

# Geography GCSE Revision Guide



Paper

1:

The

## Physical Environment

Topic areas included in this paper:

- The Changing Landscape of the UK
- Coastal Landscapes and Processes
- River Landscapes and Processes
- Weather Hazards and Climate Change
- Ecosystems, Biodiversity and Management

NOTE – Question 4 is an optional question on *Glaciation*. **DO NOT ANSWER THIS QUESTION**

Name:.....

Form: .....



# Section A – The Changing Landscape of the UK (UK Physical Landscape)

## 1.1 There are geological variations within the UK

### Sedimentary rock

Rock examples - Sandstone and Chalk

Formation/characteristics - formed in layers; formed when smaller grains are compressed together; often contains fossils; soft rock (easily eroded).

Location - largely found in lowland areas such as, central and south West England

### Igneous rock

Rock examples - Granite and Basalt

Formation/ characteristics - formed from Magma, when it solidifies; these are very hard rocks; they contain crystals.

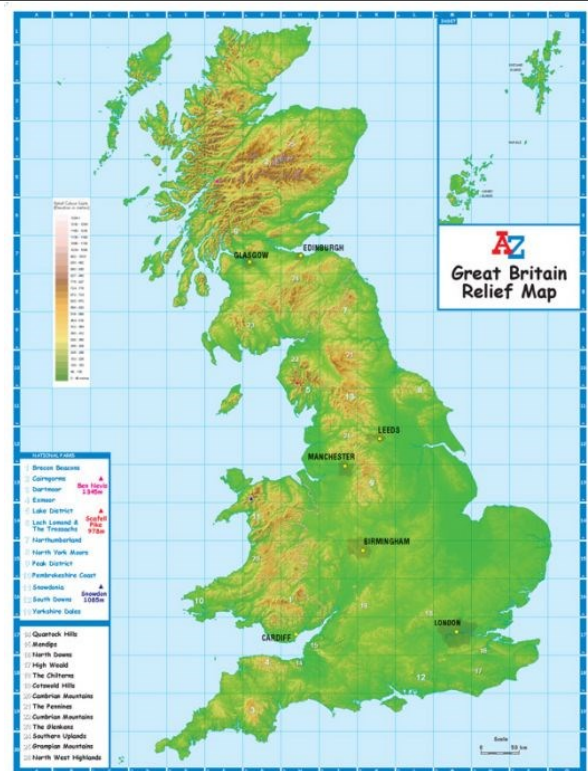
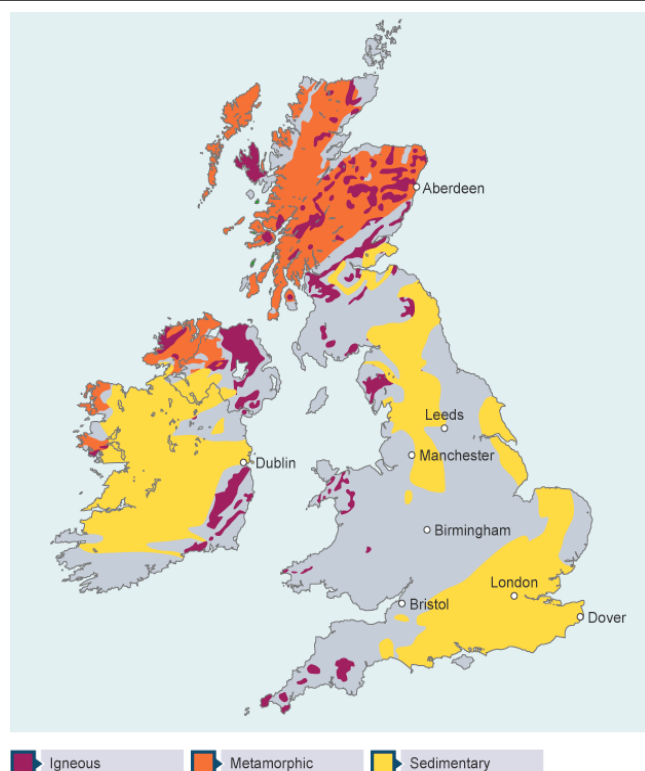
Location - largely found in upland areas such as, the Scottish Highlands and Dartmoor

### Metamorphic rocks

Rock examples - Slate and Schist

Formation/ characteristics - this is when Igneous or sedimentary rocks are changed by extreme pressure or heat; they can be in layers; they can contain crystals and fossils.

Location - largely found in upland areas such as, the Scottish Highlands and Central Wales



# Section A – The Changing Landscape of the UK (UK Physical Landscape)

## 1.2 A number of physical and human processes work together to create distinct UK landscapes

Physical factors shaping landscape	Human factors shaping landscape
<p><b>Glaciers</b></p> <p>A glacier is a large frozen river that moves slowly downhill with great force. U shaped valleys have been created as the glacier erodes through hard and soft rock landscapes. Glaciers pick up rocks from one area of the UK and can deposit (drop) these in another area of the UK, affecting the natural landscape.</p> <p><b>Rivers</b></p> <p>Rivers can affect the landscape as they can erode (hydraulic action/abrasion) their way through landscapes. Rivers also transport and deposit material from highland areas to lowland areas. When a river floods material is deposited all over the flood plains.</p> <p><b>Tectonic activity</b></p> <p>Igneous rocks were formed where volcanoes were located across the UK, such as in the Scottish Highlands. The volcanoes that produced this igneous rock are now extinct, but have created hills and mountains of igneous rock. Millions of years ago the UK was close to plate boundaries. As the two plates move towards each other mountains called fold mountains have been created. This is how upland landscapes like the Lake District and North Wales were formed.</p> <p><b>Weather and climate</b></p> <p>The UK gets heavy rainfall on the west coast due to the prevailing wind direction, therefore with more rain there is more water in the rivers for erosion, more water to saturate the ground causing mass movement, and potentially more weathering (chemical and mechanical). Mechanical weathering is caused by water freezing and then melting. This happens more in highland areas where it is colder. Biological weathering occurs due to the action of plants and animals. This occurs more in the lowland areas where the biodiversity is greater.</p> <p><b>Mass movement</b></p> <p>Slumping and sliding are examples of mass movement. This is when the land becomes saturated (wet) and this loosens the ground, causing large areas of land to suddenly and rapidly move downhill. Mass movement will occur more on the west side of the UK and in mountainous areas as this is where rainfall will be greater causing the ground to be saturated.</p> <p><b>Geology</b></p> <p>Hard rocks, like igneous or metamorphic rocks are very resistant to erosion and weathering. As they don't erode easily they form highland areas (hills and mountains). Softer rocks, like sedimentary rocks are NOT very resistant to erosion and weathering. As they erode easily they form lowland areas. Where the softer rocks are eroded away, it often has a steep slope (scarp) of hard rock surrounding the soft rock that has been eroded.</p>	<p><b>Forestry</b></p> <p>Large areas of forests may be cut down as the wood is needed for building material and furniture making. This can expose hillsides to rainfall and lead to mass movements of land, as the roots of the trees no longer bind the soil together. When deforestation takes place there are less trees to intercept the precipitation. This leads to water running straight off the land and into the river, causing greater river erosion.</p> <p>Replanting of trees (afforestation) has taken place across the UK, with a mixture of native deciduous trees and non native coniferous trees. This has resulted in a change in the trees that are present across the UK. When trees are replanted (afforestation), they are placed in rows and columns across the UK landscape. This creates an artificial look to the landscape</p> <p><b>Agriculture</b></p> <p>Farming means that the natural vegetation that once existed on the landscape has to be removed so that crops can be grown (deforestation). When the same crop is grown in all the farming fields, it creates an artificial landscape, which looks the same across the landscape. (e.g. large yellow fields can often be seen as farmers grow rapeseed oil).</p> <p>Farming of animals like sheep and cattle has led to large areas of land being deforested and a grazed/grassy landscape is put in place. Hedges in many parts of the UK have been cut down, so that no land is wasted for farming; and so large machinery can access the fields easily.</p> <p><b>Settlements/urbanisation</b></p> <p>Due to a growing population many areas of land have been removed from their natural vegetation, so that housing can be built. Roads connecting settlements have been built; areas have to be deforested and land flattened to enable the roads to be built.</p> <p>Artificial hills have been created, as waste is dumped in landfill sites, and then covered with soil.</p> <p>River and coastal management techniques have been put in place across the UK to protect urban areas of the UK. This is then affecting the ability of natural processes to take place (e.g. river walls are put in place which stop erosion taking place).</p>

# Section A – The Changing Landscape of the UK (Coastal landscapes)

## 1.3 A variety of physical processes interact to shape coastal landscapes

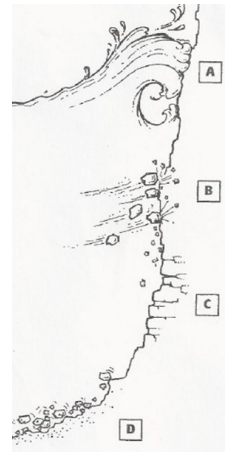
### Types of erosion

Hydraulic action - The force of water against the coast, wearing it away

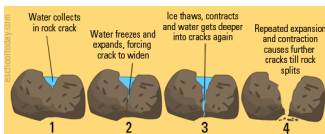
Abrasion - Waves throw particles (rocks/sand) against the cliff rock, wearing it away

Corrosion - The chemicals in the sea water slowly dissolve rocks on the coast

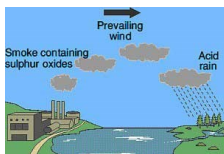
Attrition - Material carried by the waves bump into each other and are broken down into smaller particles.



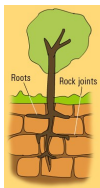
### Types of weathering



Mechanical - Water becomes trapped in a crack in the rock. When the air temperature drops below freezing, the water will freeze and expand. The ice will melt when the temperature rises above freezing. This process happens repeatedly, and the rock will weaken and eventually shatter.



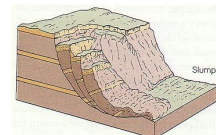
Chemical - Rainwater containing weak acids react with, break up, and disintegrate certain rock types. E.g. limestone is dissolved by weak acids



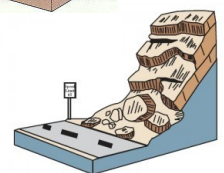
Biological - This is the action of plants or animals on the land. Burrowing animals or the roots of plants force their way through the rock causing it to break or crack.

### Types of Mass Movement

Slumping - When the ground becomes saturated (wet), and falls down a slope in a rapid movement. This occurs with a **rotational (curved) movement**



Sliding - This is similar to the slumping, however the land moves straight down a flat slope, **not in a rotational way**.



### Deposition

This refers to the process of the water dropping the material that it was carrying. This is usually due to a reduction in energy.

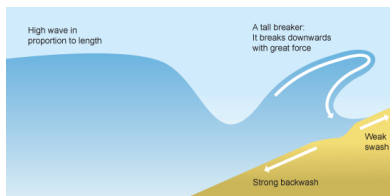
# Section A – The Changing Landscape of the UK (Coastal landscapes)

## 1.3 A variety of physical processes interact to shape coastal landscapes

### Types of wave

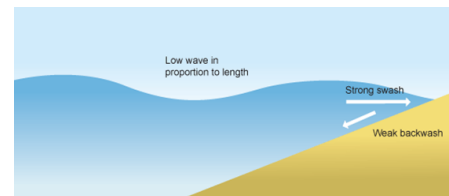
#### Destructive Wave

Strong backwash, weak swash  
 Storm conditions, high winds  
 Erosion rates are high  
 High in proportion to length  
 Frequent waves (11 to 15 per minute)



#### Constructive Wave

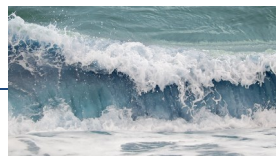
Strong swash, weak backwash  
 Deposition occurs  
 Calm conditions, light winds  
 Long in relation to height  
 Gentle waves (6 to 9 per minute)



### Factors affecting rates of coastal erosion

#### Types of wave

Destructive waves have a strong backwash to erode beaches.  
 Constructive waves have a weak backwash so can not erode the beach as easily.



#### Seasonality

This relates to the different seasons in the year (summer, spring, autumn and winter). In the winter months more storms bring bigger waves and freeze thaw weathering occurs; so more erosion will occur in winter and less in summer.



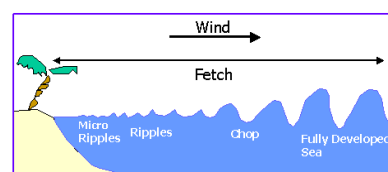
#### Geology

Types of rock. Hard rocks (like granite), erode at a much slower rate than soft rocks (like sandstone).



#### Fetch

The UK has a prevailing wind that comes from the south west, across the Atlantic Ocean. This has a large fetch, which is the distance over which the wind blows over open water. (big fetch = big waves) (big waves = more erosion).



# Section A – The Changing Landscape of the UK (Coastal landscapes)

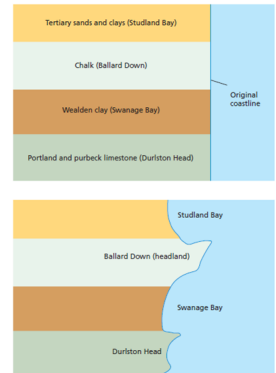
## 1.4 Coastal erosion and deposition create distinctive landforms within the coastal landscape

### Headland and bay

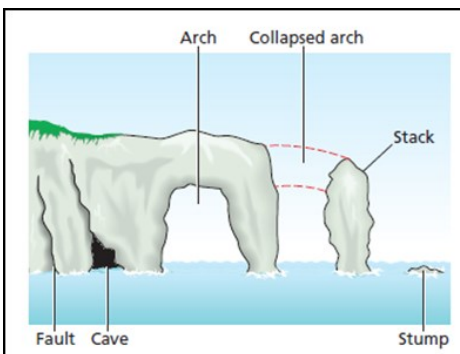
**Step 1:** The coastline is made up of different types of rock lying next to each other. (harder rocks, such as chalk, next to softer rocks such as clay).

**Step 2:** The soft rock is eroded a lot faster than the harder rock, (by hydraulic action and abrasion) meaning the harder rock sticks out further to sea.

**Step 3:** Where the softer rock has been eroded back, a bay is formed, and the sea deposits material to form a beach. The hard rock sticks out to sea and this is called a headland.



### Cave, arch, stack, stump



**Step 1:** The waves erode faults (cracks) in the rock, through hydraulic action and abrasion. In time the fault will widen to create a cave.

**Step 2:** When the cave is eroded all the way through the headland, an arch is created.

**Step 3:** The sea will continue to erode at the bottom of the arch and weathering will take place at the top. The arch will then collapse, due to gravity and its own weight (a lack of support below it).

**Step 4:** This leaves behind a column of rock not attached to the cliff, known as a stack.

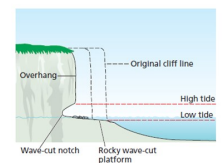
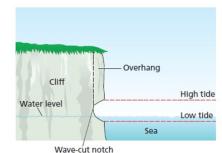
**Step 5:** Continued erosion and weathering will lead to the formation of a stump that is visible only at low tides.

### Wave cut platform

**Step 1:** The waves attack the base of the cliff and erosion takes place through the processes of abrasion, corrosion, and hydraulic action.

**Step 2:** Over time the cliff will be undercut, creating a wave cut notch

**Step 3:** Eventually the cliff becomes unstable and collapses into the sea. Where the rocks and boulders fall into the water a wave cut platform is created (the platform is a raised area of land only visible at low tide)

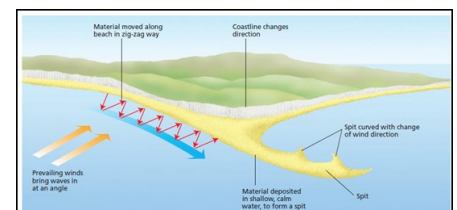


### Beach



A beach is an area of land between the high tide and low tide levels on the coast. It is made up of sand, pebbles, mud and silt. A beach is created by constructive waves depositing material and usually have a gentle slope

### Spit and bar



**Step 1:** Longshore drift is occurring along the coastline, as sediment is moved along the coastline.

**Step 2:** When the coastline ends (changes direction), the sea deposits the material it is carrying, creating a ridge out to sea. This continues to grow by the process of longshore drift and deposition

**Step 3:** A change in prevailing wind direction often causes the end of spits to become hooked.

**Step 4:** Water is trapped behind the spit as the water begins to stagnate, mud and marshland begins to develop behind the spit.

**Step 5:** If/when the spit stretches to another piece of land it creates a bar







# Section A – The Changing Landscape of the UK (Coastal landscapes)

## 1.5 Human activities can lead to changes in coastal landscapes which affect people and the environment

### Effects of coastal recession

Effects of coastal flooding/erosion on people	Effects of coastal flooding/erosion on the environment
<ul style="list-style-type: none"> <li>• House prices reduced</li> <li>• Homes lost to the sea</li> <li>• People injured or killed</li> <li>• Communication and transport links damaged</li> <li>• Increased cost of home insurance</li> </ul>	<ul style="list-style-type: none"> <li>• Natural habitats destroyed</li> <li>• Pollution of sea water</li> <li>• Pollution of farmland/urban areas</li> <li>• Lowland areas lost forever</li> <li>• Contamination of fresh water sources</li> </ul>

### Coastal management

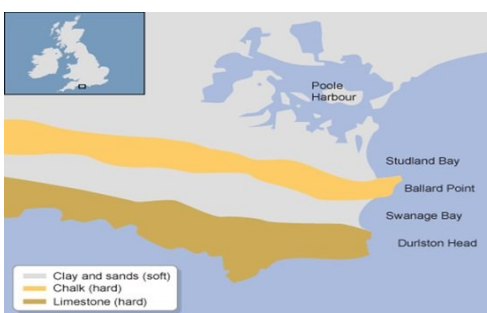
Management type	Description	Benefits	Negatives
Sea wall (hard engineering) 	This is a large wall built at the bottom of cliffs (sometimes curved) to absorb/reflect the waves energy.	Very effective. Lasts for many years.	Expensive to build. Unattractive.
Rip rap (hard engineering) 	Large rocks placed in front of the cliff to absorb wave energy.	Effective for a number of years. More natural looking than a sea wall.	Unattractive/unnatural rocks used. Can be expensive for large rocks being imported.
Groyne (hard engineering) 	Wooden walls stretching out to sea to prevent longshore drift, so the beach stays (the beach is a natural defence).	Helps to encourage a build up of a beach (a natural defence). Cheaper than other hard engineering techniques.	Not effective in storm conditions. Unattractive and a short lifespan (10-15 years).
Beach replenishment (soft engineering) 	The placing of sand and pebbles onto the beach (the beach is a natural defence).	Looks natural. Reasonably cheap option.	Only a short term option—requires constant maintenance. Expensive long term cost.
Managed retreat (soft engineering) 	Nature is allowed to naturally erode/flood the coastline	Reasonably cheap option (although compensation has to be paid) Allows nature to take its natural course	Land is permanently lost. As land falls into the sea, it pollutes sea water
Cliff regrading (soft engineering) 	The angle of the coastline is changed to create a gentle slope—reducing the wave power slowly	Looks natural Provides a natural habitat for animals	Not very effective in storm conditions Requires maintenance



# Section A – The Changing Landscape of the UK (Coastal landscapes)

## 1.6 Distinctive coastal landscapes are the outcome of the interaction between physical and human processes

### Swanage Bay — example



### Human factors affecting coastal landscape at Swanage Bay

Chemical fertilisers are used on the farm land around Swanage Bay, which can enter the sea causing pollution and add to the problem of Eutrophication.

Studland Bay to the north is a tourist hotspot. The beach is owned and managed by the national trust. The area is protected by excessive tourist damage by limiting the parking available, and therefore, the number of people who can access the beach. The sand dunes are also protected by being fenced off, creating a natural landscape

In 2005/2006 new coastal defences were built in Swanage Bay, consisting of 18 groynes and beach nourishment. This changed the area by creating a new higher beach, although it will have to be replenished every 20 years.

As urban areas, like Swanage, have been built, natural habitats have been built upon and deforestation of areas has taken place. Also old wetlands (marshland) have been drained of water so that they can be built on. This increases the chances of coastal flooding as the land is now impermeable

### Physical factors affecting coastal landscape at Swanage Bay

Studland Bay is formed from the less resistant sands and clays here eroding at a faster rate than the harder rock to the north and south.

Chalk, a more resistant rock, has formed the headland of Ballard Down. The headland is now being eroded more than the bays either side of it as it is further out to the sea and experiences more powerful waves.

The relief of the land to the south of Swanage is very steep. This has made the problem of slumping and sliding in the area worse.

The headland Ballard Point is constantly changing due to erosion and weathering. Originally there were 2 stacks off the coast (Old Harry and his wife) but in 1986 Old Harry's wife collapsed forming a stump.

# Section A – The Changing Landscape of the UK (River landscapes)

## 1.7 A variety of physical processes interact to shape river landscapes

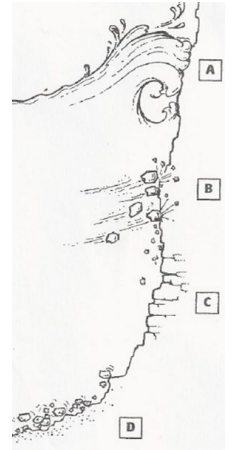
### Types of erosion

**Hydraulic action** - The force of water against the river bank, wearing it away

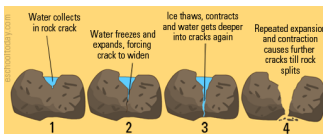
**Abrasion** - River waves throw particles (rocks/sand) against the river bank, wearing it away

**Corrosion** - The chemicals in the river water slowly dissolve rocks on the river bank

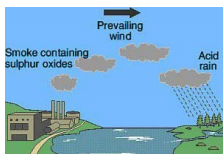
**Attrition** - Material carried within the river bump into each other and are broken down into smaller particles.



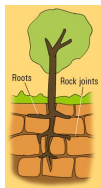
### Types of weathering



**Mechanical** - Water becomes trapped in a crack in the rock. When the air temperature drops below freezing, the water will freeze and expand. The ice will melt when the temperature rises above freezing. This process happens repeatedly, and the rock will weaken and eventually shatter.



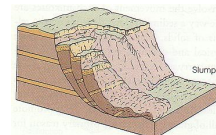
**Chemical** - Rainwater containing weak acids react with, break up, and disintegrate certain rock types. E.g. limestone is dissolved by weak acids



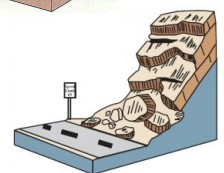
**Biological** - This is the action of plants or animals on the land. Burrowing animals or the roots of plants force their way through the rock causing it to break or crack.

### Types of Mass Movement

**Slumping** - When the ground becomes saturated (wet), and falls down a slope in a rapid movement. This occurs with a **rotational (curved) movement**



**Sliding** - This is similar to the slumping, however the land moves straight down a flat slope, **not in a rotational way**.



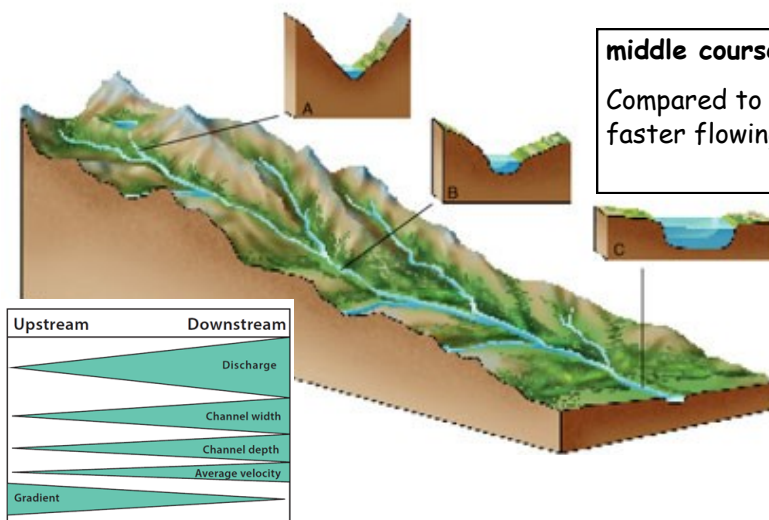
### Deposition

This refers to the process of the water dropping the material that it was carrying. This is usually due to a reduction in energy.

# Section A – The Changing Landscape of the UK (River landscapes)

## 1.7 A variety of physical processes interact to shape river landscapes

### River profile



#### Upper course:

Steep land, shallow/narrow river channel, slow flowing, small volume/discharge, large sediment size, v shaped valley, interlocking spurs, waterfalls

#### middle course

Compared to the upper course the river is slightly deeper, faster flowing, with larger volume/discharge, meanders

#### lower course

Relatively flat land, deep/wide river channel, fast flowing, large volume/discharge, small sediment size, ox bow lakes, floodplains, levees

## Factors affecting river landforms and landscape

### Climate/Seasonality/weather -

The UK has a variable climate from season to season, and from year to year. Intense rainfall increases the speed and volume of the river flow and therefore increases the river discharge and rates of erosion. This can then lead to slumping along river bank. During winter the differences in temperature between night and day (above and below freezing) can cause freeze-thaw weathering, causing river banks to collapse. When there is heavy rainfall rivers can flood leading to deposition of material at the river banks (called a levee).

### Urbanisation and industry

As urban areas have been built, natural habitats have been built upon and deforestation of areas has taken place. This means less interception of rainfall so rivers are more likely to flood. This land is seen as more valuable so river defences are built to reduce the chances of flooding. Defences like channelisation then stop coastal processes like erosion and deposition taking place (stopping the natural formation of landforms). Large ports are built along river estuaries (like the Thames in London) so that goods can be imported and exported. These areas require large ships to enter the port so the water needs to be very deep. The water is often dredged of sediment (material removed from riverbed).

### Agriculture (farmland)

As farmland areas have been created, natural habitats have been taken over and deforestation of areas has taken place. Also old wetlands (marshland) are drained of water so that they can be used for farming. Farmland is seen as less valuable than urban areas, so river processes (erosion, transportation and mass movement) are allowed to happen naturally; and coastal defences are not used. Chemical fertilisers are used on the farmland which can enter the river causing pollution in the water, and causing algae to grow in the water (this can kill fish). This is called eutrophication.

# Section A – The Changing Landscape of the UK (River landscapes)

## 1.8 Erosion and deposition interacting with geology create distinctive landforms in river landscapes

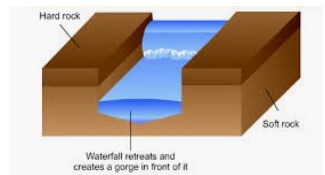
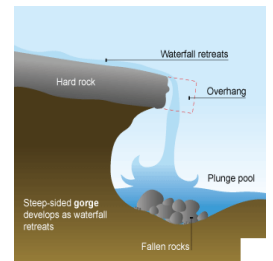
### Interlocking spurs

- Step 1:** The river flows downhill because of the force of gravity.
- Step 2:** The river erodes through the soft rock (e.g. sandstone) quite easily, but is unable to erode through the hard rock (e.g. granite) as easily.
- Step 3:** As a result the river winds around these 'interlocking spurs' of hard rock. This creates a valley like the one here...



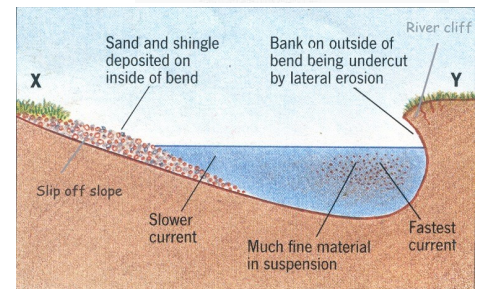
### Waterfalls and gorges

- Step 1** The river flows over hard rock lying next to soft rock.
- Step 2** The soft rock is eroded much faster than the hard rock, by abrasion and hydraulic action, creating a ledge for the river to flow over.
- Step 3** The continued erosion of the soft rock undercuts the hard rock and creates a plunge pool at the base of the waterfall.
- Step 4** The undercutting creates a ledge or overhang, which eventually collapses due to a lack of support.
- Step 5** As this continues to happen, the waterfall retreats up-river, creating a gorge wall at either side of the river.

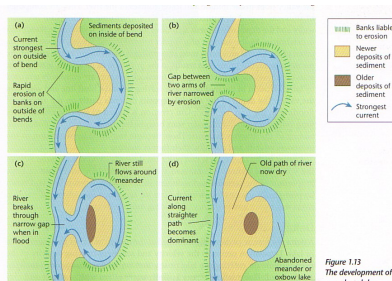


### meanders

- Step 1** The current is faster on the outside bend because the water is deeper so there is less friction to slow the water flow.
- Step 2** This means more erosion will take place on the outside bend, forming river cliffs.
- Step 3** The current is slower on the inside bend because the river channel is shallower. There's more friction to slow the water.
- Step 4** So material is deposited on the inside bend, forming slip-off slopes.



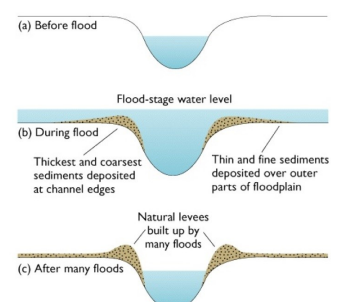
### Ox bow lakes



- Step 1** The meander on a river grows outwards because of the erosion on the outside bend and deposition on the inside bend.
- Step 2** The neck of the meander becomes narrower, due to continued erosion.
- Step 3** The river will eventually take a short cut, by cutting across the neck of the river.
- Step 4** Soon the loop is sealed off altogether due to deposition taking place. It turns into an oxbow lake. In time the lake will get covered with weeds, and fill with soil, and disappear.

### Flood plains and levees

- Step 1** Floodplains and levees are formed by deposition when the river floods.
- Step 2** When a river floods onto the floodplain it loses its energy and deposits the heavier material first.
- Step 3** The lighter material such as sands, silts and clays are deposited further away from the river.
- Step 4** The material then deposited at the sides of the river is known as a levee.



# Section A – The Changing Landscape of the UK (River landscapes)

## 1.9 Human activities can lead to changes in river landscapes which affect people and the environment

### Human and physical causes of river flooding

Human causes of river flooding	Physical causes of river flooding
<p>In built up, urban areas, the rain cannot soak through concrete (impermeable rock), so flows straight into the river, leading to flooding.</p> <p>Deforestation means there is less interception from the leaves, and the roots cannot soak up the water, so the water goes into the river much more quickly.</p> <p>Dams may burst which will cause excess water in river channels and therefore flooding.</p>	<p><b>Intense rainfall</b> over a short period of time, will lead to more water in the river.</p> <p>If a river has lots of <b>tributaries</b>, it puts <b>extra water</b> into the river, increasing the chance of flooding.</p> <p>A sudden <b>increase in temperatures</b> can cause the melting of snow, leading to a large amount of water entering the river.</p>

### Effects of river flooding

Effects of river flooding on people	Effects of river flooding on the environment
<ul style="list-style-type: none"> <li>• Homes flooded.</li> <li>• People injured or killed.</li> <li>• Communication and transport links damaged.</li> <li>• Increased cost of home insurance.</li> <li>• House prices reduced in flood risk areas.</li> </ul>	<ul style="list-style-type: none"> <li>• Natural habitats destroyed.</li> <li>• Fresh water supplies become contaminated.</li> <li>• Animals have to be evacuated from flooded areas.</li> <li>• Erosion of land, which will takes years to recover.</li> </ul>

### River management

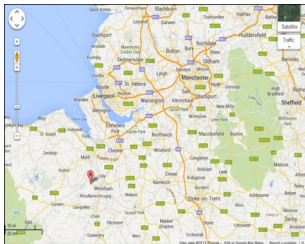


Management type	Description	Benefits	Negatives
Dams and reservoirs (hard engineering)	These are barriers (walls) constructed to hold back and control the flow of water. They store the water in a large man-made lake called a reservoir, behind the dam.	Also produces HEP Long lasting and effective	Large areas of land are flooded unsightly
Channelisation (hard engineering)	This is the process of deepening or straightening rivers, so that more water can flow through the river at a faster velocity, or so that the river can hold more water.	Long lasting Effective as river can hold more water	Disrupts the natural processes of the river expensive
Flood plain zoning (soft engineering)	This is when the government or local council will refuse planning permission for building houses near to the river and on its flood plain (therefore reducing the potential damage from flooding).	Very cheap as no defences built Provides natural habitats for animals	Large areas of land cannot be built upon
Washlands (soft engineering)	This is when areas around the river are used to let the river flood onto. It is onto less valuable land and prevents river flooding in other areas.	Gives a safe place for floodwater to go to, avoiding flooding in valuable areas	Limits the use of the land for urban area developments or farmland

# Section A – The Changing Landscape of the UK (River landscapes)

## 1.10 Distinctive river landscapes are the outcome of the interaction between physical and human processes

### River Clywedog



### Human factors affecting river processes and landforms

A small dam has been built to control the flow of the water. This can increase or decrease the volume and flow of water, depending on whether the dam is open or closed. This will therefore affect river processes further downstream.

### Physical factors affecting river processes and landforms

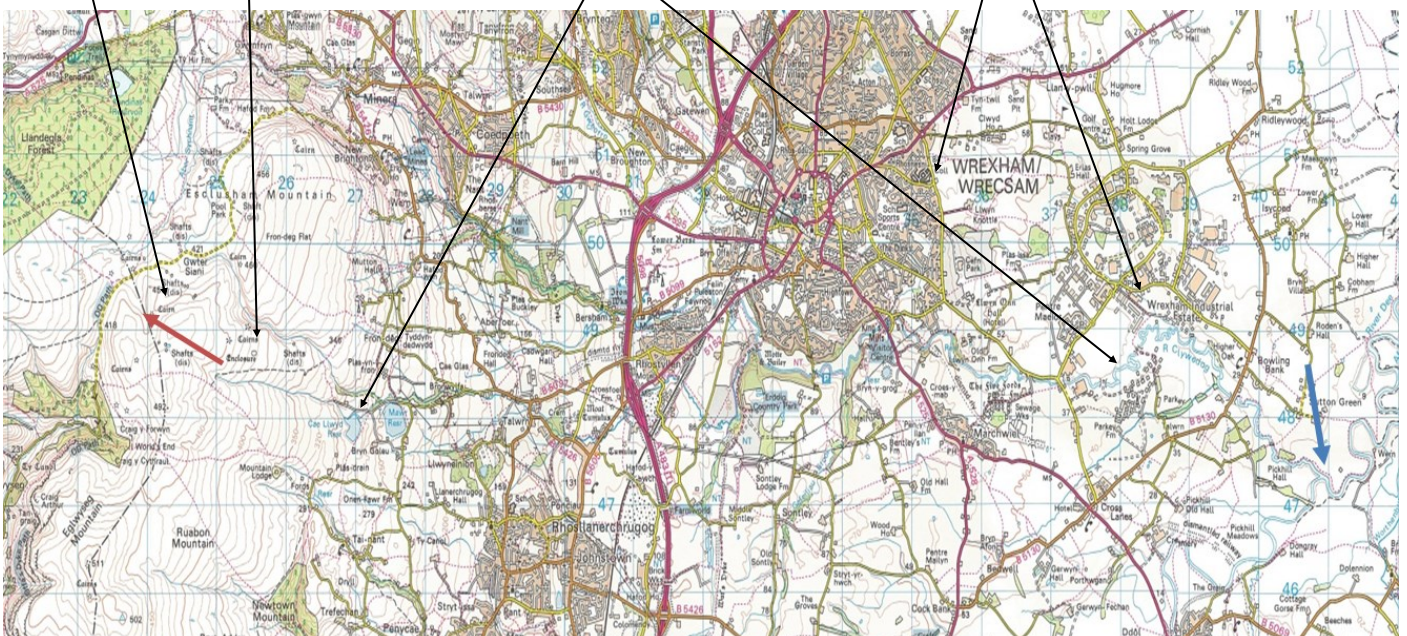
In the upper course, the land is made up of sandstone and slate. This is significant as it has led to the formation of waterfalls and interlocking spurs.

In the lower course of the river the land is much flatter and lateral (sideways) erosion takes place. This creates landforms like meanders and ox bow lakes.

Close to the source of the river, the area experiences cold temperatures and heavy rainfall due to high altitude in the mountains. This increases weathering processes and erosional processes.

There is a large urban area, Wrexham, just north of the river. The impermeable surfaces and drainage systems increases the volume of water entering the river. This increases the chances of flooding and can increase erosion and transportation rates in the river.

Deforestation has taken place on a large scale to the east of Wrexham. This reduces interception and so increases the volume of water entering the river. This increases the chances of flooding and can increase erosion and transportation rates in the river.



# Section B – Weather Hazards and Climate Change

## 2.1 The atmosphere operates as a global system transferring heat and energy

### Features of the global atmospheric circulation

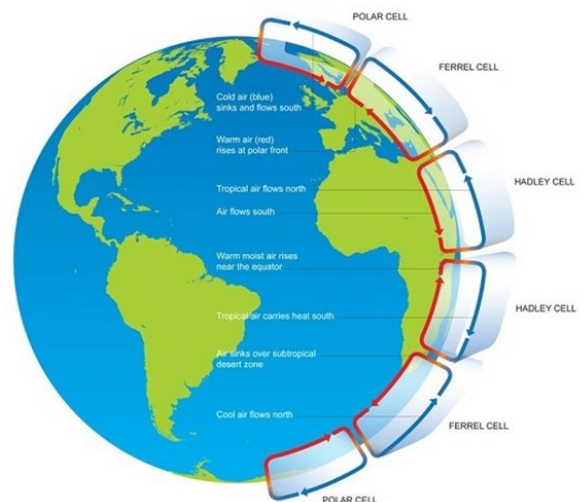
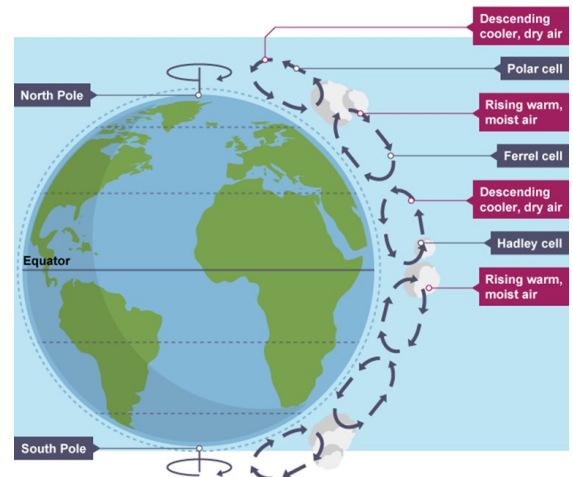
This refers to the world wide movement of heat energy around the globe. It is the movement of heat from the tropical regions to the polar regions.

There are three main cell movements within our atmosphere; Hadley cells (from equator to 30°), Ferrel cells (from 30° to 60°), and Polar cells (from 60° to the pole).

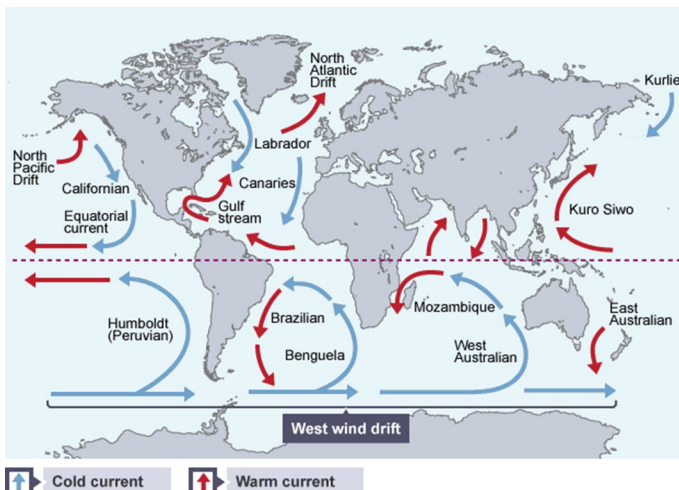
They move the air in circular movements. The warm air rises and the cool air sinks in a continuous cycle. This creates areas of high and low pressure, shown below;

Areas of low pressure (equator 0°/60°) have warm air that rises. This means that the rises air will condensate and create clouds and rainfall.

Areas of high pressure (30°/poles 90°) have cool air that sinks back to the earth. This creates hot/dry weather and cloudless skies.



### Ocean current transfers



The ocean currents are moved by the global circulation cells (wind blowing across the surface water). The currents are like rivers running through the ocean.

They take warm ocean water away from the equator towards 30° N or S; and they bring cooler waters back towards the equator.

An example of an ocean current is the North Atlantic Drift. This takes warm ocean water from the Caribbean Sea, across the Atlantic to the UK.

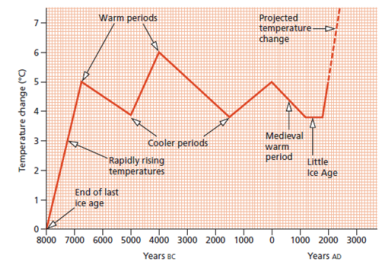
Warm ocean currents bring warmer temperatures. Cold ocean currents bring colder temperatures

# Section B – Weather Hazards and Climate Change

## 2.2 The global climate was different in the past and continues to change due to natural causes

### Changing global climate

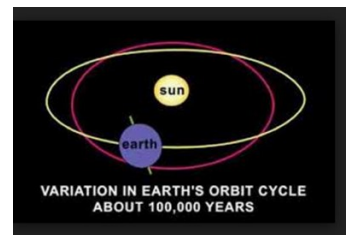
- The quaternary period covers the past 1.8 million years.
- During this time global temperatures have fluctuated (gone up and down).
- When the temperatures decrease we get ice ages - the last ice age was about 11,500 years ago. - since this time we have been in an interglacial period (warmer period).



### Causes of natural climate change

**Milankovitch cycle** The amount of heat the earth receives varies because of the earth's orbit around the sun.

1. Elliptical v circular orbit (the distance of the earth from the sun varies as it orbits the sun).
2. The earth's tilt varies so when it has a tilt towards the sun the earth will be warmer than if it is tilted away from the sun.



**Solar variation** There is a change in the amount of heat that the sun releases. Sun spots give off more heat energy. The more heat spots, the greater the global temperature.

**Volcanism** Volcanic eruptions produce carbon dioxide, sulphur dioxide and ash into the atmosphere. The ash can act as a cloak around the earth and reduce the amount of solar heat reaching the earth causing global cooling. Carbon dioxide is a greenhouse gas, so can contribute to the greenhouse effect, causing global warming.



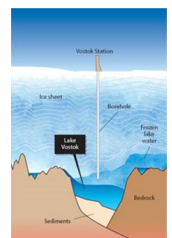
### Evidence for natural climate change

**Ice cores** - ice in Antarctica has been there for millions of years. We can drill into the ice and measure how much carbon dioxide ( $CO_2$ ) was present in past years (high levels of  $CO_2$  = hotter temperatures)

**Tree rings** - Each year a tree grows by a single ring. If the ring is wide it shows that the temperature was warm that year. If the ring is narrow it shows that the temperature was cooler that year.

**Historical records** - Old cave painting, diaries and stories from the past provide an insight into times of cold and hot periods in our past.

**Pollen records** - By digging into the ground, and looking at pollen in the ground, this shows the plants that were around in the past. Because certain plants can only survive in hot or cold weather, this shows what the temperatures were like in the past.





# Section B – Weather Hazards and Climate Change

## 2.3 Global climate is now changing as a result of human activity

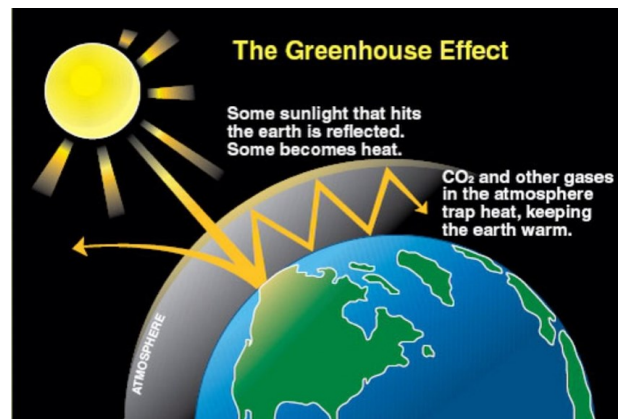
### Human causes of the enhanced greenhouse effect

**Industry** - Many industries in the UK use fossil fuels to generate energy, or produce CO<sub>2</sub> as part of the production process. For example, this is a big problem in the steel industry which produces a large amount of CO<sub>2</sub>, contributing to the enhanced greenhouse effect.

**Transport** - Car ownership is very high in MEDCs and growing in LEDCs, due to growing populations and growing wealth. The use of cars produces CO<sub>2</sub> as oil or gas is burned to use them. This contributes to the enhanced greenhouse effect.

**Energy** - Energy demands are increasing due to an increasing population, increasing wealth and increasing access to technology. Generating power in power station accounts for 25% of global CO<sub>2</sub> emissions. By burning fossil fuels to generate energy CO<sub>2</sub> is produced which contributes to the enhanced greenhouse effect

**Farming** - Cattle and rice growing produces methane. As the population increases, and the demand for western style diets increases so does the demand for cattle (beef). Therefore there is more methane produced and this contributes to the enhanced greenhouse effect



### Negative effects of climate change on the environment and people

**Retreating glaciers** - Glaciers all over the world are retreating (melting) due to warmer temperatures. For example 90% of glaciers in Antarctica are retreating. Glaciers in the Himalayas provide water supplies for people in India and Bangladesh, which will disappear.

**Migration** - As sea levels rise and land becomes unusable for farming, people are forced out of their homes. For example in the Maldives 1600 had to be evacuated out of their homes due to coastal flooding caused by rising sea levels.

**Increased storms** - Across the UK the increased temperature has led to an increase in the number of storms and floods.

**Changing patterns of crop yields** - Countries close to the equator will experience longer periods of drought and shorter growing periods. It is estimated that about 50% of India's land for growing wheat will be destroyed due to hotter and drier weather. Countries like the UK will have to change the products that they grow due to the hotter weather.

**Rising sea levels** - Melting polar ice caps has led to sea levels rising by approximately 3mm every 10 years. This will threaten large areas of low lying coastal areas like New York and Liverpool.

# Section B – Weather Hazards and Climate Change

## 2.4 The UK has a distinct climate which has changed

### Changes of the UK climate over past 1000 years

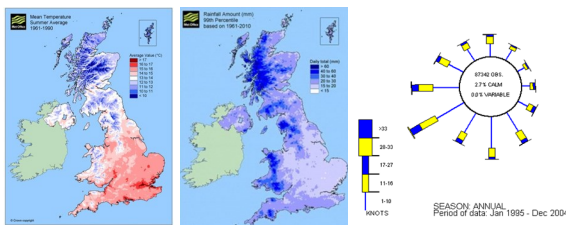
1000 AD - 1300 AD — UK experienced a warm period with temperatures about 1°C above average

1300 AD - 1900 AD — UK experienced a 'little ice age' period with temperatures about 1°C below average

1900 AD - 2000 AD — UK is again experiencing a warm period with temperatures about 1°C above average



### Spatial variations in temp, prevailing wind and rainfall across the UK



The average **temperature** is hotter in the south of the UK at lower latitudes and colder in the north at higher latitudes. The average temperature is hotter in lower lying areas of the UK (south-east) than in the mountainous areas (Central Wales).

The UK receives a large amount of **rainfall** throughout the year. The average rainfall is greater in the west of the UK

than in the east. The average rainfall is also higher in mountainous areas, such as central Wales and, the Pennines and Northern Scotland.

The **prevailing wind** (direction from which the wind usually blows) in the UK is from the south west, making the west side of the UK much more windy than the east. As the wind blows over the Atlantic ocean (from the south west), it brings moisture and that is why the west side of the UK receives more rainfall. The cooler winds will also affect temperatures along the west and south west of the UK.

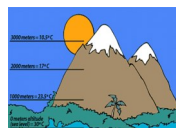
### Factors affecting the climate of the UK

The **prevailing wind** comes from the south west, across the Atlantic Ocean. So it is warm air from near the equator containing a lot of moisture, bringing rainfall, mainly to the west coast of the UK).

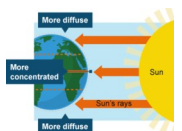
**Ocean currents** help to transfer heat across the world. The North Atlantic Drift brings a warm ocean current from near to the equator towards the UK. This raises temperatures of the UK



**Altitude** (height of land). higher altitudes are colder. For every 100 metres you go up, the temperature decreases by 1°C. In the UK, the highlands of Scotland, the Pennines and Snowdonia are affected by this.

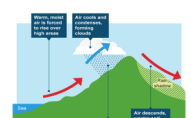


The **latitude** of the UK is approximately 60° North of the equator. The latitude determines the amount of heat energy received from the sun. If it is close to the equator it receives a lot of heat, as the sun's rays are concentrated in a small area, but if it is close to the poles, then receives very little heat.



The UK is in the northern hemisphere. Due to the **tilt of the earth**, this means that the earth is tilted towards the sun in summer, so therefore it receives more of the sun's energy, which means the temperature increases during the summer. This is the opposite in the winter.

Areas **close to the sea** have cooler summers than inland areas; and milder winters than inland locations, as the temperatures are moderated by the sea temperatures. Areas close to the sea also have higher rainfall levels, because of relief rainfall. (largely affecting UK west coast)

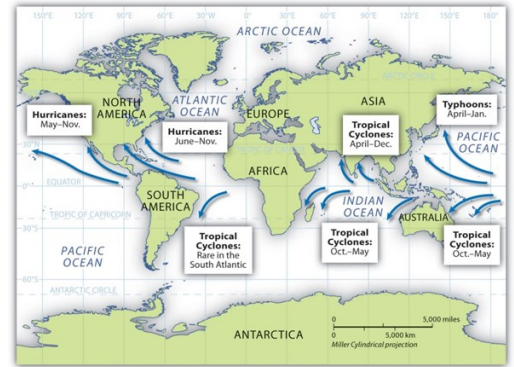


# Section B – Weather Hazards and Climate Change (Tropical Cyclones)

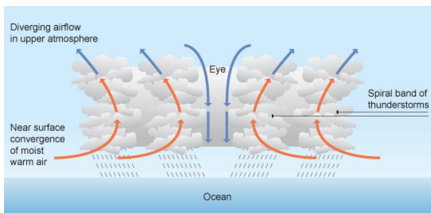
## 2.5 Tropical cyclones are extreme weather events that develop under specific conditions and in certain locations

### Location of tropical cyclones

Tropical cyclones occur in tropical and subtropical oceans between the Tropic of Cancer and Tropic of Capricorn (between 5° and 30° north and south of the equator) (where the sea temperature is over 27°C). The most tropical cyclones occur in the North Pacific Ocean



### Formation of tropical cyclones

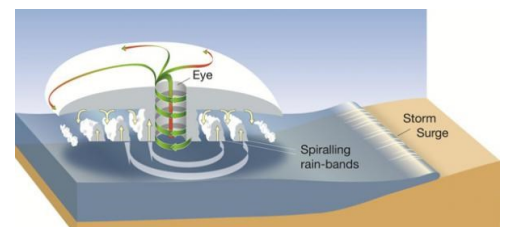


- 1) The water temperature has to be above 27°C. This only happens between the Tropic of Cancer and Capricorn. This is normally at the end of Summer and Autumn because the sea water has been able to warm up.
- 2) This produces moist, warm air. Winds converge at the ocean surface causing this warm, moist air to rise. Creating an area of low pressure at sea level.
- 3) The rising air begins to spin because of the Coriolis effect (the spinning of the earth).
- 4) As the warm air continues to rise it moves outwards and falls. The water vapour condenses and forms large cumulous clouds. This causes heavy rainfall and thunderstorms.
- 5) The eye of the storm is created and is dry and calm as it is the only place for kilometres where the air is sinking (due to the spin of the hurricane)
- 6) Local prevailing winds and ocean currents push the hurricane in a westerly direction towards land. (again this is due to the coriolis effect).
- 7) The further the cyclone travels over the ocean, the more heat and moisture it collects, therefore the strength is increased.

8) When the cyclone reaches dry land, it is cut off from its energy source. It can no longer extract heat from the ocean, loses its strength and slows.

### Characteristics of tropical cyclones hazards

- The tropical cycles have very fast average wind speeds of about 120kph.
- The tropical cyclones usually move from east to west, due to the Coriolis effect.
- The centre of a tropical cyclone is known as the 'eye'. This is usually a calm area.
- Tropical cyclones usually form between the end of the summer and autumn, when sea temperatures are at their warmest.
- Tropical cyclones bring intense rainfall, causing coastal flooding, and mass movement of saturated land.
- Tropical cyclones cause storm surges, whereby the localised sea level is raised by the wind blowing the sea towards the land.



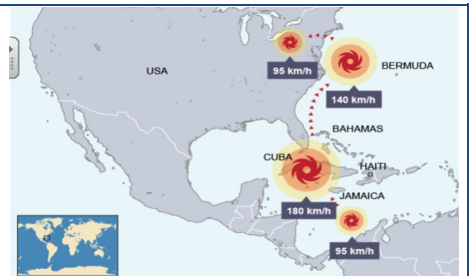
# Section B – Weather Hazards and Climate Change (Tropical Cyclones)

## 2.6 There are various impacts of and responses to natural hazards caused by tropical cyclones depending on a country's level of development

### Tropical Cyclone in a named developed country (Hurricane Sandy)

#### Background

Hurricane Sandy was the deadliest and most destructive hurricane of the 2012 Atlantic Hurricane Season. Sandy developed over the Atlantic Ocean and affected the east Coast of the US, significantly affecting New Jersey and New York.



#### Impacts

117 people were killed. More than 5000 people required healthcare treatment.

650,000 homes were damaged or destroyed in the USA; 250,500 cars were destroyed by flood water.

The damage cost in New York totalled \$19billion. Insurance claims in New Jersey totalled \$3.3 billion. \$1.1 billion was spent repairing the damage to sewage and pipes in New Jersey and New York.

Roughly 9 million homes had power cuts. The streets of New York were flooded, as was the subway, affecting transport links across the city.

Approximately 1.5 billion litres of sea water was released into the freshwater Raritan River in New Jersey. Also, around 60% of beaches in New York and New Jersey were damaged. On average the beaches were 9-12m narrower, which had a knock on effect on tourism in the area.

The storm surge meant that sea water got into fresh water habitats, which had severe impacts on wildlife from Delaware Bay to Long Island Sound. Also, 1.5 million litres of oil was spilt into the Sea between New Jersey and New York. This damaged wildlife habitats, killed fish and birds.

#### Responses

The government brought in the US military to help with the search and rescue, and also the recovery.

The US government set up evacuation centres and paid for hotels for those who had become homeless.

The Department of Agriculture promised \$6.2 million solely for the immediate repair of farmland.

The government provided \$60.3 billion in aid for victims of the hurricane, over the next 5 years.

Schools in areas where hurricanes are likely have to complete hurricane drills, to ensure that they are prepared in the event of a hurricane.

Government laws now require businesses to have an Emergency Action Plan, to show what they should do in the event of a hurricane.

The government pledged significant money to improve hurricane research, prediction and forecasting.

# Section B – Weather Hazards and Climate Change (Tropical Cyclones)

## 2.6 There are various impacts of and responses to natural hazards caused by tropical cyclones depending on a country's level of development

### Tropical Cyclone in a named emerging or developing country (typhoon Haiyan)

#### Background

Typhoon Haiyan hit the Philippines in 2013, and was one of the most powerful typhoons ever recorded. It was categorised as a category 5 super typhoon, with wind speeds reaching 235 mph. It formed over the Pacific Ocean and hit the Philippines in November.



#### Impacts

More than 6000 people were confirmed dead after the event and many more missing.

Landslides occurred throughout coastal regions, causing the mass movement of large amounts of land.

Law and order was affected on the island of Samar by a lack of communication and support.

The cost of the damage was estimated to be approximately US\$2 billion.

Transport links and routes were affected across the island.

A tanker ran aground leading to an oil spill in the ocean.

Coastal areas of mangroves were damaged and thousands of trees were uprooted.

#### Responses

Power was cut off from the island, hampering recovery efforts.

The American Red Cross helped to supply over 100,000 families with mattresses, clean drinking water, hygiene and kitchen kits.

The UK sent in excess of £60 million to help the victims of the hurricane.

Several areas were evacuated due to chemical spills from industrial facilities, and forced to live in evacuation centres funded by global NGO's.

The majority of people in the Philippines do not have home insurance, so had to rebuild their own homes.

The Philippine government announced a 'state of calamity' which meant that the government could redirect funds from others services.

Evacuations took place from the worse hit islands, like Tacloban, although this took a long time to set up.

There was a reliance on a number of charities including Save the Children and American Red Cross.

Search and rescue took place, but could only take place during the daylight due to no electricity.

# Section B – Weather Hazards and Climate Change (Drought)

## 2.7 The causes of drought are complex with some locations more vulnerable than others

### Characteristics of drought

**Drought**-A drought is a hazard that can affect any area around the world. A drought is the reduction in the usual amount of available water supply (usually caused by below average rainfall). They occur unpredictably, and for a variety of human and natural causes.

**Arid Environments**-An arid environment is one where there is always only a small amount of rainfall. It is characterised by hot daytime temperatures, very little vegetation or animal life, low precipitation levels.

### Hazards associated with drought

**Crop failure** - Crops need water to survive. Lack of water means there will be a reduction in the amount of crops and this can lead to starvation of people and animals in the area.

**Soil destruction/desertification** - The soil can dry out and be blown away by the wind. The natural vegetation and crops will therefore not be able to grow back in the area.

**Wild fires** - The trees and vegetation will dry out because of the lack of water. The dead wood and leaves can burn very easily.

**Disease** - Lack of water can force people to drink from dirty water sources, leading to the spread of disease, such as cholera.

### Causes of drought

Meteorological	Meteorological drought is when an area suffers from a lack of precipitation (rainfall), when compared to the average for that area. It is all about the weather.
Hydrological	Hydrological drought is when there is a reduction in the amount of water in an area (this could be less water in lakes, reservoirs, rivers or rainfall). This could be related to increased usage of water, human causes or a lack of rainfall
Global circulation	Drought-the areas suffering from drought usually occur just north and just south of the equator. (30°N and 30°S) Not along the equator. This is because it is between the Hadley Cells and the Ferrell cells, so warm air is sinking - therefore not causing rainfall.
Agriculture	Water can be taken from natural water sources (e.g. rivers or lakes) to irrigate farmland. This can cause water levels to be even lower than normal
Dam building	construction of dams and large reservoirs leads to a reduction of water further downstream (leading to drought)
Deforestation	the cutting down of trees reduces the amount of water intercepted or held by the tree. This could cause the water to dry out (leading to drought). Also, on a global scale, less trees means more CO <sub>2</sub> in our atmosphere leading to the greenhouse effect and global warming

# Section B – Weather Hazards and Climate Change (Drought)

## 2.8 The impacts of, and responses to, drought vary depending on a country's level of development

### Drought in a named developed country (California, USA)

#### Background

California is a state in the USA. It is located on the west coast of the country and is about 35° north of the Equator. In 2014 California suffered from a severe drought. The drought affected over 50% of California.



#### Impacts

Over 17 000 jobs were lost in the farming industry in California as a result of the drought.

The predicted increased cost of fruit and vegetables due to the drought was 6%.

12 forest fires occurred in May 2014, as a result of the trees and woodland drying out.

US\$1.8 billion was predicted to be lost directly or indirectly because of the drought.

21 000 people lost money as a direct or indirect result of the drought.

500 000 acres of farmland was destroyed or permanently damaged as a result of the drought.

The drought resulted in the death of 12 million trees.

Only 50% of water was left in large reservoirs, resulting in the death of salmon, and a decline in recreational activities on the reservoir.

#### Responses

96 million shade balls have been dumped into the LA Reservoir to reduce evaporation rates, saving up to 300 million gallons of water each year.

California has a proposed plan to build a water pipe to transfer fresh water from Alaska to California (1,400 miles).

Many farmers have changed the crops that they grow, to smaller crops that require less water.

There have been over 1,400 dams built across California to hold and control the regular flow of water into urban areas.

Many individuals have adapted their homes, to become greywater homes, whereby waste water from baths and showers is used for other purposes (e.g. toilets or for the garden hose).

In 2015, a desalination plant was built in California, which cost \$1 billion and transfers sea/salt water, into drinkable water.

Residents in Santa Clara can only water their lawns twice a week, or they will be fined \$500 by the government (new laws).

# Section B – Weather Hazards and Climate Change (Drought)

## 2.8 The impacts of, and responses to, drought vary depending on a country's level of development

### Drought in a named emerging or developing country (Namibia)



#### Background

Namibia is an African country, located on the south west coast of Africa. It is about 25° South of the Equator. In 2013 Namibia suffered from a severe drought. It was the worst in the country in 30 years.

#### Impacts

Rural-urban migration rates increased, as people were forced to leave their homes and villages as their water supplies had dried up. This put pressure upon other areas.

Harvest yields (amount of crops produced) were reduced by 50% from the previous year.

Large amounts of animals and livestock were killed due to a lack of water, food and dehydration. (this affected the farming livelihood of 30% of the population in Namibia).

Many individuals have permanently migrated away from their homes in search of better destinations for water, or in search of jobs elsewhere.

Wood is used as a local fuel source. Trees, plants and woodland areas were killed by the heat and lack of water, leading to a lack of wood as a fuel source.

Large areas of grassland have changed becoming deserts due to the lack of rainfall, destroying natural habitats of animals and affecting local food chains.

As Namibians are mainly subsistence farmers (only grow enough to feed their family), over 750,000 Namibians suffered from severe or moderate food insecurity, and so illness, due to crop failures.

#### Responses

The role of the government was minimal and short term, as the Namibian government does not have the money or resources to help everyone.

The government has invested in the Neckartal Dam Project in order to provide a regular supply of water to areas within Namibia, but can not afford to build a large number of dams.

Water aid (Charity) works with local communities to dig boreholes and wells, so that local people can access groundwater deep under ground.

Charities have helped to educate farmers on drip irrigation systems, which use less water by transferring the water directly to the roots of the plants.

Overseas aid from other countries and charities has been given to Namibia. (e.g. International Red Cross gave \$1.5 million, Lutheran Church set up basic food distribution points in some rural areas).

Small amounts of financial aid were offered by the Namibian government (a promise to pay \$13 million), although there was a reliance on foreign governments for funds.

To help the farmers, the government offered them money if they wanted to sell their livestock, or provided transport to move their livestock to other areas of Namibia where there was a better water supply.



# Section C – Ecosystems, biodiversity and management

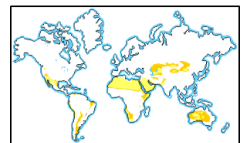
## 3.1 Large-scale ecosystems are found in different parts of the world and are important

### Distribution and characteristics affecting location of world ecosystems

**Tundra** (e.g. Canada). Temperature below 0°C for most of year. Permafrost ground. Low levels of precipitation (less than 250mm). Very few plants except for mosses.



**Deserts** (e.g. Sahara). Very hot all year, above 30°C. Very hot day time temperatures and very cold night temperatures. Very low levels of precipitation (less than 250mm). Very few plants unless they have water-storing features.



**Temperate Grasslands** (e.g. Argentina). Hot in the summer (25°C) and cold in winter (-40°C). Precipitation about 500-900mm each year. They have a dry season and a wet season. Mainly grasses are found with few shrubs and trees.



**Tropical Grassland** (e.g. Kenya). Hot all year, around 25°C - 30°C. Precipitation about 500-1000mm each year, but always has a dry season. Tall grasses are here with a small number of trees and shrubs.



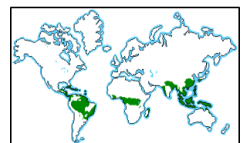
**Temperate Forests** (e.g. UK). Warm summers, around 18°C and cool winters around 5°C. Precipitation all year (approx 1000mm). Deciduous trees found here.



**Boreal Forests** (e.g. Russia). Warm summers (15°C - 30°C) and very cold winters (well below 0°C). Low levels of precipitation (less than 500mm). coniferous trees with needles (not leaves), creating acidic soil.



**Tropical Forests** (e.g. Brazil). Hot all year (25°C - 30°C). High levels of precipitation (more than 2000mm). Wet all year. A huge variety of broadleaved plants (high biodiversity).



### Factors affecting location of ecosystems around the world

#### Climate -

Temperatures decrease with latitude. The equator receives the most heat as the sun's rays are concentrated here. Further away from the equator temperatures decrease, as the curvature of the earth means that the sun's rays are less concentrated.

The global circulation cells also dictate the areas that will receive heavy rainfall or drier zones.

#### Soil -

Different plants require different soils to grow. For example Boreal forests have acidic soils due to the leaves/needles falling to the ground.

Some soils are more permeable, so created well drained soils. Other areas will have more impermeable rock, so will create swamp style bog areas of soil. Both are suitable for different types of vegetation.

#### Altitude -

The distribution of different ecosystems is largely caused by the climate of the area, which is affected by the height of the land.

As you go higher the temperature drops by 1°C per 100 metres. As you go higher, soils become thinner and contain less organic material.

# Section C – Ecosystems, biodiversity and management

## 3.2 The biosphere is a vital system





### Goods used and exploited from the biosphere

resource	examples	impacts
<b>Food</b>	Wheat for bread; Animals, such as cattle, for meat; Fruit, such as bananas; Coffee beans for flavoured drinks; Fish taken in large quantities.	Overfishing (affecting food chains, affecting sustainability of fish industry) Deforestation (to make space for an increasing demand of food) Increased cattle breeding (linked to climate change)
<b>Medicine</b>	Periwinkle plant used for the treatment of childhood leukaemia; Poppies used in the pain killer morphine.	Deforestation (to make space for an increasing demand of medicine) Loss of biodiversity (as natural habitats are destroyed)
<b>Building material</b>	Wood is taken to build housing structures; Straw is used in thatched roofing or as an insulation.	Deforestation (to extract the wood to be used) Loss of biodiversity (as natural habitats are destroyed)
<b>Minerals</b>	Gold and silver are extracted for jewellery and decorative features; Copper is extracted to be used for pipe building.	Deforestation (to extract the minerals to be used) Increased pollution (due to the energy needed to extract, transport and process the minerals) Loss of biodiversity (as natural habitats are destroyed)
<b>Fuel/energy</b>	Oil, coal and natural gas extracted for the production of energy and for transportation (oil); Wind turbines used to convert wind power into an energy source.	Deforestation (to extract the fuel source) Loss of biodiversity (as natural habitats are destroyed) Increased pollution (due to the energy needed to extract, transport and process the minerals) Global warming and pollution (due to the burning of the fossil fuels)
<b>water</b>	Water extracted from on land and ground sources to be treated and then used in a variety of ways including drinking, washing, toilets, agriculture, industry and in the production of thermal and nuclear power.	Drought (as excessive water sources are removed from areas) Loss of biodiversity (animals and plants die as their marine environment is exploited)

# Section C – Ecosystems, biodiversity and management

## 3.3 The UK has its own variety of distinctive ecosystems that it relies on

### UK main ecosystems

UK Main Ecosystem's	Distribution	Characteristics
<b>Moorlands</b> 	Usually found in the upland areas of the UK, such as the Scottish highlands.	Acidic and peaty soil. Only certain plants will survive, such as small shrubs like heather. Deer and foxes found here.
<b>Heathland</b> 	Usually found in lowland countryside areas, such as East Anglia.	Dry and sandy soils. Not very fertile. Only certain plants can survive, such as small shrubs like heather. Rabbits and hares found here.
<b>Woodlands</b> 	Found across the country with concentrations of woodland in South Scotland and South Wales.	Can be deciduous (broad leaved trees that lose their leaves in the autumn) <u>or</u> coniferous woodland (needle like leaves. They keep their leaves throughout the year). Deer and foxes found here.
<b>Wetlands</b> 	Areas of low lying lands that is very wet and boggy (peat bogs and marshes), found along coastlines and rivers. There are a large number in North Scotland.	Peaty, fertile soil that is periodically waterlogged. It is often drained to be used for farming. Otters and wading birds found here.

### UK marine ecosystem

Use of marine ecosystem
Energy - oil and natural gas is extracted from the sea bed around the UK. The UK has oil reserves off the coast of the UK in the North Sea (approximately 24 billion barrels). This provides many jobs and an energy source for the UK.
Renewable energy — The UK uses the wind in the offshore environment to generate electricity/energy. The Liverpool has an offshore wind farm called Burbo Bank Wind Farm with 25 turbines.
Tourism and recreation — 250 million people visit the UK coasts each year for leisure and recreational activities (e.g. sailing or swimming). This brings about £3 billion into the UK economy.
Ports — The UK has ports across the country to import and export goods. 90% of the UK's imports and exports come through the coastal ports.
Food - The UK uses the marine ecosystem for fishing seafood. Over 25 thousand people work in the fishing industry in the UK.

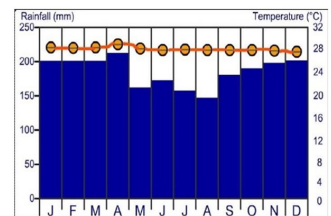
Human impact on the marine ecosystem
Overfishing has had an impact on marine life, food chains and jobs. As a result in 2011 there was a collapse in cod stocks around the UK. New laws have been passed such as the creation of Marine Protected Areas (MPA). No fishing can take place in these areas.
Exploitation of oil reserves in the North sea means that there are now only 24 billion barrels of oil left in this area. Whilst this sounds a lot, it will only last for the next 30 years. There have also been oil spills within the North Sea, affecting marine life.
Construction of renewable energy like offshore wind farms across marine areas of the UK affect marine ecosystems. The construction of the turbines requires them to be connected to the sea bed, affecting natural habitats here.
Coastal Management techniques like the use of groynes can affect marine ecosystems by preventing coastal processes from taking place, such as longshore drift.
Eutrophication is a form of water pollution which takes place in the sea. It is caused by fertilisers from farmland being washed into the sea. This then causes sea algae to grow rapidly, and can block sunlight from reaching other plants in the ocean. Thus, affecting food chains and oxygen levels in the water.

# Section C – Ecosystems, biodiversity and management (Tropical Rainforests)

## 3.4 Tropical rainforests show a range of distinguishing features

### Biotic and abiotic characteristics of the tropical rainforest

Biotic characteristics	Abiotic characteristics
<p><b>Plants</b> - The rainforest has 4 distinct plant levels (shrub layer/forest floor - under canopy - canopy - emergent). Some of the rainforest trees can grow up to 50 metres high.</p> <p><b>Animals</b> - The rainforest has a great variety of animals living on the different layers of the rainforest. For example on the forest floor there are mice, rats and insects. On the canopy layer there are birds, monkeys and sloths.</p> <p><b>Humans</b> - Humans play an important role in rainforest ecosystems, by hunting animals for food, spreading the seeds of rainforest plants through fruits, nuts and seeds that they eat, and through cutting down (deforestation) areas of rainforest.</p>	<p><b>Temperature</b> - the temperature ranges between 27° C and 30°C. There is very little variation between sunlight throughout the year (12 hours daylight; 12 hours night).</p> <p><b>Rainfall</b> - In the rainforest it rains every day. It gets approximately 2,200mm of rainfall each year.</p> <p><b>Soil</b> - soil quality is poor in the rainforest. The constant rainfall washes away nutrients. This process is called leaching.</p>



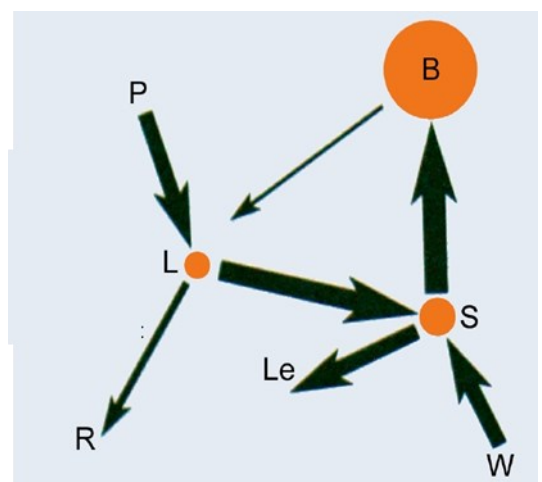
### Tropical rainforest nutrient cycle

The nutrient cycle is the movement of **nutrients** from the non-living environment, to the living environment and back again.

The **Biomass store** is **large** as most nutrients are held in the plants and vegetation, due to the very high biodiversity of plants in the rainforest. Also the lack of seasons means that the trees don't drop their leaves, so nutrients can't be lost in this way.

The **Litter store** is very **small** due to the litter being decomposed very quickly due to the hot and damp climate. Also the constant rainfall means that large amounts of nutrients are taken away by surface run-off.

The **Soil store** is very **small** because the nutrient uptake by the plants and vegetation is very fast, due to the high biodiversity of the rainforest. Also because a lot of the nutrients are washed away, through the soil, by the process of leaching.



Key	
B	- Biomass
L	- Litter
P	- Precipitation
R	- Run-off
Le	- Leaching
W	- Weathering
S	- Soil

# Section C – Ecosystems, biodiversity and management (Tropical Rainforests)

## 3.4 Tropical rainforests show a range of distinguishing features

### Plant and animal adaptation in the tropical rainforest

Plant adaptation technique	Explanation of plant adaptation technique
Drip tip leaves...	To remove excess water off the leaves, in conditions of over 2000mm of annual rainfall.
Buttress roots...	To stabilise the trees as they grow to a great height to gain as much sunlight as possible.
Waxy leaves...	To stop water from infiltrating into the leaf and rotting it.
Tall, straight tree trunks...	To grow straight up towards the light, to out compete other species.
Epiphytes sink roots into a host plant...	So they get all their nutrients from another plant and gain more sunlight by growing high above the ground.



Animal adaptation technique	Explanation of animal adaptation technique
Strong limbs...	The spider monkey has powerful, strong arms to help it to climb through the rainforest trees – finding food and avoiding predators.
Suction cups...	Many frogs have these to be able to grip onto the wet surfaces in the rainforest, and so to allow easy movement throughout.
Camouflage...	The sloth, and many other animals like snakes, use this to hide and to make it difficult for predators to spot them.
Wing structure	The hummingbird has strong, but light muscles in its wings, allowing it to hover in the air to feed. This avoids the threat of predators.
Modified beak	The toucan has a long, large bill to allow it to reach and cut fruit from branches that are too weak to support its weight.



# Section C – Ecosystems, biodiversity and management (Tropical Rainforests)

## 3.5 Tropical rainforest ecosystems provide a range of goods and services some of which are under threat

### Goods and services provided by the tropical rainforest

- 1) Mahogany, found and extracted from the Amazon Rainforest is used for furniture and flooring.
- 2) 7000 drugs have their origins in the rainforest plants and animals. E.g. the Rosy Periwinkle is the basis for a drug used to treat childhood leukaemia.
- 3) Indigenous tribes use the wood in the rainforest to burn as a source of heat and fuel for cooking.
- 4) Bananas grow in the rainforests and are a US\$5 billion dollar industry.
- 5) Large companies, like Shell, extract large amount of oil from the Amazon rainforest since the 1960s.
- 6) Palm oil is grown in many rainforests and is used in food products such as pizza dough and biscuits.
- 7) River boat rides on the Amazon are offered as a good way to see the plants and animals of the rainforest.
- 8) White water rafting is also organised for adventure tourists on rivers, such as the Amazon.
- 9) The hardwood ebony is used to make furniture around the world.
- 10) Quinine which helps cure malaria is extracted from the bark of the cinchona tree from rainforests in Africa.

### Climate change affecting the tropical rainforest

- 1) One prediction is that precipitation levels will vary (with some areas receiving 20% less rainfall than current levels by 2030). Forest vegetation and animals, that can not adapt to changing conditions, will die out or migrate away from that area.
- 2) The Amazon Rainforest contains 40% of earth's species, and biodiversity will be threatened by less rainfall and higher temperatures. As a result links in the food chain will be broken, significantly affecting this biodiversity.
- 3) Another prediction is that climate change could bring seasons (e.g. summer and winter) to the rainforest. The vegetation would therefore change to that of a seasonal tropical forest, affecting the nutrient cycle in the forest, as trees would drop their leaves annually and this could have a knock on effect.
- 4) Due to the increased heat and lack of rainfall, drought or forest fires could occur in the rainforest. This will have a significant impact due to the high biodiversity. And due to the high density of the forests, this means that the wildfires could spread very easily and quickly.
- 5) As temperatures become drier and warmer new plant and animal species may begin to grow in population size. This could include the spread of pests and diseases that current species are not immune to.



# Section C – Ecosystems, biodiversity and management (Tropical Rainforests)

## 3.5 Tropical rainforest ecosystems provide a range of goods and services some of which are under threat

### Causes of deforestation in the tropical rainforest

- 1) Resources such as oil have been extracted from tropical rainforest, like the Amazon Rainforest, for many years. Large areas of forest have to be destroyed to access the oil and generate revenue (money) from selling it.
- 2) A rapidly growing population, (particularly in developing countries, where many tropical rainforests are located) means that there is increasing demand for space, for housing and businesses — both of which lead to large scale deforestation.
- 3) Trees are cut down for fuel/ firewood. In many developing countries (where many tropical rainforests are located) this may be the only source of fuel to meet the needs and demand of a rising population.
- 4) Mining in the tropical rainforest takes places to extract minerals, such as gold, copper, diamonds and other precious metals or gemstones. These are then sold to the global market to generate money for the developing country
- 5) The tropical rainforest is cleared for farming. Poorly educated farmers use the slash and burn' farming methods. The forest is cut down and burned and this adds nutrients to the soil. The cleared area is quickly planted and good crops are harvested intensely. After a few years the nutrients in the soil are exhausted. The farmer will then burn another plot of rainforest, and the cycle continues.

### Sustainable management of the Tropical Rainforest — Costa Rica

- 1) **Land owner tax reduction.** In 1979, the Costa Rican government gave tax reductions and financial grants to owners of rainforests if they conserved the area and protected the scenic beauty. Approx US\$50 was given for every hectare of forest they protected.
- 2) **National parks were set up.** In 1995 the Costa Rican government set up National Parks to protect areas of rainforest with high biodiversity. These areas were protected by law and could not be cut down or damaged.
- 3) **Ecotourism.** In 1983 an ecotourism project took place in Costa Rica called the Rara Avis project. This project has helped to protect 485 hectares of rainforest; and employs all the working staff from the local village of Las Horquetas. The tourists eat locally sourced fruit and vegetables and conserve the environment by recycling all waste. This helps to raise money for the local people, so that they will continue to conserve the rainforest, and is a source of income rather than logging. (Eco tourism now raises almost US\$2 billion every year for Costa Rica)
- 4) **Working with NGOs.** The World Land Trust (an NGO charity) works with the national government to protect the rainforest. The WLT has purchased over 2000 hectares of land in Costa Rica to become part of their national trust, to protect and preserve the land.
- 5) **Carbon credits.** Costa Rica does not produce much CO<sub>2</sub>, due to the large amount of rainforest in the country. Therefore it has many carbon credits that it can sell to other countries that do have high levels of CO<sub>2</sub> emissions. It must keep the rainforests to ensure that it has these carbon credits (For example — The USA is allowed to emit 10 tons of CO<sub>2</sub> but if it emits 11 tons it can buy 1 carbon credit ton from Costa Rica to keep to international law. This money can be used to protect the rainforests in Costa Rica)

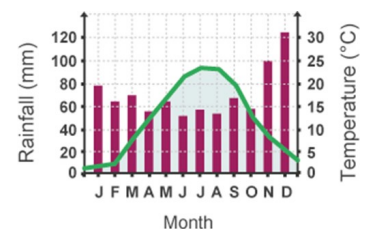


# Section C – Ecosystems, biodiversity and management (Deciduous Woodland)

## 3.6 Deciduous woodlands show a range of distinguishing features

### Biotic and abiotic characteristics of the deciduous woodland

Biotic characteristics	Abiotic characteristics
<p><b>Plants</b> – The deciduous woodland has 4 distinct plant levels (ground layer - field/herb layer - sub canopy layer - canopy layer). Some of the deciduous woodland trees, like Oak or Ash trees can grow up to 30 metres high</p> <p><b>Animals</b> – Due to the changing weather conditions in winter and summer, some animals (like hedgehogs) have to hibernate during the winter months. Other animals (birds) will migrate away from the UK in winter to avoid the cold weather.</p> <p><b>Humans</b> – Humans play an important role in deciduous woodland ecosystems. Cutting down of the deciduous woodland for housing or road building destroys the ecosystems and natural habitats of animals. However, some deciduous woodlands are protected and owned by the national trust to preserve the ecosystem and natural environment.</p>	<p><b>Temperature</b> – the temperature ranges between 4°C and 17°C. There are long periods of light during the summer months (approx. 17 hours) and only short periods of light during the winter months (approx. 8 hours).</p> <p><b>Rainfall</b> – In the deciduous woodland the rainfall is greater in the winter months than in the summer months. However it does rain all year round. It gets approximately 1,000 mm of rainfall each year.</p> <p><b>Soil</b> – soil quality is very fertile in deciduous rainforests. The autumn fall of leaves means there are plenty of nutrients in the soil and earthworms help to mix the nutrients together.</p>



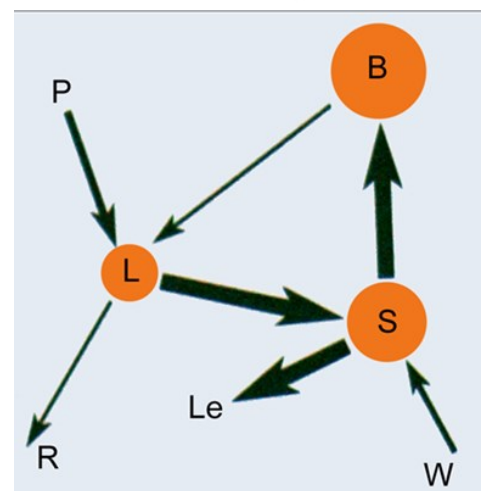
### deciduous woodland nutrient cycle

The nutrient cycle is the movement of **nutrients** from the non-living environment, to the living environment and back again.

The **Biomass store** is **large** (but not as large as in the tropical rainforest). This is due to the deciduous woodlands being fairly biodiverse, so most nutrients are held in the plants and vegetation,

The **Litter store** is **moderately large** due to the leaves from the trees falling annually in autumn because of the seasons. The constant rainfall throughout the year means that nutrients are still taken away by surface run-off. The decomposition rates are moderate, compared to the faster rates in the tropical rainforest.

The **Soil store** is **moderately large** because there is a supply of nutrients that are obtained from decomposing litter, particularly in the spring when the temperatures begin to warm up. However, the constant rainfall throughout the year means that nutrients are still taken away by leaching and taken up by the vegetation in the woodland.



Key	
B	- Biomass
L	- Litter
P	- Precipitation
R	- Run-off
Le	- Leaching
W	- Weathering
S	- Soil



# Section C – Ecosystems, biodiversity and management (Deciduous Woodland)

## 3.7 Deciduous woodlands ecosystems provide a range of goods and services some of which are under threat

### Goods and services provided by the deciduous woodland

- 1) Air dried fuel wood is used in the UK for wood burning stoves and charcoal barbecues.
- 2) Venison (deer meat), game birds (pheasant and partridge) are found within temperate forest areas.
- 3) Some UK Power plants are being converted to burn biomass - much of it wood pellets from deciduous and coniferous woodlands.
- 4) Edible fungi is taken and used from deciduous woodlands.
- 5) The UK produces 13 million tonnes of timber in 2014 which is used in furniture making and building materials.
- 6) Go-ape is a company that uses the deciduous woodlands across the UK for zip wire and high wire activities.
- 7) Parts of the deciduous woodlands have been made into nature trails, cycle paths and horse riding trails.
- 8) Oak is one of the main wood types used in furniture building in the UK.
- 9) Poppies are used as the main source of the painkiller morphine. These can be found in some deciduous woodlands.
- 10) Oak trees are often cut down to be used as a wood in housing construction.

### Climate change affecting the deciduous woodland

- 1) Plants and animals are adapted to surviving the cold winters in a seasonal climate. However with climate change, winters will get milder, killing animals and plants that can not adapt to this.
- 2) Key processes such as seed germination (the process by which an organism grows from a seed, or buds) is triggered by cold temperatures. Without this plants may not start their growth.
- 3) Pests and diseases are often killed off during the winter due to the cold winter temperatures. If the winters are mild, then diseases may spread.
- 4) More frequent droughts would put a lot of stress on deciduous woodland trees as they are not adapted to survive these conditions year after year. Beech trees are particularly vulnerable to drought stress.
- 5) Drier conditions could also lead to an increase in forest fires.



# Section C – Ecosystems, biodiversity and management (Deciduous Woodland)

## 3.7 Deciduous woodlands ecosystems provide a range of goods and services some of which are under threat

### Causes of deforestation in the deciduous woodland

- 1) The UK has a large and complex rail and road network. To put this in place, large areas of forest have had to be removed. This is continuing as new roads/rail links are built (e.g. HS2 from Manchester—London).
- 2) A rapidly growing population worldwide means that there is increasing demand for space, for housing and businesses – both of which lead to large scale deforestation.
- 3) Landowners across the UK have cut down large areas of forest to plant crops. This is because there is a great demand for food in the UK, and also linked to a growing total population.
- 4) Due to a growing UK population, there has been a greater demand for housing which meant that trees across the UK have to be felled, to use in home building.
- 5) The UK has a large number of dams, which have been constructed to provide a regular supply of water and HEP energy. These often require large areas of land to be deforested to make room for the dam and the reservoir.

### Sustainable management of the deciduous woodland – New Forest, UK

- 1) When coniferous trees (non native to the UK) are cut down for timber in the New Forest, they are replanted with native species of deciduous trees. This increases the percentage of deciduous trees in the New Forest.
- 2) The use of pesticides (used to kill pests, such as insects and rodents) and herbicides (used to kill unwanted plants and weeds) is restricted across the New Forest. It is only used sparingly to avoid damaging the ecosystem, as they can kill animals, affect the growth of plants and contaminate water supplies.
- 3) Very little maintenance work in the New Forest takes place during the summer months. The foresters, who help to sustainably maintain the forest, only cut down timber, plant new trees and cull deer in the winter. This is when there are the fewest visitors, so the local economy does not suffer from a lack of tourists. Also this means that nesting birds are not disturbed, and plants and trees are not cut back in their growing season.
- 5) Half of the New Forest is owned and managed by the Forestry Commission. This is a non-government organisation (NGO) which ensures for the protection of the New Forest. This organisation runs courses in sustainable woodland management for private woodland owners in the area and supports volunteers in conservation work.
- 6) In the New Forest there are restrictions as to where people can go, so that areas of the New Forest are not damaged by tourists. There are a lot of car parks in the New Forest so that people do not park on roadside verges, as this could erode away the land or disturb animals. Special cycle routes and paths have been set up through the Park, which guide visitors away from vulnerable areas. Also, fences and barriers are used to stop access to certain areas to protect them.
- 7) The New Forest has a visitors centre, set up and run by the Forestry Commission. At the New Forest Visitor Centre they provide a visitor leaflet called '5 ways to love the forest'. This explains why visitors should drive slowly through the forest or leave their car behind, and about why it is important to keep to pathways around the forest. This helps to reduce the impact by humans on the area.

