a super typhoon forms.

7th November With winds of 190 mph, the typhoon reaches its peak intensity as it hits the Philippines.

9th - 11th November The typhoon moves westerly over the South China Sea and dissipates as it hits Vietnam and China.




Village on water, Philippines

The Philippines

The Philippines is a low-income country (LIC) that is highly susceptible to tropical storms.

With a high population density and many people living in poorly constructed wooden buildings, the Philippines was severely affected by Typhoon Haiyan.


Typhoon Haiyan destruction

Primary Effects

- Heavy rainfall (400 mm) and a 5-metre storm surge caused severe flooding.
- Infrastructure (e.g. hospitals, airports and roads) was damaged.
- An oil spill caused damage along the coast.
- There were over 6,000 fatalities.
- Homes and buildings were destroyed, with over 2 million people made homeless.
- Widespread power outages occurred.

Secondary Effects

- Large areas of agricultural land were flooded, resulting in crop failure and food shortages.
- Contaminated flood water led to the spread of disease.
- The overall damage was estimated to be £10 billion.

Primary Responses

- Around 800,000 people were evacuated to temporary shelters.
- Over £100 million worth of aid was sent, including food, water and medicine.
- The distribution of aid was slow because of the scale of damage to the country's infrastructure.
- A curfew was introduced to prevent looting.

Secondary Responses

- New legislation was introduced to prevent construction in high-risk areas.
- A new disaster early warning system was developed.
- The government announced a four-year, £6.2 billion plan to rebuild homes, businesses and infrastructure.

UK Weather Hazards

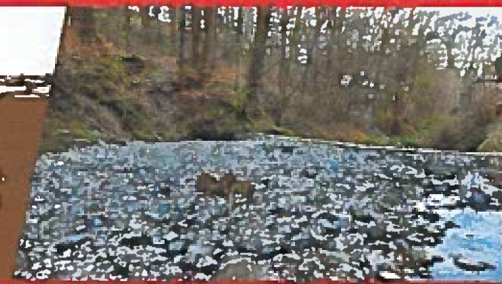
There are various types of extreme weather that affect the UK.

Drought

A prolonged period of abnormally low rainfall, leading to a shortage of water

Potential Impacts:

- Crop failure can lead to higher food prices, lower incomes for farmers and reliance on food imports.
- Water conservation regulations, such as hosepipe bans, may be introduced, which can affect businesses and householders.



Heavy Rain

A period of abnormally heavy rain

Potential Impacts:

- Short periods of intense rain can cause flash floods. Prolonged rain saturates the ground, which can lead to river flooding.
- Damage may occur to buildings, transport links, communication links and energy supplies.
- Flooded farmland kills crops and animals.
- Repairs often cost millions and can take years to complete.
- Businesses and homeowners in high-risk areas may be denied insurance.

Heatwaves

A prolonged period of abnormally hot weather

Potential Impacts:

- Fatalities and health issues, such as heat exhaustion and breathing difficulties, can occur.
- Road surfaces can melt and rail lines can deform, disrupting transport.
- Crops wither and scorch, which may lead to higher food prices, lower incomes for farmers and reliance on food imports.

Namibia - drought 2013

People

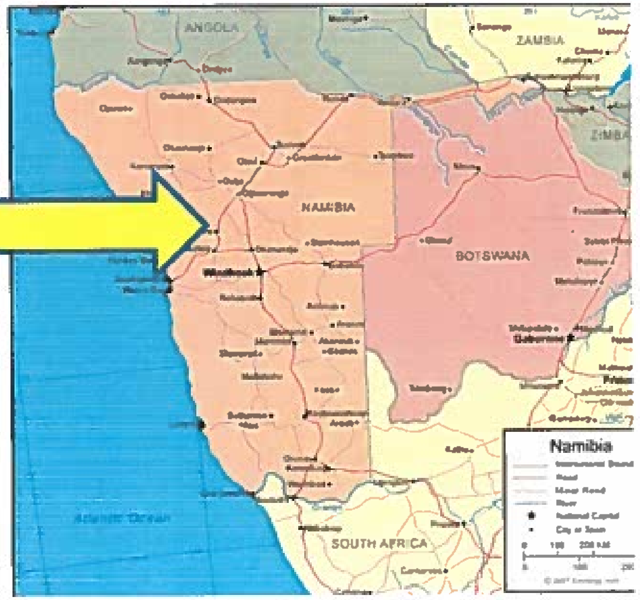
- 1:3 at risk of malnutrition
- 778,000 at risk of starvation (food insecure)
- Harvest yield 42% less than 2012
- People left homes due to lack of water

Response by organisations

- UNICEF appealed for US$7 mill
- International red cross and red crescent appealed for US$1.5 mil
- Algeria donated US$1 in food aid
- Lutheran church helped in various ways - provided basic food - ensuring safe environment and access to clean water

Environment

- Huge impact on ecosystem
- Savannah changing to desert



Responses by government

- In May President Pohamba declared state of emergency - asked for US$ of international aid
- Pledged £13 million for most affected
- Ministry of Agriculture, Water and Forestry gave 2 options - either sell livestock while still in good condition or receive a subsidy for the cost of transporting animals to another area

Response by individuals

- Farmers forced to sell livestock
- Migration to towns
- In one village 350 people left in search of food/water

California – drought 2014

Environment

- Wildfires – 12 wildfires May 2014 near San Diego
- Rivers and streams closed to fishing
- Earth shrinking
- 2008 -2011 Central valley subsided 60cm+
- Better grape harvest – better tasting wine

People

- Farmers use 80% of total water usage
- Loss of 17,100 jobs
- 5% land irrigated
- Department of agriculture predicts 6% rise in food prices

Responses by individuals

- Farmers pump more water extra cost US$453
- Use water sparingly
- Develop new ways to manage and monitor usage

Responses by government

- State prepared to move fish – move from shallow water to deep water eg Chinnock salmon taken in trucks to San Pablo
- Governor Brown issued state of emergency
- February President Obama gave US$183
- March Governor Brown signed drought relief legislation US$687 mil
- Santa Clara valley residents told to limit watering lawns to 2x per week or be fined US$500
- Reclamation and Nature resources conservation service provide up to US$14 mill to help farmers improve management

Responses by organisations

- New mandatory laws forbidding water on tables in restaurants
- Hotels to ask guests to reuse linen
- NASA to develop advance forecasting
- Develop new ways to manage and monitor state's water

Hurricane Sandy case study

Cuba - impacts

Economic

- Total losses in Santiago de Cuba
- Roads to airports blocked - no tourist leave or arrive
- Total loss US$ 2 bill
- 5% in Cuba's GDP

Social

- No electricity or fresh water
- 11 killed
- 17,000 homes destroyed, 226,000 damaged
- 55,000 evacuated

Environmental

- 2,600 hectares of banana destroyed
- Trees up rooted - leaves stripped
- Coffee plantations swept away
- Coastal areas flooded - beaches swept away - habitats destroyed

USA - impacts

Economic

- Insurance claims New Jersey US$3.3 billion
- US$ 1.1 billion spent repairing damage to sewers/ pipes in new Jersey & New York
- Damage to New York US$19 billion

Social

- 9 million homes no power
- 117 killed
- 650,000 homes damaged/destroyed
- 250,500 cars destroyed

Environmental

- Nature reserves damaged in Delaware impacted on crab breeding
- Millions of raw sewage entered the water course around New York and New Jersey

Ecosystems, Biodiversity and Management

Key terms

Altitude: height above sea level

Biosphere: the part of the earth and its atmosphere in which living organisms exist or that is capable of supporting life

Distribution: where something is located

Ecosystems: a community of plants and animals and their non- living environment

Exploitation: the act of using natural resources

Finite Resource: a resource that will eventually run out

Litter: decomposing leaf and other organic debris found on forest floor

Resource: a stock or supply of something that is useful to people

Water cycle: the closed system in which water moves between the atmosphere, the ocean and the land

Aquaculture: the breeding of fish in pens under controlled conditions

Colonise: to become established in an area

Coniferous: trees that stay in leaf all year round – pine trees

Deciduous: broad- leaved trees such as oak and ash – loose leaves in autumn and regrow in spring

Heathland: open countryside in lowland areas – small shrubs such as gorse and heather

Moorland: land that is not intensely farmed – upland areas of the UK, peaty and acidic soils

Wetlands: areas of low lying land that are wet and boggy – Somerset levels and the Fens

Hibernate: to spend winter in close quarters in a dormant (sleeping) position

Short rotation coppice: trees usually willow grown specifically to be used as biomass fuel – densely harvested every 2 or 5 years

Ancient woodlands: contains trees that were planted before 1600

Afforestation: the planting of trees in an area that has not been forested before

Abiotic factors: the physical, non – living environment, such as water, wind, oxygen

Biotic factors: the living organisms found in an area

Detritovore: an animal that feeds on dead plant or animal matter

Organic material: something that was once living

Inorganic material: something that was never living

Soil: the top layer of the earth in which plants grow, contains both organic and inorganic material

Biomass: the amount of weight of living or recently living organisms

Nutrient Cycle: the movement and exchange of organic and inorganic material into living matter

Food Chain: a series of steps by which energy is obtained and used by living organisms

Food web: a network of food chains by which energy and nutrients are passed from one species to another (who eats who?)

Biodiversity: the number of species present in the area

Limiting factors: factors that limit biodiversity/ population size, such as temperature, moisture, light, nutrients

Structure: the structure of a tropical rain forest is the layers of plants and animals in the forest

Function: in a rainforest this is its ecosystem

Transpiration: evaporation of moisture from the leaves of the plant

Eutrophication: the growth of algae on water courses due to chemicals entering the water course

Monoculture: the growing of one crop on large areas of land

Overpopulation: Too many people living in an area for the area to support

N G O: non-government organisation, a not for profit organisation, and not in governmental control

Carbon credits: a permit that allows the holder to emit one tonne of carbon dioxide or other greenhouse gas and can be traded

Ecotourism: travel to natural areas that does no damage conserving the environment and improving the well-being of local people

Ecosystems

Food Chains & Food Webs

The biotic elements of an ecosystem interact to form food chains and food webs.

Food Chains

A food chain shows the direct transfer of energy between organisms in an ecosystem. In a food chain, organisms can be classed as producers, consumers or decomposers.

The Sun is the source of all energy.

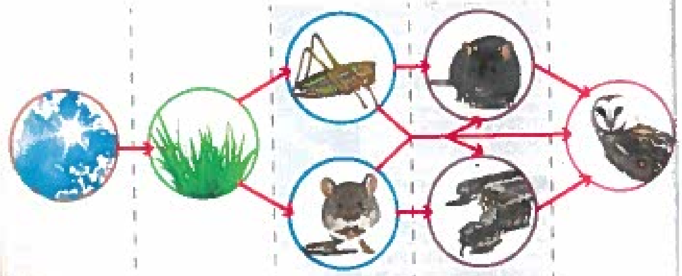
Producers (e.g. hawthorns) convert sunlight into energy to produce food.

Consumers (e.g. mice) feed on producers, other consumers or both.

Decomposers (e.g. fungi) feed on dead or decaying matter.

Food Webs

A food web is a series of interlinked food chains. The food web example below shows the interaction between producers and consumers within an ecosystem. In this example:



The Sun is the source of all energy.

The producer (grass) converts sunlight into food through photosynthesis.

Primary consumers (grasshoppers and mice) feed on the producer.

In turn, secondary consumers (rats and snakes) feed on the primary consumers.

Tertiary consumers (owls) can feed on all other consumers.

Interdependence

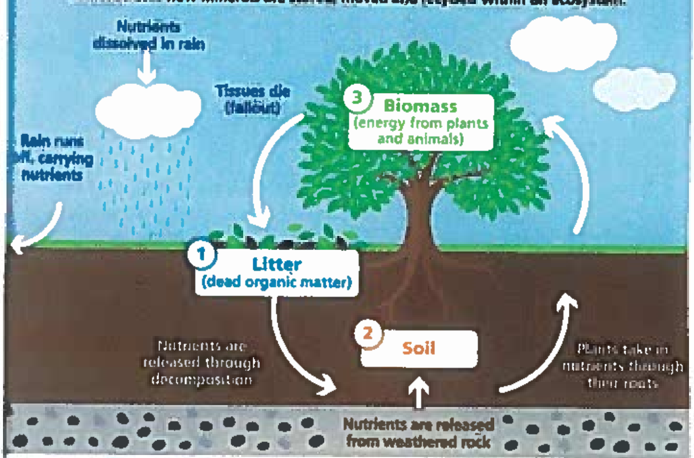
All parts of an ecosystem are interdependent. This means that if one factor changes, it will affect the other organisms within the ecosystem.

The weather is hot and little rainfall occurs. → Fewer plants grow. → Less food & shelter cause grasshopper and mouse populations to shrink. → Less food causes rat and snake populations to shrink. → Less food causes the owl population to shrink.

Changes to any part of the ecosystem can cause problems for consumers further along the food chain.

Nutrient Cycles

All living organisms need nutrients from food to survive. The nutrient cycle demonstrates how minerals are stored, moved and recycled within an ecosystem.



1 In an ecosystem, nutrients are dissolved in rainfall or stored in dead or waste matter as litter. Nutrients in the leaf litter will run off in rainwater, whereas others will decompose and be released into the soil.

2 Once in the soil, these nutrients will be added to the nutrients that have been released from weathered rock. Some of these nutrients will then be either washed out of the soil (leaching) or taken up by plants through their roots.

3 Nutrients in plants (producers) are stored in biomass and can be passed through food chains when they are eaten by consumers. When these producers and consumers die, the dead matter becomes litter, and the nutrient cycle begins again.

Tropical Rainforests

Physical Characteristics

Tropical rainforests are found close to the Equator, where the climate is hot and humid all year round. The concentrated sunlight warms the moist air, and as it rises, it condenses to form large clouds and convectional rain. This results in high annual rainfall.

2000–3000 mm rainfall | 25–30°C | No distinct seasons*

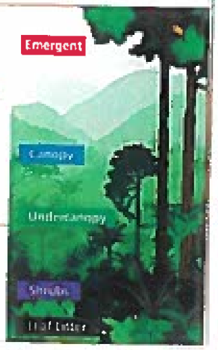
*Some rainforests, such as the Amazon rainforest, do have a 'dry' season.

Vegetation and Soil

More than two-thirds of the world's plant species are found in tropical rainforests.

There are various layers of vegetation, including high emergent trees that are over 50 m tall (e.g. evergreens), mid-level canopies and low-level shrubs.

Despite the rainforest's diverse vegetation, its soil is not very fertile as heavy rain washes away nutrients. Most nutrients come from dead matter on the rainforest floor that decomposes quickly due to the hot, humid conditions. The constant warm, wet weather speeds up the nutrient cycle and ensures the growing season lasts all year.



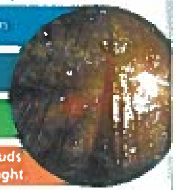
Animals and People

Tropical rainforests are home to half of the world's animal species, including toucans, jaguars and gorillas. People of the rainforest rely on their surroundings for food and shelter. They survive by hunting, fishing, and growing plants for food and medicines.

Interdependence of the Ecosystem

All parts of the rainforest are interdependent. For example:

- The warm, wet climate supports the growth of luxuriant vegetation.
- Dense vegetation provides food and shelter for many species.
- Insects and animals pollinate plants and spread seeds, enabling them to reproduce and grow elsewhere.
- Trees release moisture into the atmosphere, which helps to form clouds and rain. This keeps the rainforest wet and reduces the risk of drought.



If one element in an ecosystem changes, other parts of the ecosystem will be affected. For example, deforestation has a huge impact on rainforest ecosystems; it reduces the number of trees, which results in loss of habitats, decreased transpiration and drier conditions.

Plant and Animal Adaptations

Plants and animals have developed special features that enable them to survive in the hot and humid rainforest environment. These features are known as adaptations.

Plant Adaptations

Poor soil, heavy rainfall and competition for sunlight mean that rainforest plants have had to adapt to compete and thrive in tropical conditions.

Smooth bark and waxy drip tip leaves help water to run off quickly, preventing damage.

Tall trees compete for sunlight. They have developed sturdy buttress roots to support their trunks as they grow.

Epiphytes are plants that have adapted to grow on other plants. They absorb minerals and water from the moist atmosphere.

Plants have shallow roots to help them absorb nutrients from the soil surface before they are leached away.

Animal Adaptations

With an abundance of food, shelter and warmth, tropical rainforests have a diverse range of animals. However, with more animals comes more competition, and certain species have developed certain adaptations to help them survive.

Poison Dart Frogs

Poison dart frogs have toxic glands in their skin. Also their skin is brightly coloured to warn off predators.

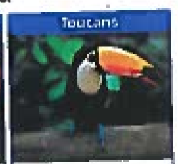
Bats

Bats are nocturnal: they sleep all day and hunt at night. They do so to avoid hot temperatures and competition from other species.

Glasswing Butterflies

Glasswing butterflies have transparent wings to help them blend in and hide from predators.

Toucans



Toucans have long, curved beaks for reaching into tree holes to obtain otherwise unreachable food.

Eco - system summary

Tundra

- Large area
- Perma frost
- 60 day growing season
- Temp range -34c - 12c
- Annual rainfall 200mm
- Lichen, mosses, grasses and dwarf shrubs
- Animals adapt

Temperate forest

- Temp range 4c - 17c
- Annual rainfall 1,000mm
- Vegetation in 4 layers, canopy, Sub- canopy, herb, ground
- Deciduous
- Animals such as squirrel store food

Tropical grasslands

- Temp range 25c - 30c
- Annual rainfall 1000mm
- Rain in 6-8 months of the year
- Soil has poor fertility
- Rich in iron
- Animals adapt in many ways eg Meercats
- Plants have a thick bark to prevent water loss

Deserts

- Temp range 30c - 35c
- Large night/ day range 18c - 45c
- Can be hot or cold (Africa / Antarctic)
- Sandy course well-draining soil
- Plants short and spikey
- Camels are adapted

Temperate grasslands

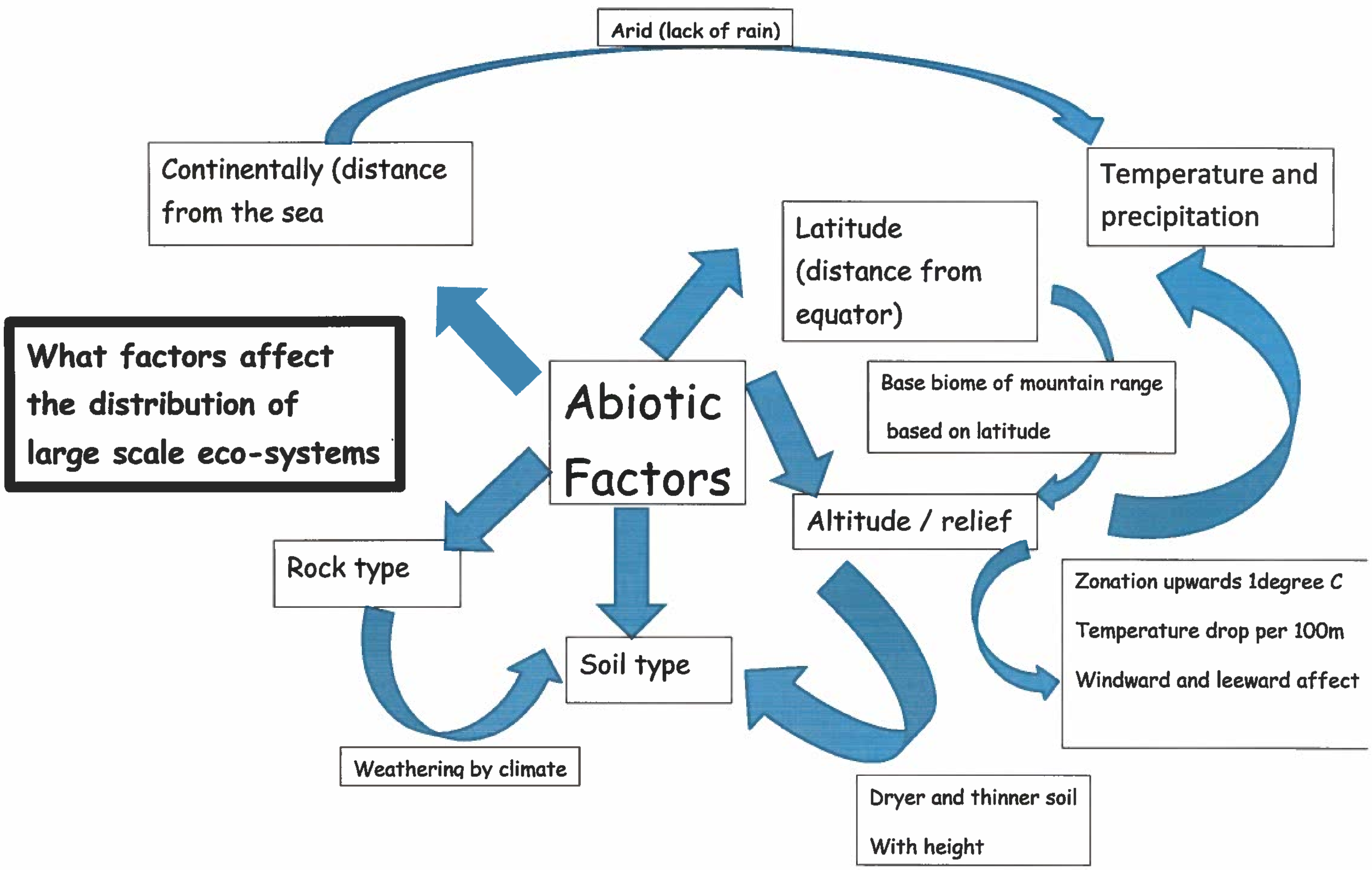
- Warm moist summers - cool winters
- Annual temp range 10c - 18c
- Annual rainfall 500mm
- Plants have soft stems allowing them to bend in the wind
- Animals adapt in order to eat grass

Boreal Forest

- Temp range 10c to -15c
- Rainfall 500mm
- Poor soil with low nutrients
- Winter the ground is frozen
- Trees have needles
- Animals store food and bears can climb trees

Tropical rainforests

- Situated mainly between the tropics of Cancer and Capricorn
- Temperature range of 27c to 30c
- Annual rainfall 2,200mm
- Has 4 layers:- Emergents, Canopy, Under canopy, forest floor
- Animals adapt such as the monkey has a long tail
- Plants have waxy leaves for example

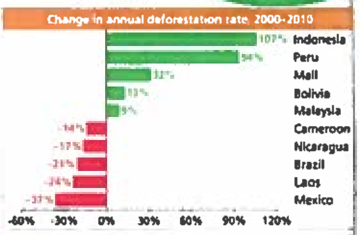

What factors affect the distribution of large scale eco-systems
Abiotic Factors
Continentally (distance from the sea
Arid (lack of rain)
Temperature and precipitation
Latitude (distance from equator)
Base biome of mountain range based on latitude
Altitude / relief
Zonation upwards 1degree C
Temperature drop per 100m
Windward and leeward affect
Rock type
Soil type
Weathering by climate
Dryer and thinner soil
With height

Deforestation

Rate of Deforestation

It is estimated that 50% of the world's tropical rainforests have been lost to deforestation over the last 100 years.

Increased awareness of the importance of tropical rainforests has led many countries, such as Brazil, to reduce their deforestation rates. Although the global rate is decreasing, it continues to increase in some areas. For example, in Indonesia, large areas of the rainforest are being cleared to make way for palm oil plantations. Indonesia is the world's biggest producer of palm oil, and its economy relies on its production.



Causes of Deforestation

There are many reasons why rainforests are being destroyed.

Overpopulation
As population grows, trees are cleared to make room for settlements.

Mining
Trees are cleared to dig for valuable minerals, such as coal and gold.

Logging
Trees are felled to harvest timber for profit. Roads must also be built to access logging sites, requiring further deforestation.

Farming & Agriculture
Trees are cleared to create space for crops and grazing livestock.

Energy Development
Forests are flooded to build dams for hydroelectric power (HEP), and areas are razed to make way for biofuel crops.

Impacts of Deforestation

Indigenous peoples have long cleared small areas of forest with little damage. However, modern large-scale deforestation has had huge environmental, economic and social impacts.

Trees remove CO_2 from the atmosphere; increased CO_2 levels contribute to the greenhouse effect and rising global temperatures. Fewer trees means fewer roots to soak up water from the soil, so more nutrients are leached. Deforestation also reduces biodiversity: plants and animals become extinct due to a lack of food and shelter.

In 1500, 6.9 million people were living in the Amazon rainforest. Only 200,000 remain there today as their homes are destroyed by deforestation. Moreover, deforestation's effects make these areas less attractive to tourists, leading to lost income. However, more jobs are being created through logging, farming and mining, and selling timber can also be very profitable.

Deforestation: The Amazon Rainforest

The Amazon rainforest is the largest tropical rainforest on Earth. However, a staggering one-fifth of the rainforest has been lost to deforestation since 1970.

Fact File

- The Amazon rainforest covers nearly 6 million km².
- Located in South America, it covers nine countries, including Brazil (60%), Peru (13%) and Colombia (10%).
- With over 40,000 plant species, 400 mammals, 1,300 birds and 3,000 fish, it is home to more plant and animal species than any other ecosystem on the planet.

Causes of Deforestation

Subsistence Farming	Farmers clear areas of the forest and burn it to make room to grow crops for their families (slash-and-burn agriculture).
Commercial Farming	Over 70% of deforestation in the Amazon is due to commercial farming of livestock (cattle) and crops (rice, palm oil, sugar cane and coffee).
Logging	Trees are felled to sell as timber for furniture and as pulp for paper. Illegal logging is a big business in the Amazon.
Mineral Extraction	Large mines have been built in the Amazon to enable extraction of valuable minerals such as bauxite, iron ore and gold.
Energy Development	Hydroelectric (HEP) power stations have been created using dams. The Balbina reservoir alone flooded over 2,300 km² of the rainforest.
Road Building	Various roads, including the Trans-Amazonian Highway, have been built to enable greater access to the Amazon and its rich resources.
Settlements	Large areas of rainforest have been cleared to create settlements for rainforest workers, who then use some of the timber for building and fuel.
Population Growth	The Brazilian government offers land to people who move out of overcrowded cities and clear small areas for farming.

Effects of Deforestation

Deforestation has several effects locally, nationally and globally.

Soil Erosion	Economic Development	Climate Change
When trees are removed from an area, the soil is no longer held together by tree roots. The soil erodes and its nutrients are leached, reducing soil fertility and preventing further plant growth.	The farming, mining and logging industries provide many jobs and significant income for rainforest countries, boosting their economies and helping them pay off foreign debts.	Trees in the Amazon store 20% of all the carbon in the Earth's biomass. As large portions of the rainforest are cleared, CO_2 is released into the atmosphere, adding to the greenhouse effect.

Tropical Rainforests: Sustainable Management

The Value of Tropical Rainforests

Tropical rainforests are vital to people, animals, plants and the environment.

They are the world's oldest biome with the greatest biodiversity of plant and animal life.	Goods such as timber, rubber, cocoa, coffee and medicines are all sourced from tropical rainforests.	They are home to indigenous people who rely on the environment for shelter, food and medicines.	Trees absorb CO_2 from the atmosphere, limiting the greenhouse effect. They also regulate the water cycle, reducing flooding.

If rainforests are not managed sustainably, they could be wiped out completely, greatly affecting the environment both locally and globally.

Sustainable Management

There are several strategies that can be used to manage the rainforest sustainably.

Conservation and Education

Conservation is concerned with the sustainable use of natural resources. On a governmental level, this may involve protective measures, such as creating laws to stop damaging practices or setting up national parks and wildlife reserves.

Organisations such as the Nature Conservancy and WWF rely on donations to help them promote conservation through education and training programmes. They also aim to directly protect threatened areas by purchasing threatened land and creating nature reserves.

Educating people about deforestation's effects can help them understand the value of the rainforest and how it can be sustainably managed. Education is especially important for those actively involved in damaging practices and teaches people about more sustainable alternatives.

Debt Reduction

Most tropical rainforests are found in low-income countries (LICs) that have large debts. LICs often borrow large sums of money from high-income countries (HICs) to aid development. They also often rely upon income from activities such as logging and farming to repay their debt.

To protect rainforests, some HICs have agreed to write off LICs' debts in exchange for a guarantee to protect large areas of their rainforests. For example, in 2011, the US government agreed to convert $28.5 million of Indonesian debt into an investment to protect tropical rainforests.

Selective Logging and Replanting

Selective logging involves limiting the number and types of trees that can be felled – for example, only trees of a certain height or age. This causes less damage to the rainforest's structure and biodiversity.

Replanting involves replacing any felled trees with new trees of the same type. This helps to maintain the rainforest's long-term structure and biodiversity.

Despite laws being in place to control logging, it is not always possible to enforce them because of the vastness and remoteness of rainforest areas. As a result, illegal logging is common.

FSC

Ecotourism

Ecotourism is a responsible form of tourism that supports conservation and wildlife, while also benefitting local people.

Ecotourism aims to educate visitors and minimise damage to the environment caused by tourism. It also creates employment opportunities for local people, such as work as tour guides or in hospitality.

If ecotourism programmes are managed sustainably and work to support the local community, they can positively affect an area's economy and environment.

International Agreements

International agreements can help reduce or restrict practices that damage the environment.

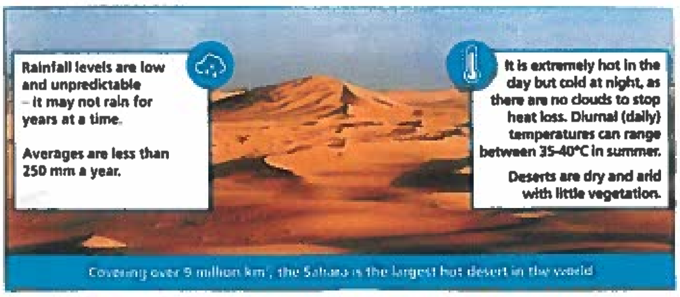
For example, hardwoods such as teak and mahogany have become increasingly scarce because of high demand in HICs where they are used to make wooden furniture.

To protect these woods, more than 70 nations signed the International Tropical Timber Agreement in 2006. The agreement limits the trade of tropical hardwoods. It requires hardwood timber to be felled from sustainably managed areas and marked with a legal registration number.

Hot Deserts

Physical Characteristics

Hot desert environments are found between 20° north and 30° south of the Equator, where hot, dry air sinks and causes cloud-free conditions.



Rainfall levels are low and unpredictable – it may not rain for years at a time.

Averages are less than 250 mm a year.

It is extremely hot in the day but cold at night, as there are no clouds to stop heat loss. Diurnal (daily) temperatures can range between 35-40°C in summer.

Deserts are dry and arid with little vegetation.

Covering over 9 million km², the Sahara is the largest hot desert in the world

Vegetation and Soil

Most hot desert soil is dry and not very fertile. Due to a lack of rainfall and sparse vegetation, there is little decomposing matter to enrich the soil. The nutrients that are present decay rapidly due to high temperatures.

Only a limited number of plants, such as drought-resistant cacti, can survive the harsh desert conditions.

Animals and People

Hot deserts offer extremely challenging environments for animals and people.

Due to the hot, dry conditions, soil is poor and desert biodiversity is low. Only specially adapted animals are able to survive.

Desert people are often nomadic, meaning they keep moving in search of food and water. They grow crops where they can and rely on animals such as goats and camels for food and transport.

Interdependence of the Ecosystem

- Soil provides plants with nutrients and water.
- Plants provide animals with nutrients and water
- Animals help plants to reproduce through pollination.
- Plant roots stabilise the soil, helping to prevent desertification
- The biotic (living) and abiotic (non-living) components of hot deserts are interdependent.

The hot desert ecosystem is extremely fragile. If one component changes, it can greatly affect the other components in the ecosystem.

- Climate change is making hot deserts hotter and drier. This change reduces the amount of water available for plants and animals.
- Crop irrigation (artificial watering) lowers the water table underground and leaves less water available for other plants.
- As the number of plants in hot deserts declines, the soil becomes less stable, and the risk of desertification increases.

Adaptations of Plants and Animals

Deserts have far less biodiversity than other global ecosystems. Plants and animals have had to develop special adaptations to survive the challenging desert conditions.

Plant Adaptations

Desert plants have had to adapt to the intense heat and dry soil.

Succulents, such as cacti and aloe, can store water in their fleshy leaves or stems. Their small, waxy leaves help to minimise water loss through transpiration. Some succulents may have toxins and sharp spines to deter thirsty animals.

Plant roots are either long and deep to reach underground water supplies or short and shallow to collect surface water when it rains.

Ephemerals, such as desert primrose, only germinate when it rains. They complete their life cycles rapidly: they grow, flower and produce seeds within a matter of weeks before dying and scattering their seeds.

Animal Adaptations

Desert animals have adapted to intense heat, a lack of water, sandy surfaces and cold nights.

Fennec Foxes

Their large ears are full of blood vessels that allow excess heat to leave their body in the day. Their fur keeps them warm during cold nights.

Camels

Camels store fat in their humps to sustain them when food and water is scarce. Their long eyelashes protect against sandstorms.

Sidewinders

Their distinctive movement helps them travel along loose, sandy surfaces and minimises bodily contact with the hot sand.

Hot Deserts: Thar Desert

Thar Desert Fact File

The Thar Desert lies partly in north-western India and partly in eastern Pakistan and covers an area of over 200,000 km². Its population of 30 million people gives it a population density greater than 80 people/km², the highest of any desert.

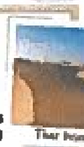
Dunes of Thar Desert

Challenges

Extreme temperatures and accessibility issues mean the people of the Thar Desert face many challenges.

Extreme Climate

The desert is extremely hot, with an average daytime temperature of around 46°C, though this can drop to as low as 5–10°C in winter. This heat makes outdoor work (e.g. farming) difficult. Rainfall is very low and ranges from 100 to 500 mm per year. Most rain falls during the July–September monsoon season. High evaporation rates from irrigation canals increase toxic salt in the soil, killing plants and making crop growth difficult.



Thar Desert

Camel in Thar Desert

Inaccessibility

Road building is limited because of melting tarmac in extreme heat and little funds. Public transport is poor and relies mostly on overloaded buses. Due to the lack of roads and heavy sandstorms, some places are accessible only by camel.

Water Supplies

Climate is the main cause of the Thar Desert's limited water supplies. Rainfall is unpredictable, and rivers do not flow all the time. Groundwater is the main source of water. However, this is usually found deep underground and requires a well. This water is often saline.

Development Opportunities

Though life in the Thar Desert can be challenging, the desert's location and natural resources (e.g. minerals, fossil fuels) have created a range of opportunities for future development.

Water well

Mineral Extraction

Minerals such as gypsum, limestone and white marble are valuable building materials, and kaolin can be used to manufacture paper.

Tourism

With its exotic location and vibrant village culture, the Thar Desert attracts a growing number of tourists. Locals can earn money by selling souvenirs, acting as tour guides or offering camel rides.

Energy Production

The lignite coal and oil found in Barmer District is used to power coal-fired electricity plants in Pakistan and India. Although coal extraction remains popular, the desert's sunny climate and high winds have created opportunities to generate green energy. There is already a wind park at Jaisalmer and a solar energy plant at Bhaleri.

Farming

The Indira Gandhi Canal has provided irrigation for commercial crops such as wheat, cotton and pulses. It is also a source of drinking water. Sustainable drought-tolerant trees, such as the jujube tree, are planted to stabilise sand dunes and produce a valuable crop.

Desertification

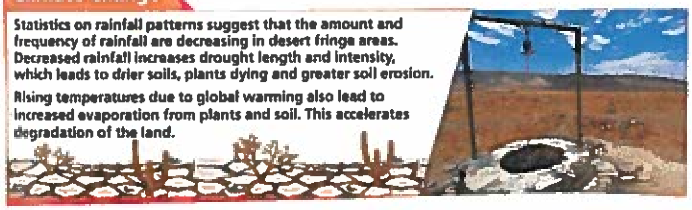
Causes of Desertification

Desert fringe areas are under threat from desertification because of climatic and human factors.

Climate Change

Statistics on rainfall patterns suggest that the amount and frequency of rainfall are decreasing in desert fringe areas. Decreased rainfall increases drought length and intensity, which leads to drier soils, plants dying and greater soil erosion.

Rising temperatures due to global warming also lead to increased evaporation from plants and soil. This accelerates degradation of the land.



Human Activities

Population growth and increased human activity are putting huge pressure on desert fringe areas. Increased demand for food and water means that land is being used more intensively. This eventually leads to soil erosion and desertification.

Overgrazing

Grazing animals strip the land of its vegetation quicker than it can grow back. Without the plant roots holding the soil together, it erodes.

Overcultivation

Replanting crops in the same area robs the soil of vital nutrients. Crops cannot grow, and the exposed soil becomes vulnerable to erosion.

Removal of Fuelwood

Trees are cut down for fuelwood for cooking, leaving the soil exposed and vulnerable to erosion.

Management Strategies

The risk of desertification can be reduced by using a variety of management strategies.

Water and Soil Management

Drip irrigation, rock walls (bunds) and terraces cut into slopes can help reduce water run-off and soil erosion. Crop rotation and the use of compost can help ensure soil is fertile and rich in nutrients. Drought-resistant plants, such as pigeon peas, are suited for crop growth in deserts.

Tree Planting

Trees help bind and stabilise soil to protect it from the wind and reduce erosion. They also provide shade, and their decomposing leaves add nutrients to the soil.

Use of Appropriate Technology

Affordable and sustainable new technologies can help people implement practices that reduce their impact on the land. For example, solar cookers can be used to reduce the need for fuelwood.

Sustainable management of a deciduous woodland – Dolby Forest

Introduction

Dalby Forest is located in North Yorkshire, West of Scarborough and South of Whitby and within the North Yorkshire Moors National Park.
It is an ancient deciduous woodland with human evidence dating back as far as the Bronze Age. The 3500 hectare forest also contains coniferous woodland used in the timber industry. Surrounding Dalby forest is moorland and mixed farm land.

Woodland Management

On steep slopes, deciduous woodland will be left unmanaged to reduce erosion and disturbance to the slopes.
Coppice management involves cutting down trees and allowing the shoots from the stumps to grow. This creates more stems and in future some of these will be cut again to allow further growth. This means that the forest will always have a mixture of young and old trees.
Invasive conifers have been gradually replaced with oak trees as they are native to Britain and are more suited to the temperate climate. Areas which already contain oak woodland have been turned into conservation areas to protect the trees.
Deer can be a nuisance in woodland as they eat tree shoots and rub their antlers on the bark as a mark of their territory. This can disrupt the ecosystem so a control of 4-7 deer per sq Km has to be met to allow a balance.

Wildlife Management

The Forestry Commission who run Dalby Forest have tried to create a varied landscape with a mixture of woodland, moorland and scrub. This provides a variety of habitats for wildlife in the area.
Invasive species such as Himalayan balsam and Rhododendron (planted by the Victorian's) will be removed to allow the new oak trees to develop and recolonise.

Community Management

Friends of Dalby Forest, who are made up of local volunteers, work in partnership with the Forestry Commission on a variety of different tasks and events throughout the year, with regular meetings the 3rd Sunday of every month. This ranges from footpath maintenance to tree planting.
Volunteers are also encouraged to visit Dalby Forest to develop and look after the mountain bike trails.

Sustainable management of a deciduous woodland – Dolby Forest

Leisure and Recreation Management

The forest aims to provide facilities and activities that meet the needs of tourists and local visitors.
The visitor centre at Thornton-Le-Dale has been sustainably built and has wind turbines, rainwater harvesting as well as counters made from recycled materials. Inside there is a hands-on interactive exhibition which allows visitors to understand the work done in the forest.
Recreational activities found at Dalby Forest include Go-Ape which has Segway hire as well as treetop walkways and zip wires; bike barn cycle hire and courses, park run and woodland themed play areas.

Education

Dalby Forest has become a hub for sharing knowledge about usage and sustainable management of ancient deciduous woodlands.
Weekly and daily monitoring takes place to look at the impact of recreational use on the forest.
Research is being carried out on how the woodland is responding to climate change and pollution.
Children have been introduced to woodlands and wildlife through use of the 'ranger in a backpack' resource which include games and activities for children to use as they walk around the forest. Activities range from building shelters, to finding out about the forest through touch.
The Dalby Activity Centre allows visitors to learn about the forest through guides. Again these focus around activities such as minibeast hunting.
Family activity packs can also be bought from the visitor centre to do activities such as orienteering.
Recently a new app has been created called the ForestXplorer which allows visitors to learn about the woodland and wildlife.