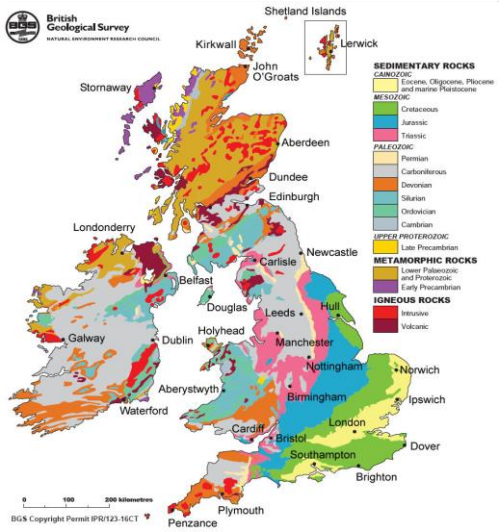
UNIT 1: CHANGING LANDSCAPE OF THE UK



THE UK'S GEOLOGY

The UK's **geology** is varied, with different rock types found in a range of locations across the country. All three distinct rock types – sedimentary, metamorphic and igneous – can all be found in the UK, and each presents distinct characteristics due to their unique formation.

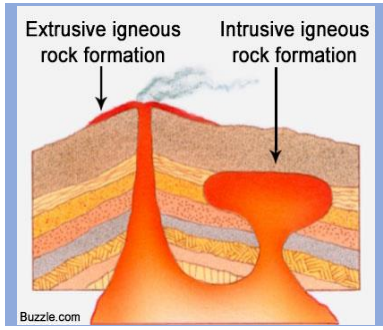
ROCK TYPE	CHARACTERISTICS	EXAMPLES	DISTRIBUTION
Sedimentary	Formed in layers, often contain fossils.	Chalk, sandstone	South East
Metamorphic	Formed by heat/pressure, crystals arranged in layers.	Marble, slate	Scotland, especially Hebrides
Igneous	Formed from magma, random crystal, very resistant to erosion.	Basalt, granite	Northern Ireland, Cornwall, Northern Scotland

FORMATION OF DIFFERENT ROCK TYPES

Sedimentary: Formed when weathered or eroded rocks and dead sea creatures are transported and deposited in layers. The weight of the sediment above causes layers at the bottom to compact and over millions of years, rocks are formed.

Metamorphic: Formed when sedimentary or igneous rocks are changed by extreme pressure or heat. These cause the rocks to change chemically.

Igneous: Formed when molten rock (magma) cools. There are two different types of igneous rock that can form through this process: intrusive and extrusive rocks.



IGNEOUS ROCK FORMATIONS

Intrusive igneous rocks are formed by magma that cools slowly underground. They are characterised by large crystals. An example is granite.

Extrusive igneous rocks are formed by magma that cools quickly above ground. These are characterised by small crystals. An example is basalt.

HUMAN ACTIVITY IN UK LANDSCAPES

Settlement building: Mass deforestation took place to make room for settlements. New build housing may not be reflective of local character in material and design, losing distinctiveness.

Agriculture: Decline in chalk grasslands due to the use of chemicals in farming. Agriculture clears the natural surface of vegetation and replaces it with monoculture and/or an artificial landscape.

Forestry: Planting coniferous trees has led to reduction of biodiversity in tree species, as deciduous are native. Cutting down large areas of forest has further worsened this issue.

UPLAND AND LOWLAND LANDSCAPES

UPLAND LANDSCAPES

Location of upland landscapes

Scotland: Cairngorm Mountains, Grampian Mountains e.g. Ben Nevis, the UK's highest peak.

Wales: Snowdonia e.g. Snowdon, Brecon Beacons.

England: The Pennines, Lake District e.g. Scafell Pike, Dartmoor and Exmoor.

Formation of upland landscapes

Geology: Made of more resistant rock types e.g. igneous or metamorphic rocks, which erode at a far slower rate.

Tectonic processes: Millions of years ago, the UK was closer to plate boundaries than today. Tectonic activity led to the formation of the geology and landscapes of today, for example, the igneous and metamorphic rock roots were formed through volcanic activity.

Glaciation: Glacial erosion during the last ice age led to rocks above the granite being eroded and the intrusive rock left exposed. It has also created U shaped valleys, hilltops and ridges found in our landscapes.

River processes: Mass movement, particularly rock fall during glacial and interglacial periods, cause broken off rocks to move downslope.

Weathering: Mechanical, biological and chemical weathering have been influenced by changes in the climate. For instance, glacial periods let to more mechanical (freeze-thaw) weathering, whilst the hot and humid climate of the South West accelerates weathering too.

LOWLAND LANDSCAPES

Location of lowland landscapes

Lowland landscapes are predominantly found in southern and eastern parts of England.

England: The Wash (East Anglia), Lincolnshire, London Basin, Vale of York.

The Fens (East Anglia) are the lowest part of the UK.

Formation of lowland landscapes

Geology: Sedimentary rocks. Lowland landscapes are not always flat, and can contain rolling hills, but they tend to be lower than uplands as the rock type is less resistant to physical processes.

Tectonic processes: 250-350 million years ago, the UK was surrounded by warm, tropical seas rich in plant and animal life. Dead plant and sea creatures were deposited on the sea bed in layers, forming sedimentary rocks.

Glaciation: The lowland areas of the UK were shaped by glacial erosion to a greater extent than upland landscapes. These formed distinctive lowland landscapes continually shaped by river processes today.

UNIT 1A: COASTAL LANDSCAPES AND PROCESSES

PHYSICAL PROCESSES

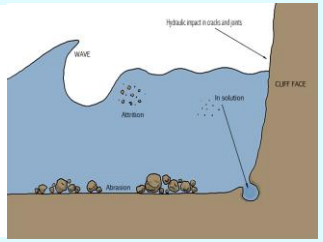
Hydraulic action: Water crashing into joints and faults causes pressure to increase, breaking the rock apart.

Abrasion: Rocks carried in waves grind away at the cliff face.

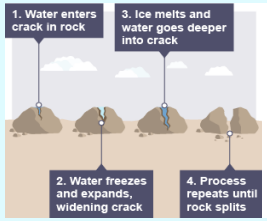
Attrition: Rocks being carried by waves hit into each other, causing them to become smaller, smoother, and rounder.

Solution: Rock minerals dissolve in the water.

EROSION



WEATHERING



Biological: Plant roots get into cracks in the rock. As plant grows, rock is forced apart. Burrowing animals may cause rock to weaken.

Chemical: Slightly acidic rainwater reacts with minerals in rock, causing it to dissolve.

Mechanical: One example of this is freeze-thaw, where the repeated freezing and thawing of water causes a crack to widen over time and the rock forced apart.

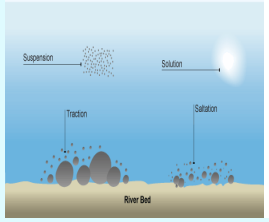
MASS MOVEMENT

Coastal cliffs become less steep over time as material is moved by:

Sliding: Where weathered/eroded rock or earth material moves down a slope. Gravity pulls the weakened material downwards quickly.

Slumping: When saturated (filled with water) soil slumps down a curved surface. Common after heavy rainfall or storm surges in winter.

TRANSPORTATION



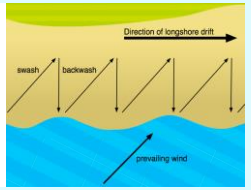
Solution: Minerals in rocks like chalk and limestone are dissolved in water and carried in solution – the load is not visible.

Suspension: Small particles are suspended in flow of water.

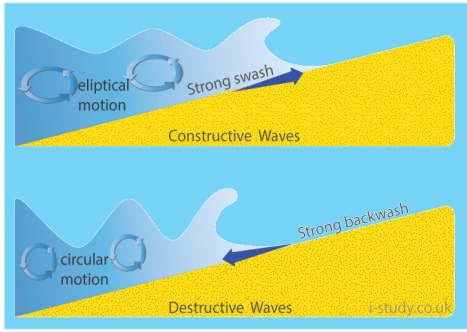
Saltation: Where small pieces of shingle bounce along the sea bed.

Traction: Larger material are rolled along the sea bed e.g. boulders.

LONGSHORE DRIFT



Due to the direction of the prevailing wind (strongest wind), waves approach coast at an angle. The swash carries material towards the beach, and the backwash carries material back down the slope of the beach and back out to sea at a right angle due to gravity. Over time, this process repeats and material moves along the beach in a zig-zag formation.



WAVE TYPES

Constructive waves have a strong swash (wave moving towards the coast) and a weak backwash (wave moving away from the coast). This means that they bring material to the beach and contribute to the creation of depositional landforms such as beaches and spits.

Destructive waves have a weak swash and a strong backwash. These are responsible for erosion, forming arches, bays and wave-cut platforms.

COASTAL LANDFORMS

Longshore drift moves material along the coastline, its direction dictated by the prevailing wind. As the coastline changes direction, material is deposited offshore due to a loss of energy in the water. Over time, there is a build up of material off the coast, forming a spit. Gradually, the spit can become hooked or recurved, its shape influenced by both the river and coast. Behind the spit, mudflats or a saltmarsh can form, creating a habitat for seabirds and marine life.

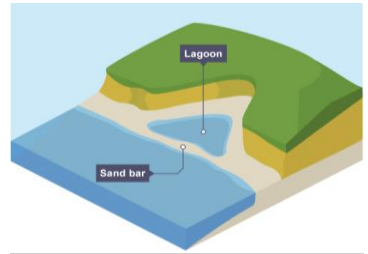
Bars are formed in a similar way to spits. They occur where there is a gap in the coast with water in it. This might be a bay or a natural hollow along the coast. The process of longshore drift occurs and carries material across the front of the bay. The deposited material eventually joins up with the other side of the bay and a strip known as a sand bar blocks off the water in the bay. The area behind this newly formed bar is known as a lagoon.

Wave refraction causes waves to attack the side of the headland. This causes faults in the rock to be exploited through processes of erosion (hydraulic action and abrasion), which widen over time to create caves. Over time, erosion cuts through to the other side of the headland and an arch is formed. Consequently, due to a lack of support, the arch collapses under the force of gravity and a stack is left behind in the water, separated off from the mainland.

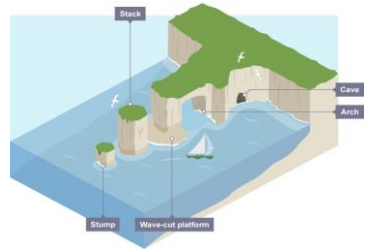
The sea attacks the base of the cliff between the high and low water mark. A wave-cut notch is formed by erosional processes such as abrasion and hydraulic action. This causes the notch to increase in size, and the top of the cliff is weathered, causing it to weaken further. Over time, the instability of the cliff will result in eventual collapse, resulting in mass movement as a large quantity of material falls onto the beach or in the water. The backwash transports this material away, revealing a wave-cut platform. This process will repeat, causing the cliff to retreat further back over time.

LONGSHORE DRIFT & SPIT FORMATION

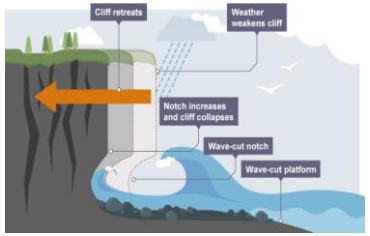
BAR FORMATION



CAVES, ARCHES, STACK & STUMPS



WAVE-CUT PLATFORMS



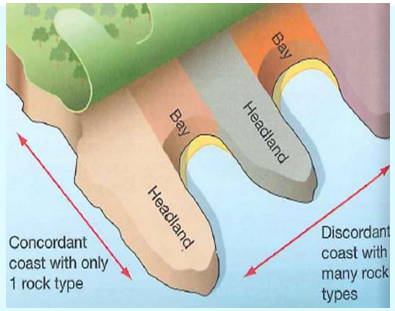
UNIT 1A: COASTAL LANDSCAPES AND PROCESSES

GEOLOGY OF THE COASTLINE

Concordant coastlines are found where there is only one rock type present. **Discordant** coastlines, by comparison, are made up of alternating rock types and will therefore experience differential erosion.

Hard rocks are more resistant e.g. igneous which will be less affected by weathering and erosion. These will form headlands.

Soft rock are less resistant rocks e.g. sedimentary which will be more vulnerable to physical processes.



COASTAL DEFENCES

SEA WALL

ROCK ARMOUR/RIP RAP

GROYNES

BEACH NOURISHMENT

IMPACTS OF COASTAL EROSION

These may vary by coastline, its geology and any existing sea defences, but may include:

Social: Disruption to electricity supplies, damage to transport and communication networks, loss of people's homes.

Economic: Decreasing value of property, difficulty obtaining home insurance, loss of business from disappearing cliffs, loss of agricultural land, reduction in tourism.

Environmental: Wildlife habitats destroyed for plants and animals, particularly nesting seabirds.

HOW DOES THE UK'S WEATHER AND CLIMATE AFFECT THE COAST?

Prevailing wind: The UK's prevailing winds come from the south-west. This brings warm, moist air from the Atlantic and frequent rainfall, which contributes to weathering and mass movement on the coast.

Seasonality: In the winter, cold temperatures lead to freeze-thaw weathering in cliffs. This is also the season in which storms are most frequent.

Storm frequency: Frequent storms can damage delicate coastal landforms like spits. Beach sediment may be removed from sections of the coastline, which may lead to increased rates of erosion in these places.

Climate change: A warmer climate causes thermal expansion and glacier melt, contributing to rising sea levels. This will result in greater rates of erosion and coastal retreat increasing in places.

	HOW IT WORKS	ADVANTAGES/DISADVANTAGES
SEA WALL	A curved concrete wall that deflects waves back out to sea to reduce erosion.	Most effective solution that lasts a long time, promenade for tourists to enjoy. Expensive (£6k a metre), visually displeasing and can make beach less accessible
ROCK ARMOUR	Large boulders at the base of a cliff that absorb wave energy. The gaps between the rocks allow the water through, dissipating the energy.	Effective protection for many years, acts as a barrier in front of the cliff. Expensive to transport boulders, beach inaccessible, different to local geology.
GROYNES	Wooden/rock structures built at right angles that trap sediment being transported through longshore drift. Built up beach can absorb energy.	Quick to construct, widens the beach to attract more tourists. Stops longshore drift which leads to more erosion further along coast, wooden groynes can rot.
BEACH NOURISHMENT	When sand/shingle is added to the beach to make it wider. The beach can absorb more wave energy and protect the coastline.	Provides beach for tourists, looks natural, cheaper than hard engineering strategy. Requires constant maintenance as material is washed away, so can become costly

If an engineering strategy cannot be justified then **managed retreat** is implemented, which is the controlled flooding of low-lying coastal areas to reduce the volume of water available to flood other built-up areas of land containing buildings and houses. This is a low-cost strategy and it can create a salt marsh which can encourage wildlife, however landowners have to be compensated for lost land.

UNIT 1B: RIVER LANDSCAPES AND PROCESSES

PHYSICAL PROCESSES

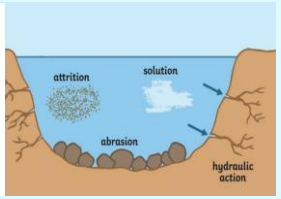
Hydraulic action: Water crashing into river bed causes air to become trapped in cracks, breaking the rock apart.

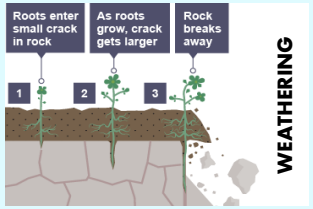
Abrasion: Pebbles grind against river bed, creating a sand-paper like effect.

Attrition: Rocks being carried by the river hit into each other, causing them to become smaller, smoother and rounder.

Solution: Rocks are dissolved e.g. limestone and carried by the water.

EROSION





WEATHERING

Biological: Plant roots get into cracks in the rock. As plant grows, rock is forced apart. Burrowing animals may cause rock to weaken.

Chemical: Slightly acidic rainwater reacts with minerals in rock, causing it to dissolve.

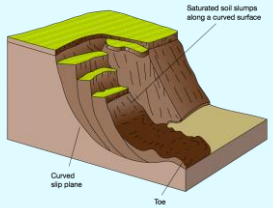
Mechanical: One example of this is freeze-thaw, where the repeated freezing and thawing of water causes a crack to widen over time and the rock forced apart.

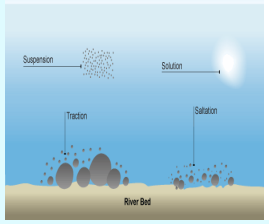
River valleys become less steep over time as material is moved by:

Sliding: Where weathered/eroded rock or earth material moves down a slope. Gravity pulls the weakened material downwards quickly.

Slumping: When saturated (filled with water) soil slumps down a curved surface. Common after heavy rainfall caused by winter storms.

MASS MOVEMENT





TRANSPORTATION

Solution: Minerals in rocks like chalk and limestone are dissolved in water and carried in solution – the load is not visible.

Suspension: Small particles and silts are <u>suspended</u> in flow of water.

Saltation: Where large pebbles are <u>bounced</u> along the river bed.

Traction: Larger material is <u>rolled</u> along the river bed e.g. boulders.

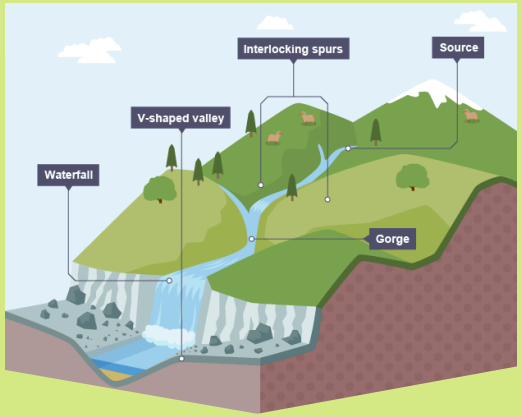
The rate at which these physical processes occur will vary at different points along a river's course:

Upper: Vertical erosion is the main process, often through hydraulic action and abrasion.

Middle: Tributaries increase the volume of water, leading to more energy for lateral erosion and transportation.

Lower: The energy of the river decreases, leading to greater rates of deposition.

RIVER LANDFORMS FROM SOURCE TO MOUTH



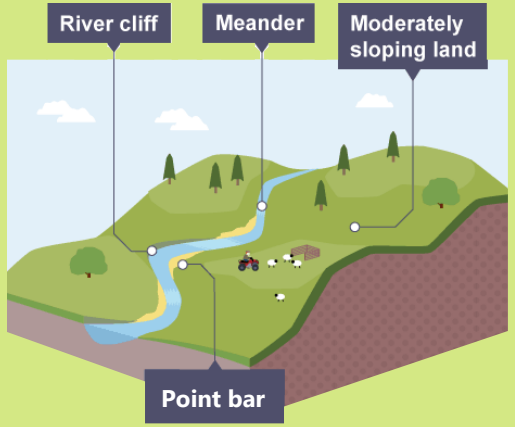
In the **upper course**, rivers are shallow (low discharge) and have less energy (slower velocity) due to friction with the riverbed. The surrounding land is made up of varying rock types, some of which are <u>more resistant</u> to erosion. The river will wind around these areas, cutting down into weaker rock which creates **interlocking spurs**. As the main form of erosion in the upper course is <u>vertical</u>, V-shaped valleys will also feature in upper course landscapes.

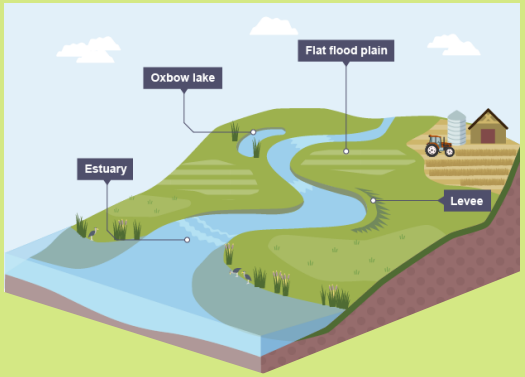
Waterfalls are formed in areas where hard rock overlies softer rock. The soft rock is less resistant and erodes faster, creating a <u>step</u>, with a <u>plunge pool</u> at the bottom. As the river flows over the step, <u>hydraulic action</u> and <u>abrasion</u> deepen and widen the plunge pool and the soft rock erodes further. When the overhang becomes top heavy and unstable it breaks off, collapsing into the plunge pool beneath. Over time, this process will repeat, leading to waterfall recession and a <u>gorge</u> being created.

Moving into the **middle course**, the river deepens and widens due to vertical and lateral erosion. This causes the <u>velocity</u> (speed) and the <u>discharge</u> (volume of water) to increase, resulting in the formation of distinctive landforms.

Meanders are formed through erosional and depositional processes. The forces of the fast-flowing water <u>erode</u> the outside bend of the river, undercutting the bank and forming a steep <u>river cliff</u>. On the inside bend, the river is shallower and moves slower. Less energy results in <u>deposition</u> and the formation of a point bar. Continued erosion will widen the meanders over time.

Where land is flatter in the middle/lower course, **ox-bow lakes** feature. These are formed when continued erosion of the outside bend of a river cause the neck of the meander to narrow. In a flood, the water breaks through the neck and takes the straighter, faster route. This causes material (alluvium) to be deposited in the old bend, cutting it off and creating an ox-bow lake.





The relief of the land is flattest in the **lower course** of the river. Gravity has less of an influence, resulting in a slower <u>velocity</u> and more <u>deposition</u> occurring.

Floodplains are wide, flat areas either side of a river which are covered in water in event of a flood. When this occurs, the water loses speed and energy once it leaves the river channel, causing <u>deposition</u> to occur. The largest/heaviest material is deposited on the banks since it require the most energy to be transported. Over time, further flooding will raise the height of the floodplain and cover it in a material called <u>alluvium</u>, which makes the land very fertile and good for agriculture. The steeper riverbanks are known as **levees**, and these decrease future flood risk as the river channel can hold a greater volume of water.

Estuaries are found where a river meets the sea. The river here is tidal and when the sea retreats, the volume of water in the estuary reduces. This will result in deposition and the formation of <u>mudflats</u>, an important wildlife habitat.

UNIT 1B: RIVER LANDSCAPES AND PROCESSES

HOW DOES THE UK'S WEATHER AND CLIMATE AFFECT RIVERS?

Droughts: Decreased erosion, weathering and transportation due to a loss of energy resulting from lower discharge (volume of water). Baked soil becomes impermeable which increases surface-run off and flood risk.

Seasonality: More freeze-thaw weathering in the winter when temperatures are colder.

Storms: Heavy rainfall from storms leads to greater discharge and therefore more erosion and transportation.

Climate change: Increased frequency of storms will lead to more erosion and transportation, whilst rising temperatures will lead to more evaporation and less erosion due to the decrease in water.

HOW DOES HUMAN ACTIVITY AFFECT RIVER LANDSCAPES?

Urbanisation: More impermeable surfaces e.g. concrete lead to more surface run-off. Homes built on floodplains to meet housing demands. Channelisation of rivers for urban development disrupts physical processes e.g. erosion and deposition, and can increase flood risk elsewhere.

Agriculture: Ploughing fields can increase sediment in rivers and increase deposition. Field drains may cause surface run-off into rivers. Abstracting water for irrigation reduces discharge of river, causing more deposition.

Industry: May lead to over abstraction (more water taken from river than can be replenished). Industrial processes may pollute rivers with chemicals, harming plants, animals and damaging the natural landscape.

CAUSES AND EFFECTS OF FLOODING

HUMAN

Urbanisation: More impermeable surfaces e.g. concrete and drainage systems lead to more surface run-off.

Deforestation: Less interception so rain reaches ground faster. Ground becomes saturated, more run-off.

Agriculture: Irrigation creates channels allowing water to reach rivers faster.

Climate change: More frequent storms will increase discharge.

PHYSICAL

Relief: Steep slopes increase surface run-off and allow less time for water to be absorbed by the soil.

Geology: Impermeable rocks reduce infiltration. Water unable to percolate from thin soil above.

High rainfall intensity: Soil becomes saturated and infiltration reduced.

Weather conditions: Hot, dry soils can make the soil impermeable leading to an increase in surface run-off.

The **effects** of flooding will depend on the intensity of the flood event, the area affected and the river defences that are in place. However, they are likely to include: landslides, soil erosion, loss of natural habitats, contamination of water supplies, death, diseases, damage to property, loss of crops/farm animals and disruption to transport.

RIVER DEFENCES

DAMS

CHANNELISATION

WASHLANDS

FLOOD PLAIN ZONING

	HOW IT WORKS	ADVANTAGES/DISADVANTAGES
DAMS AND RESERVOIRS	Control the level of water in the river.	Can provide a water supply and produce hydroelectric power (HEP). Creates a large area of water that can be used for recreational activities. Expensive to build and control the flow of the water. Construction often involves flooding habitats or large areas of land. Reduces flow downstream which may create conflict e.g., Ataturk Dam has led to tension between Turkey and Iraq.
CHANNELISATION	Straightening channels and making them wider and deeper, increasing channel capacity.	Allows more water to flow through the channel, decreasing flood risk. Can also be used to divert water from at risk areas e.g., city centres. Water is taken downstream which may increase flood risk elsewhere. Do not look natural so will not fit into the landscape. Very costly to build.
WASHLANDS	Allows either side of the river (floodplains) to be deliberately flooded.	Can store a large volume of water and help to protect the areas against significant flooding. Controlled flooding means there is less disruption to people's lives. Preserves parklands within urban areas. Land cannot be used during flooding, which may create economic costs for agricultural industry.
FLOODPLAIN ZONING	Identifying areas at risk of flooding and managing the land use of the area.	More expensive buildings and land use are moved to safer areas. Less damage leads to lower insurance claims. Restricts future land use and development. Cannot move existing property, so particularly ineffective in historical areas.

Paper 1- Unit 2- Weather Hazards and Climate Change

THE UK'S CLIMATE

Latitude: The UK is located at 50-60°N. Solar radiation is less direct than at the equator, meaning less heat energy.

Prevailing wind: South-westerly brings warm, moist air and therefore more rainfall in SW England and Wales.

Air masses: Five air masses influence the UK climate, resulting in changeable weather conditions.

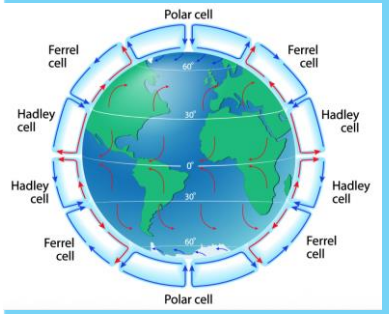
Continentality: Surrounded by sea, the UK experiences less extreme temperature variations than inland areas.

Seasonality: Four distinct seasons. Axial tilt means the sun is more concentrated in the summer, bringing more heat energy to the UK and therefore warmer temperatures.

GLOBAL CLIMATE SYSTEMS

GLOBAL ATMOSPHERIC CIRCULATION

Areas at different latitudes receive different amounts of solar radiation. There is a surplus at the equator, and a deficit at the poles. The GAC redistributes this heat energy.



Hadley cell: Warm air rises at the equator, causing low air pressure. As the air reaches the edge of the atmosphere, it travels north/south towards the poles and starts to cool, sinking at 30°N/S leading to high air pressure.

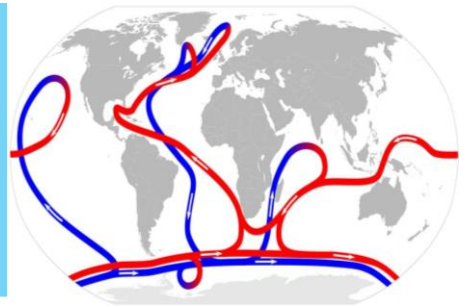
Polar cell: Cold air descends at the poles (90°N/S) resulting in high air pressure. As it travels towards the equator, it warms up and rises at 60°N/S, forming low air pressure.

Ferrel cell: Warm air from the tropics and cold, polar air meet around 60°N/S. Warmer air is lighter and rises, creating low pressure at the surface.

OCEAN CURRENTS AND THE NORTH ATLANTIC DRIFT

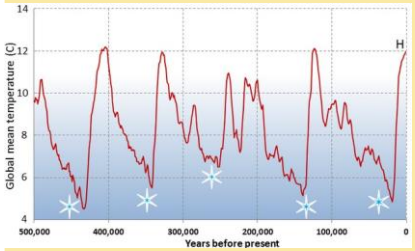
Heat from the tropics can be transferred to the cold, polar regions by large-scale water movements within the oceans. Warm currents transport warm water from the equator towards the poles, and cold currents take colder water towards lower latitudes.

The **North Atlantic Drift (or Gulf Stream)** ocean current flows across the Atlantic Ocean, bringing warm water from the Guld of Mexico. This results in milder temperatures in the west of the UK.



NATURAL CLIMATE CHANGE: CAUSES AND EVIDENCE

The Earth has experienced natural fluctuations in its climate between glacials (cold period) and interglacials (warm periods).



Orbital changes: Milankovitch cycles (eccentricity, obliquity and precession) result in natural warming (interglacial) and cooling (glacial) periods.

Solar variation: There can be fluctuations in the amount of radiation produced by the sun. If there is a high amount emitted, temperatures will increase. This can be caused by sunspots. Relatively short-term.

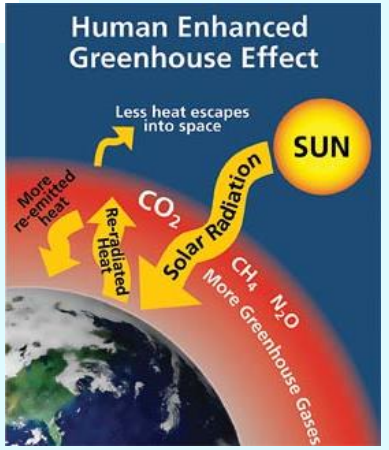
Volcanism: Volcanic eruptions release large amounts of dust containing gases such as sulphur dioxide. These can block incoming solar radiation, resulting in cooler temperatures. This has a short-term effect on the world's climate or may be localised.

The **evidence** of natural climate change is varied, with ice cores and tree rings giving us evidence. Tree rings show the temperatures of given years, with thick rings showing warm and wet years, and thin rings show cool and dry. Ice cores show the levels of carbon dioxide within the ice. More carbon dioxide shows for a warmer year.

HUMAN CLIMATE CHANGE

ENHANCED GREENHOUSE EFFECT

Greenhouse gases, and the 'greenhouse effect', are vital for holding heat within our atmosphere and keeping the Earth at a liveable temperature. The enhanced greenhouse effect, however, has resulted from human activity and increase greenhouse gas emissions. It causes more heat to be trapped in the atmosphere, resulting in rising temperatures. Causes of the enhanced greenhouse effect include:



Transport: Cars have become more affordable, and ownership has increased. Long haul flights have reduced in price, increasing popularity. More fuel burnt because of both.

Energy: Growing demand due to increases in population and technology. Main source is fossil fuels, which produce greenhouse gases when burned to create electricity.

Agriculture: Rice production and cattle ranching release methane into the atmosphere. Deforestation for agriculture means fewer trees to remove CO_2 from the atmosphere.

IMPACTS OF CLIMATE CHANGE ON PEOPLE AND THE ENVIRONMENT

The impacts of climate change are varied, with localised and global effects.

Changing crop yields: Global crop fields of soy, maize, rice and wheat are decreasing as a result of climate change. As the availability of these decreases, food prices will rise as demand for these staple foods remains high. May lead to malnutrition in developing countries.

Rising sea levels: Rising temperatures are leading to thermal expansion, where the molecules within water expand in size and therefore the volume of water increases. Rising sea levels will affect 200 million people by 2100, particularly affecting low-lying areas.

Retreating glaciers: Glaciers in locations such as the Himalayas are melting quickly as a result of rising temperatures. Due to the volume of water, this will affect ocean currents and exacerbate rising sea levels, as well as reduce freshwater supply for drinking and irrigation locally.

Paper 1- Unit 2- Weather Hazards and Climate Change

TROPICAL CYCLONES

CAUSES OF TROPICAL CYCLONES

Tropical storms form between 5-30° N/S of the equator. They cannot form on the equator as the Coriolis effect is too weak.

1. When ocean surface water reach at least 27°C due to solar heating, the warm air above the water rises quickly, causing an area of very low pressure.
2. As the air rises quickly, more warm and moist air is drawn upwards from above the ocean, creating strong winds.
3. The rising, warm air spirals upward and cools. The water vapour it carries condenses and forms clouds, which make up the eye wall of the storm. Cooling air sinks in the centre of the storm, creating calm conditions in the eye.
4. With trade winds blowing in the opposite direction and the rotation of the earth involved (Coriolis effect), the storm will eventually start to spin.

LOCATED EXAMPLES: HURRICANE SANDY AND TYPHOON HAIYAN

	Hurricane Sandy, USA (2012)	Typhoon Haiyan, The Philippines (2013)
CONTEXT	A Category 3 storm, Hurricane Sandy hit the eastern coast of the USA in October 2012. Impacts were smaller and short-term in nature due to the preparedness of the country.	A Category 5 storm, Typhoon Haiyan was one of the worst in the country's history. Preparation and responses were inadequate due to a lack of resources, meaning the impacts were far more destructive and have taken many years to recover from.
IMPACTS	• 150 deaths • $65bn in damage to property/infrastructure • NY stock exchange closed for 1 day • 1.5bn litres of sewage released into river	• 6000 deaths • 500,000 displaced (made homeless) • Mangrove forest destroyed • $2bn damage cost • Damage to infrastructure e.g. Tacloban airport
RESPONSES	• FEMA resources put into place before the hurricane e.g. hurricane tracking, evacuation 17,000 Red Cross workers provided food, water and shelter to those in need • AmeriCare raised $7.1 million in aid	• Government declared an emergency, meaning other countries were called in to support them • Community effort to rebuild houses • Save the Children distributed rice seeds so farmers could plant crops, educated children about sanitation

DROUGHT

CAUSES OF DROUGHT

Drought is an acute water shortage associated with long periods of rainfall deficiency. There are two main causes of drought: **meteorological** and **hydrological**. Meteorological drought occurs when the amount of precipitation received is less than the average, whilst hydrological drought is caused decreased precipitation affecting water supply e.g., rivers, reservoirs and groundwater.

CAUSE	EXPLANATION
Natural variations in atmospheric conditions (meteorological) **Natural cause**	• Prolonged high-pressure systems reduce evaporation and the amount of water vapour in the atmosphere. This will mean there is less precipitation and more chance of drought.
Agriculture **Human cause**	• Increase of farming may involve unsustainable use of irrigated water in crop production. This leads to overuse of water, where more water is taken from water sources than is replenished.
Dam building **Human cause**	• Large areas of land behind a dam are flooded to create a reservoir, an artificial store of water that may be used for consumption or energy production. This greatly reduces the amount of water flowing downstream, which can lead to shortages and/or drought.
Deforestation **Human cause**	• Cutting down trees reduces the soil's ability to hold water, causing land to dry out which can result in droughts. • Deforestation leads to reduced tree cover, meaning that there is less transpiration. As a result, it reduces the amount of moisture in the atmosphere leading to less rainfall.

LOCATED EXAMPLES: ETHIOPIA AND CALIFORNIA, USA

Ethiopia

More severe impacts due to the ineffectiveness of responses. Been experiencing droughts since the 1980s. 85% of the community depend on agriculture.

IMPACTS
- Loss of 17,000 farming jobs
- Many children had to walk 20km to get water
- Increase in diseases in wildlife
- Wildfires destroyed local habitats

RESPONSES
- Large charity events such as Live Aid helped raise awareness.
- Oxfam helped secure water sources.
- USA gave $128 million in food aid in 2015.

California, USA

Less severe impacts due to response. A period of lower than usual rainfall and snowfall cause distinct drop in water supplies.

IMPACTS
- Hosepipe bans were put in place.
- Farmers unable to go crops.
- Land and drinking water contaminated by sea water.
- Wildfires destroyed local habitats.

RESPONSES
- State government ran campaigns to educate on saving water supplies.
- Farmers recommended to use drip irrigation.
- Homeowners asked to check for leaks.

UNIT 3: ECOSYSTEMS, BIODIVERSITY, AND MANAGEMENT

SIX MAIN GLOBAL BIOMES

The distribution of global biomes is influenced by a range of different factors, including latitude, altitude and continentality. These affect the broad ranging climates experienced globally, and therefore vegetation found in different regions.

The six main global biomes, each of which holds unique biodiversity, are:

- Tropical rainforests
- Grasslands
- Deserts
- Temperate deciduous forests
- Taiga
- Tundra

UK'S MARINE ECOSYSTEMS

As the UK is an island, it has many unique marine ecosystems around its coastline. These can provide many benefits, including:

Tourism: 250 million people visit the UK's coast.
Fishing: Provides 25,000 jobs and generates income as the UK sells fish overseas.
Energy production: London Array in the Thames Estuary is the world's biggest wind farm. The UK has oil reserves of around 24 billion barrels in the North Sea.

Human activity can damage marine ecosystems in many ways, including:
Overfishing: Removing too much of a particular species will disrupt the food chain, leading to less fish or smaller fish.
Boat trawling: Big nets pulled along the seabed can cause destruction to marine life and habitats.
Economic development: Growth of urban areas and industry can damage or remove coastal ecosystems.

UK'S TERRESTRIAL ECOSYSTEMS

There are four main ecosystems found in the UK.

MOORLAND

Found in upland areas with heavy rainfall such as Dartmoor. Characterised by acidic or peaty soils, low-growing shrubs.

HEATHLAND

Found in lowland areas such as the South Downs. Characterised by infertile soils and heather. Lots of human intervention here.

WETLAND

Very small amount remaining in areas like East Anglia. Characterised by waterlogged soils, reeds and bulrushes and birds.

WOODLAND

12% of UK land is woodland. Mainly deciduous trees in England. Brown, earthy soils. Squirrels, foxes and hedgehogs found here.

THE THREAT OF DEFORESTATION

Deforestation is when trees are cut down or removed, usually for an economic purpose.

TROPICAL RAINFORESTS

Urbanisation:
- Trees are cut down for timber. This can be used in the construction of buildings, and demand for this material has increased as the rate of urbanisation has grown.
- Land is cleared to build housing that can accommodate a growing population.

Resource extraction:
- Trees can provide fuel, timber and medicine.
- Land is cleared to access resources beneath rainforests, such as minerals, metals and oil/gas.

Agriculture:
- Land is cleared for cattle ranching or palm oil production. Demand for both is increasing as populations rise.

TEMPERATE DECIDUOUS FORESTS

Urbanisation:
- Ancient woodlands were cleared to allow urban areas to expand (urban sprawl) and house a growing population.

Resource extraction:
- Trees are chopped down for resources such as timber, which can be used in the construction of housing and furniture.

Agriculture:
- Changing agricultural practices, and the need to feed a larger population, have meant more land is needed for agriculture. This has resulted in large areas of forest being chopped down.

NUTRIENTS IN THE TRF AND TDF

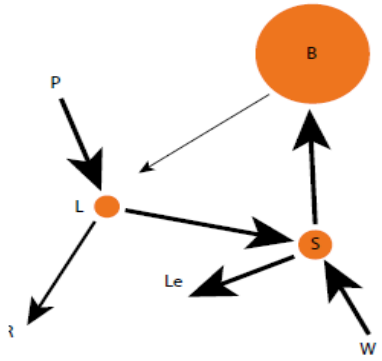
The nutrient cycle (**Gersmehl model**) involves the movement of nutrients between the physical environment (**abiotic**) and living organisms (**biotic**). Their interaction makes the ecosystem function.

TROPICAL RAINFORESTS

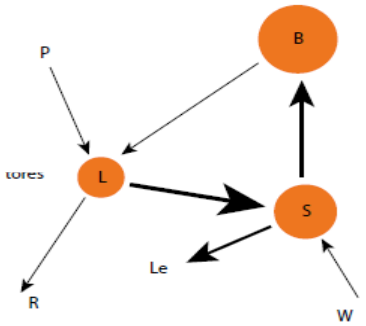
Litter:
- Hot and humid conditions allow for rapid decomposition of dead plant material. This provides nutrients easily absorbed by plant roots. High precipitation in the TRF causes increased rates of surface run-off and leaching.

Soil:
- Many of the soils in the TRF are old and low in nutrients. Leaching occurs due to high precipitation, causing nutrients to be washed away.
- Nutrients stay close to the surface and do not remain in the soil for long, due to high demand from the TRF's many growing plants.

Biomass:
- This is the largest store of the TRF's nutrient cycle, as high levels of biodiversity mean lots of nutrients are stored within the vegetation.



TEMPERATE DECIDUOUS FORESTS



Litter:
- Larger than the soil due to nutrient transfer being slower. This is due to rainfall and humidity levels being lower than that of the TRF.
- The colder climate of temperate deciduous forests also reduces the rate of decomposition.
- Bigger in the autumn/winter due to the high concentration of deciduous trees in the TDF.

Soil:
- Soils are more fertile than those in the tropical rainforest due to slower nutrient uptake, less leaching and less surface run-off.

Biomass:
- A large biomass because there is plenty of precipitation and summer warmth, though this is not as big as that of the tropical rainforest.

UNIT 3: ECOSYSTEMS, BIODIVERSITY, AND MANAGEMENT

THE IMPACT OF CLIMATE CHANGE IN THE TRF AND TDF

TROPICAL RAINFORESTS

Structure: Less rainfall may cause TRF to become a seasonal tropical forest due to a prolonged dry season.
Functioning: Drier forest emits more CO_2 than it takes in. High likelihood of forest fires which will worsen this.

Biodiversity: Plant species cannot tolerate drier conditions, prolonged drought or forest fires. Spread of invasive species that TRF not immune to.

TEMPERATE DECIDOUS FORESTS

Structure: High temperatures make drought and forest fires more likely. This could cause significant damage to plant and animal habitats.

Functioning: Increased risk of drought could threaten the survival of trees.

Biodiversity: Milder winters could mean an introduction of invasive species, threatening and possibly reducing levels of biodiversity.

SUSTAINABLY MANAGING THE TEMPERATE DECIDOUS FOREST

LOCATED EXAMPLE: THE NEW FOREST, HAMPSHIRE, ENGLAND

The New Forest is located within Hampshire, South England. Approximately 175,000 people live within the park. Annual, the forest brings in £500 million in tourism.

Issues of New Forest	Management of New Forest
Trampling: Visitors cause trampling of delicate plants and erode the grass. They also may start fires with BBQs and drop litter. **Driving:** Visitors may scare livestock (ponies and pigs) by driving too quickly. **Forest operations:** Some forestry operations are not compatible with visitors using woodlands for recreation.	• A visitor leaflet called '5 ways to love the New Forest' suggests why visitors should drive slowly through the forest and leave cars behind. • Foresters cut down timber, plant new trees and cull deer in winter, when there are few visitors. • Special cycle routes and paths have been set up through the Park, which guides visitors away from vulnerable areas.

BIODIVERSITY IN THE TRF AND TDF

The TDF has very high biodiversity because rainforests offer the optimum conditions for plant growth, which then supports very high animal biodiversity. There are a variety of layers which provide many different habitats. By contrast, the TDF has only moderate biodiversity in comparison to tropical rainforests due to the low temperature conditions that slow down the production of food in winter months.

TROPICAL RAINFORESTS

Plants
Buttress roots: Wide roots stabilise the tree as it increases in height. Shallow rooted in the soil as this is where nutrients are.

Drip tips: an adaptation of 95% of plants in the TRF, these help to remove excess water from the plant in a biome with frequent rain.

Animals
Lemur: Have strong arms/grip to allow them to swing between the different trees in the canopy layer.

Serpent eagle: Sits motionless then pounces on prey. Sharp beak and powerful legs enable it to catch snakes, lizards and other small mammals.

TEMPERATE DECIDUOUS FORESTS

Plants
Oak tree: Deciduous leaves shed in autumn/winter to preserve energy. Thick back protects them during cold winter. Broad leaves allow tree to maximise photosynthesis during summer months.

Bluebells: Bloom in early Spring before trees come into leaf to maximise sunlight exposure.

Animals
Hedgehogs: hibernate to slow down their energy use during winter months when food is scarcer.

Nightingales: Migrate to Africa during the winter months due to the lack of food availability in the UK.

SUSTAINABLY MANAGING THE TROPICAL RAINFOREST

LOCATED EXAMPLE: THE AMAZON RAINFOREST, SOUTH AMERICA

The Amazon rainforest is in the north of South America, spanning an area of around 8 million km2. including parts of Brazil, Columbia, Peru, Venezuela, Ecuador Bolivia, Suriname, Guyana and French Guyana. Already, 20% of the Amazon biome has been lost, and the World Wildlife Fund estimates that 27% of the Amazon biome will be without trees by 2030 if the current rate of deforestation continues.

STRATEGIES
Governance: In Brazil, the largest protected area of rainforest is the CACC.It is classified as a World Heritage Site. Limits are placed on hunting, logging and fishing. Local people are employed to teach members of the community on how to protect habitats and endangered river species. **Selective logging:** Selective logging involves only removing a small number of trees, allowing the forest to regenerate naturally. Sustainable logging companies such as Precious Woods Amazon place limits on the number of trees being cut down so the rainforest can recover. **Ecotourism:** An example of an ecotourism project is the Yachana Lodge in Ecuador. It is in a remote area of the Amazon Rainforest where local people rely on subsistence farming. The project employs local people. This provides a reliable source of income and a better quality of life. Tourists are only allowed to visit in small groups