

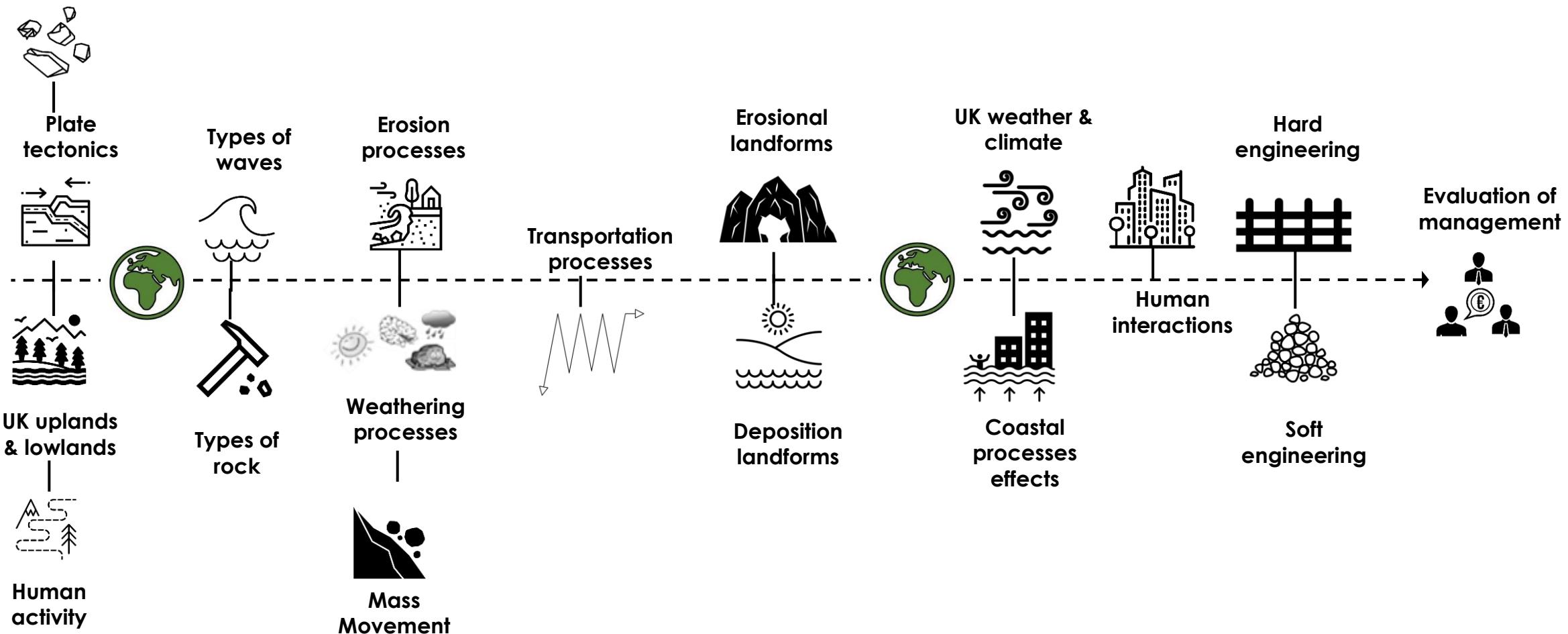
# KTC Geography GCSE Edexcel Spec A Knowledge Organiser

## How to use this Knowledge Organiser

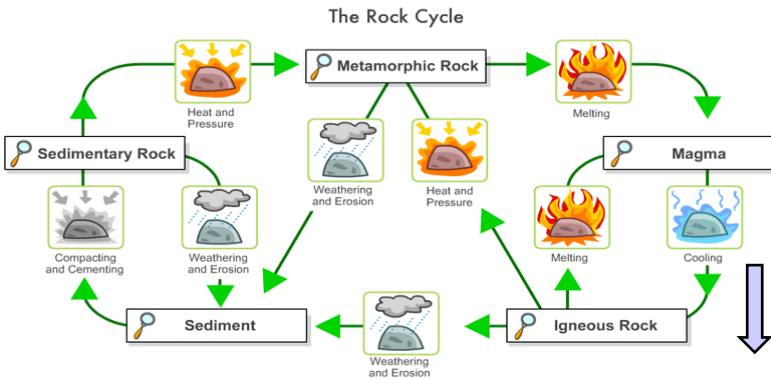
1. Study each Topic route map
2. Check you know and understand each section of the route map by studying the details on the following pages
3. Self-test (or test each other) on your knowledge and understand of each process or concept
4. Make flash cards, especially of the parts that you struggled with on the self-test
5. Go back over the Google Classroom lessons for those parts you found really difficult to understand
6. Design flow charts for concepts, models and Case Studies
7. Visit Seneca and test yourself on those parts that are really difficult
8. Make your own vocabulary book with definitions of the keywords
9. Check out the Command Words for this spec and know what writing and Geography is required for each Command Word
10. Create spider diagrams to show how each topic is linked to others and explain why they are linked

# Paper 1 Topic 1 The changing landscape of the UK – Geology and Coasts

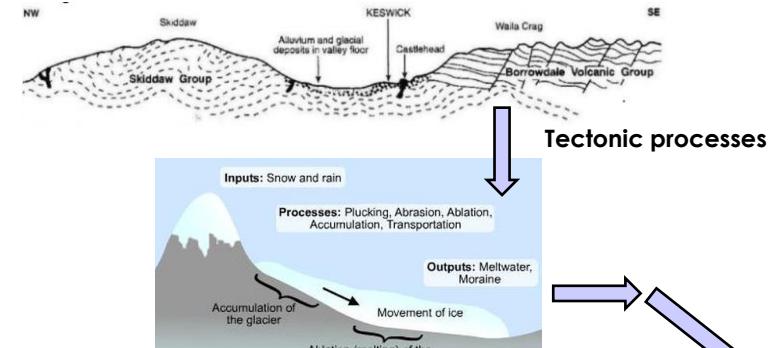
## Geology



# Paper 1 Topic 1 The changing landscape of the UK - Geology



- Geology = type of underlying rock – igneous, metamorphic, sedimentary
- Tectonic processes = movement of the Earth's tectonic plates
- Glaciation = process of land or water being covered by glaciers or ice sheets



## Glacial processes

### Tectonic processes

**Weathering – the breaking down of rock by heat, wind & water**

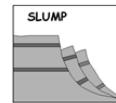
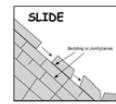
**Freeze-thaw**

**Onion skin**

**Chemical**

**Biological**

## Mass Movement



## Case Studies: The Lake District & The Weald

**Helvellyn** stands as one of England's highest mountain, standing at 949 metres above sea level in the Lake District in north-west England. It is made up of **igneous** rocks which were formed 450 million years ago. Many of the landscape features visible around Helvellyn today were formed during the last ice age over 20,000 years ago. Large **glaciers** dominated the landscape and through their erosive power, carved out classic glaciated landforms such as **arêtes, corries and glacial troughs**. Helvellyn is a mountain, which contains several glacial landforms. Two arêtes ascend to the summit of Helvellyn, Striding edge and Swirlal edge. Striding Edge forms the back wall of the Red Tarn corrie.

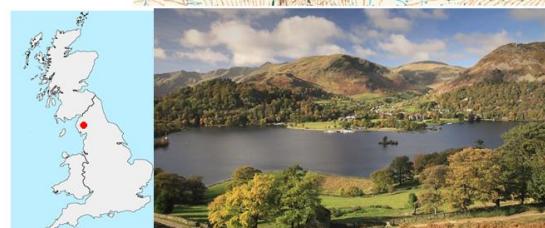
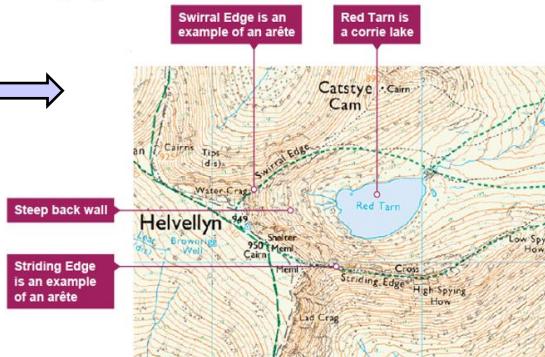


**The UK's main rock types**  
Rocks can be classified into three main groups - **igneous, metamorphic** and **sedimentary**. These three different rock types can be found in distinct areas of the UK.

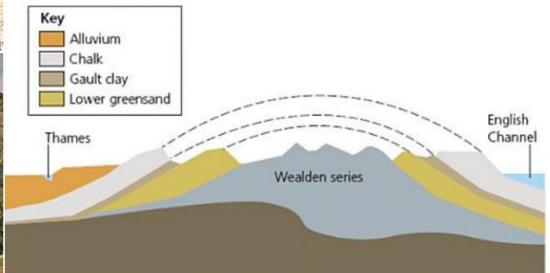
**Igneous rocks** - these rocks are a result of **tectonic processes** in the past, when Britain was close to a plate boundary.

**Metamorphic rocks** - these are rocks that have been changed in shape and form by **intense heat and pressure** at a plate boundary or along a fault line.

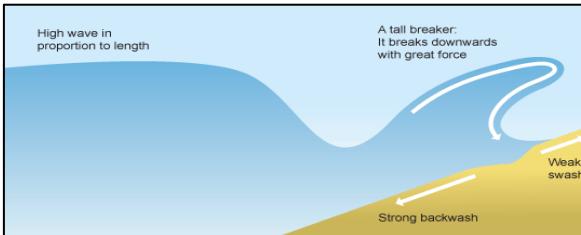
**Sedimentary rocks** - these are made up of small particles of sand and rock, which have been transported by the **wind, rivers and ice** and are usually deposited on lake or seabed.



**The Weald** is an area of upland landscape in lowland southern Britain, in Kent and Sussex. It is about 250m above sea level and was originally an anticline of folded rocks that has been exposed to much **weathering**. This weathering has resulted in different layers of strata being exposed, with more resistant rocks such as chalk being exposed as escarpments. This gives a scarp and vale landscape between the North and South Downs.



# Paper 1 Topic 1 The changing landscape of the UK – Coastal processes

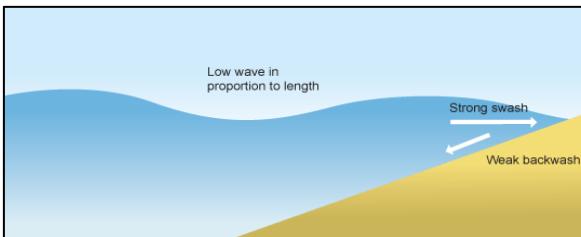


## Destructive waves

Waves are created by **wind** blowing over the surface of the sea. As the wind blows over the sea, friction is created - producing a **swell** in the water. The energy of the wind causes water particles to rotate inside the swell and this moves the wave forward.

The size and energy of a wave is influenced by:

- how long the wind has been blowing
- the strength of the wind
- how far the wave has travelled (the **fetch**)



## Constructive waves

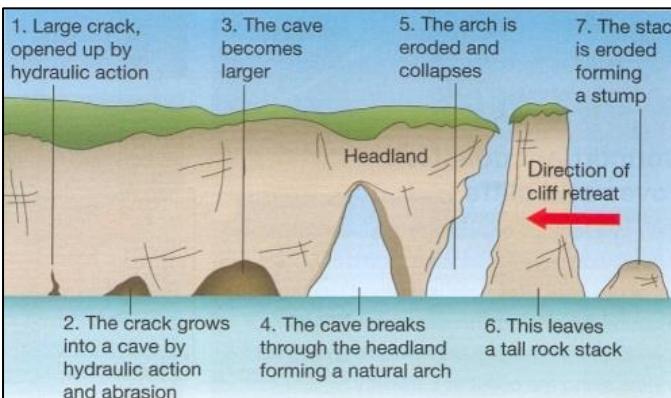
When a wave breaks, water is washed up the beach - this is called the **swash**. Then the water runs back down the beach - this is called the **backwash**. With a constructive wave, the **swash is stronger** than the backwash. With a destructive wave, the **backwash is stronger** than the swash.



### Coastal Processes

#### Erosion

- Hydraulic action
- Abrasion
- Attrition
- Corrosion



### Coastal Processes

#### Transportation – longshore drift

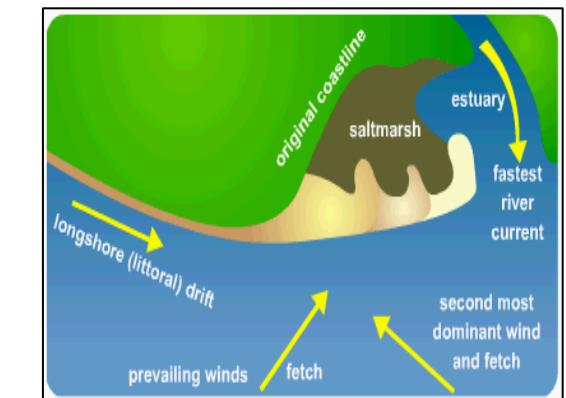
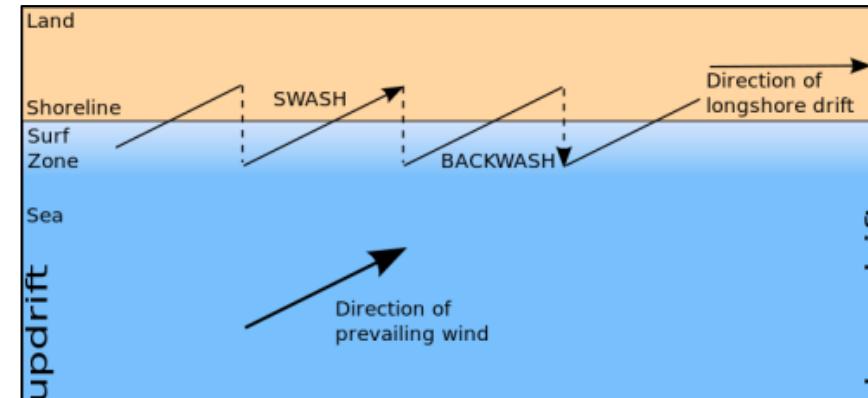
- Traction
- Saltation
- Suspension
- Solution



### Coastal Processes

#### Deposition

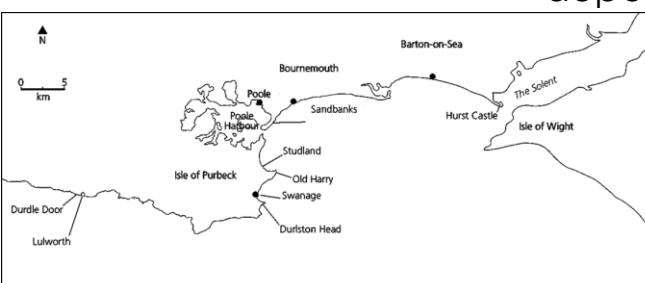
- Heaviest material 1<sup>st</sup>
- Change in coastline



# Paper 1 Topic 1 The changing landscape of the UK – Coastal Management



## Case Study: Coastal landforms Dorset Coast

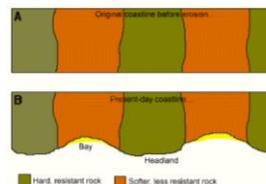


**Where:** Dorset coast (Jurassic Coast)

**Why:** Lines of hard and soft rock, **concordant and discordant coastline**, prevailing SW winds

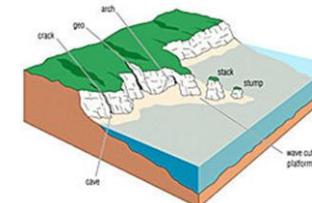
**Who:** Main urban areas Swanage, Poole, Bournemouth

**How:** **Swanage Bay = discordant coastline** - formed through erosion of soft clay and sands, **headlands** remain of harder limestone and chalk

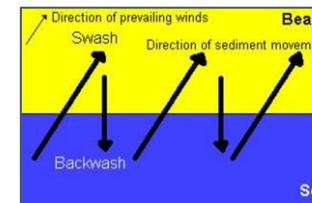


**How:** **Old Harry's Rocks** formed through hydraulic action, abrasion and attrition.

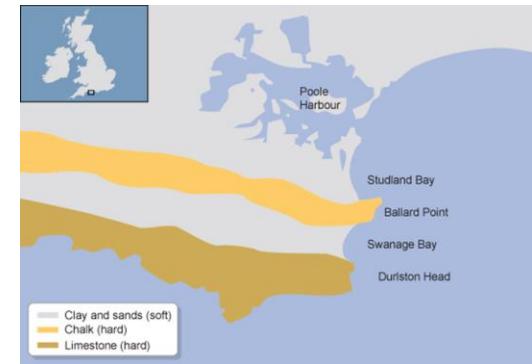
Crack → Cave → Arch → Stack → Stump



**How:** **Sandbanks spit** formed by longshore drift and deposition at estuary at **Poole Harbour**



**Main industries:** Tourism (Swanage and Jurassic Coast), transportation (Poole Harbour), Oil refinery (Bournemouth)



# Paper 1 Topic 1 The changing landscape of the UK – Coastal Management

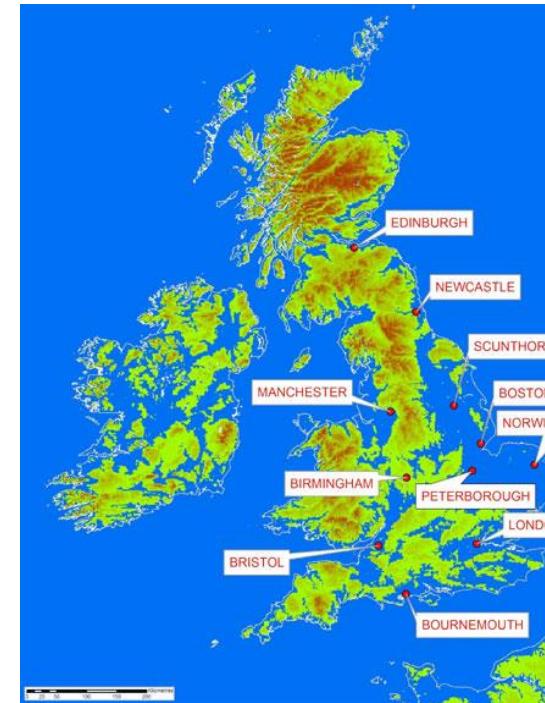
Erosion processes remove land from some parts of the coastline, whereas deposition processes create new land in other places. In addition, the fact that the sea level is rising locally and globally could add to these erosion and deposition problems whilst also removing land from use at the coastline. It is for these reasons that human beings have long sought to control and MANAGE the coastline. However, there is a huge debate as to how to do this - either by using HARD ENGINEERING or SOFT engineering.

## Hard engineering

- Sea Wall
- Rip-rap
- Gabions
- Off-shore breakwater
- Groynes



## Sea level rise around the UK



## Soft engineering

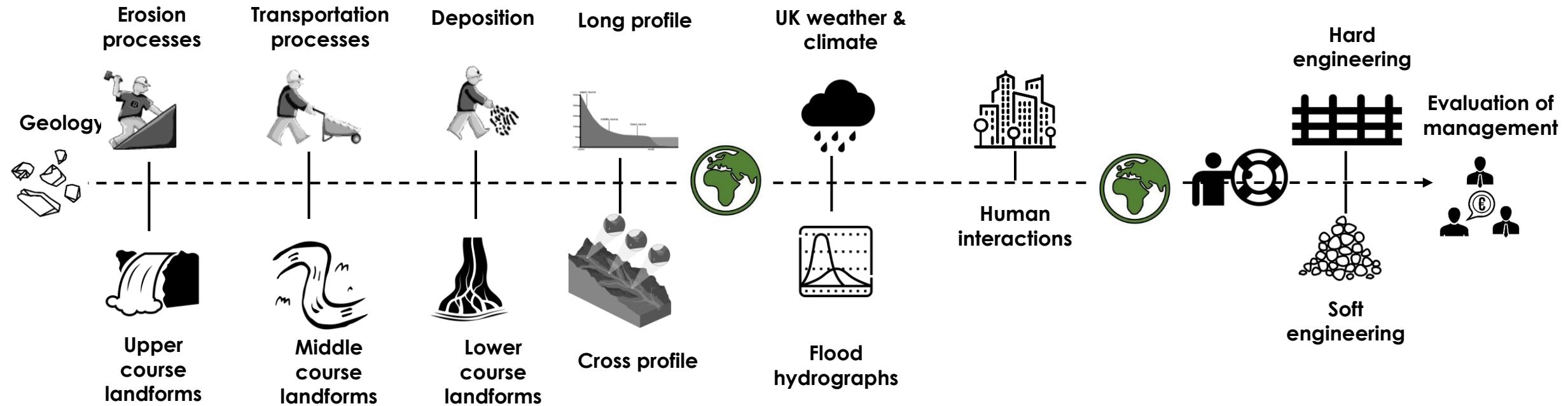
- Beach nourishment
- Dune regeneration
- Salt marsh
- Coastal zoning
- Mangrove swamps (tropical climates)



**Shoreline Management Plans (SMP's)** use one of 4 options to manage the coast:

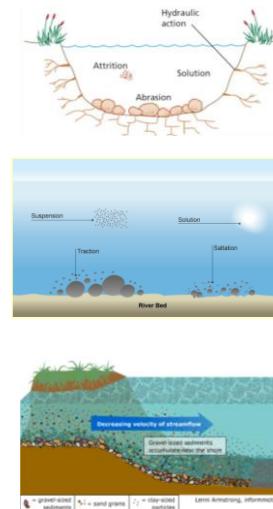
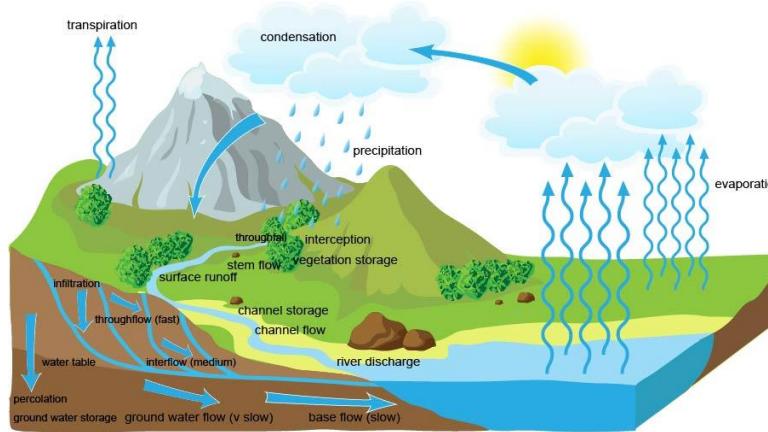
- **Advance the line:** move the coastline seaward – expensive
- **Hold the Line:** use of hard or soft engineering methods – expensive but preferred by locals
- **Managed retreat:** allows coastline to move inland – cheap but causes conflict
- **Do nothing:** allow natural erosion and flooding – cheap but causes great conflict

# Paper 1 Topic 1 The changing landscape of the UK – Rivers



# Paper 1 Topic 1 The changing landscape of the UK – River processes

## The Hydrological Cycle



## Hydrological Processes

### Erosion

- Hydraulic action
- Abrasion

### Attrition

- Attrition
- Corrosion

### Transportation

- Traction
- Saltation
- Suspension
- Solution

### Deposition

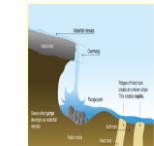
- Heaviest pebbles 1st

## River Landforms

### Upper Course

- V-shaped Valleys
- Interlocking spurs
- Rapids
- Waterfalls and Gorges

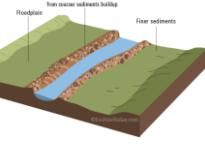
Source



### Middle Course

- Meanders
- Ox-bow lakes
- Floodplains
- Levees

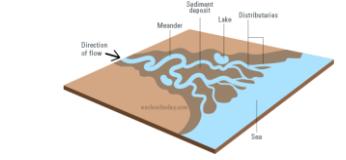
Middle Course



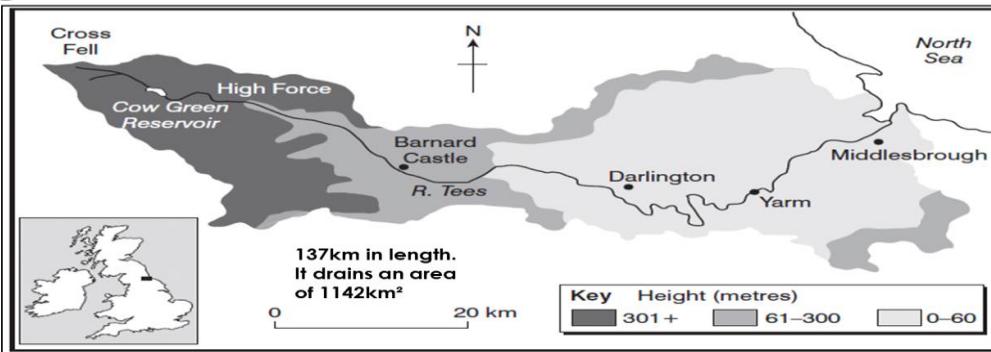
### Lower Course

- Estuaries and deltas

Mouth



## Case Study: River Landforms - River Tees



**Upper Course**

- Source high in the Pennines (893m above sea level)
- High run off as steep V shaped valleys of impermeable rock
- High rainfall – good water supply
- Many tributaries
- Famous high fall waterfall – tallest in England 21m high – **High Force**
- Gorges, rapids and potholes

**Middle Course**

- Clear widening and meandering
- Meanders cut off in the 19<sup>th</sup> century
- Sides become less steep
- Lateral erosion
- Fertile soil

**Lower Course**

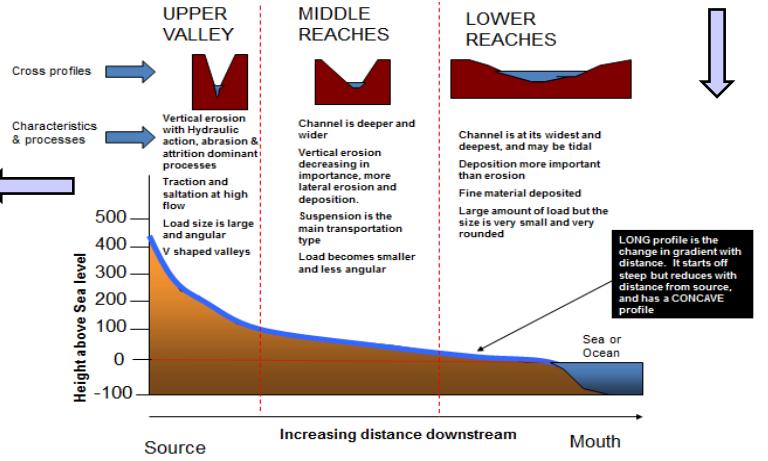
- Very urbanised and large populations. Eg Yarm
- Important wildlife seals & migratory birds also SSSI
- Ox bow lakes
- Large oil, gas and petrochemical industries (as flat land)
- Natural levees formed due to silt build up
- Mouth is in the North sea
- Wide mudflat estuary (tidal)
- Huge water sports complex Tees Barrage

**River Management**

- Long history of flash flooding
- Cow Green reservoir, controls water supply for industries along the river
- Straighten the river for easier navigation during the industrial revolution
- Flood protection schemes in Yarm

Upstream	Downstream
Discharge	
Occupied channel width	
Channel depth	
Average velocity	
Load quantity	
Load particle size	
Channel bed roughness	
Slope angle (gradient)	

## The Bradshaw Model



The **long profile** of a river shows the changes of the **relief** of a typical river as it moves from its upstream source to its downstream mouth.

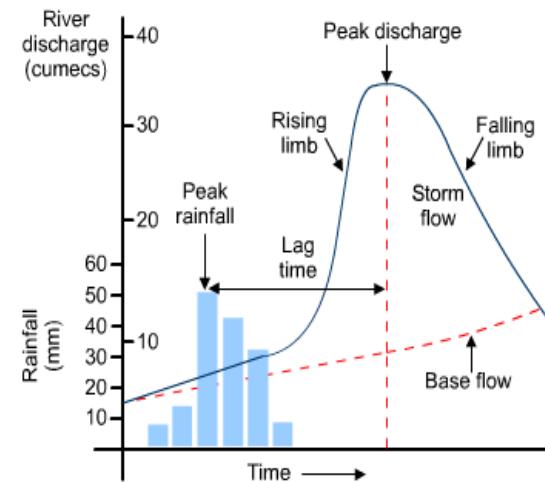
The **Bradshaw Model** shows why these changes occur. **Discharge increases because there is a larger drainage basin/catchment.**

# Paper 1 Topic 1 The changing landscape of the UK – River Management

Rivers are managed in a huge variety ways and for a variety of different reasons. We use rivers for collecting water for drinking, industry and farming, and we manage them to prevent damage caused by deposition, erosion and flooding. Management can be split into 2 areas - HARD and SOFT ENGINEERING.

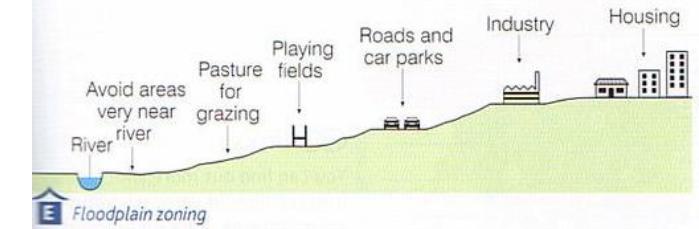
## Hard engineering

- Dams and reservoirs
- Channelization
- Culverts
- Sluice gates
- Flood walls or levees
- River groynes (deflectors)
- Weir
- Gabions
- Flood relief channels
- Dredging



## Soft engineering

- Afforestation
- Managed flooding, washlands, floodplain restoration or preservation
- Floodplain zoning

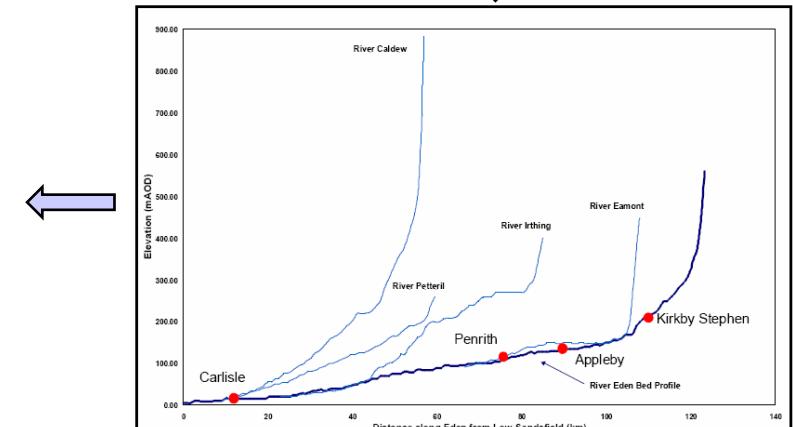
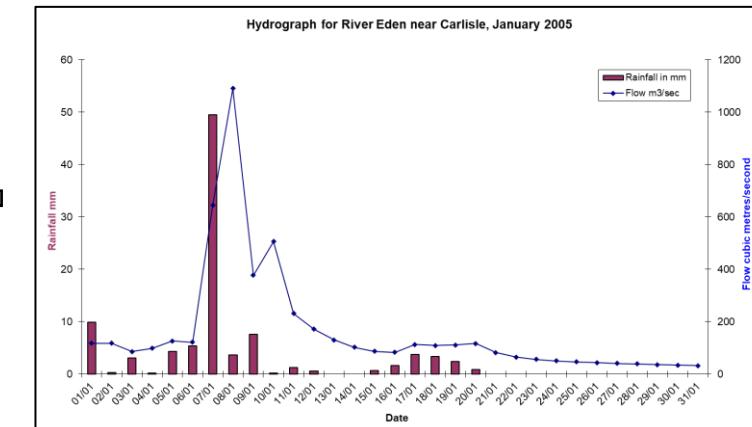
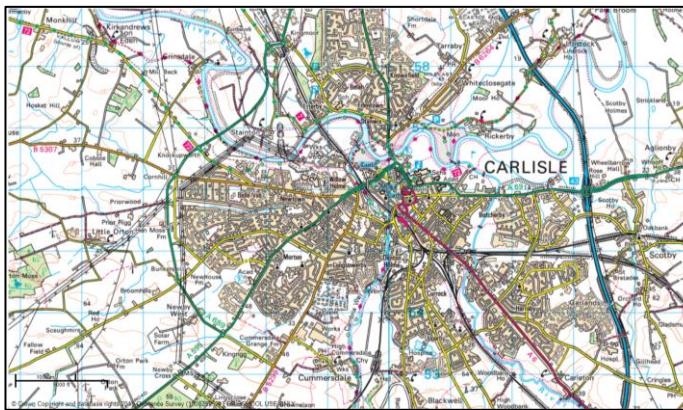
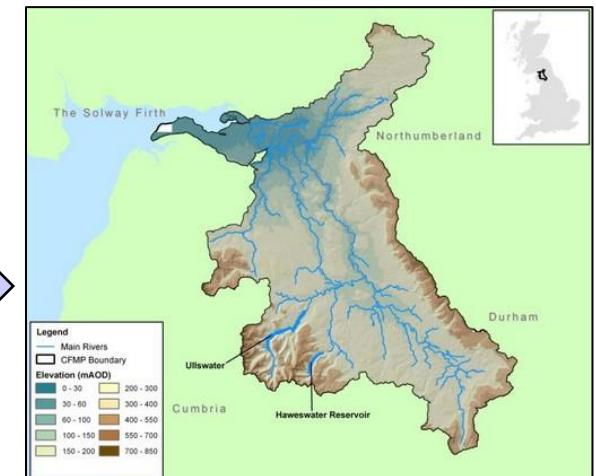
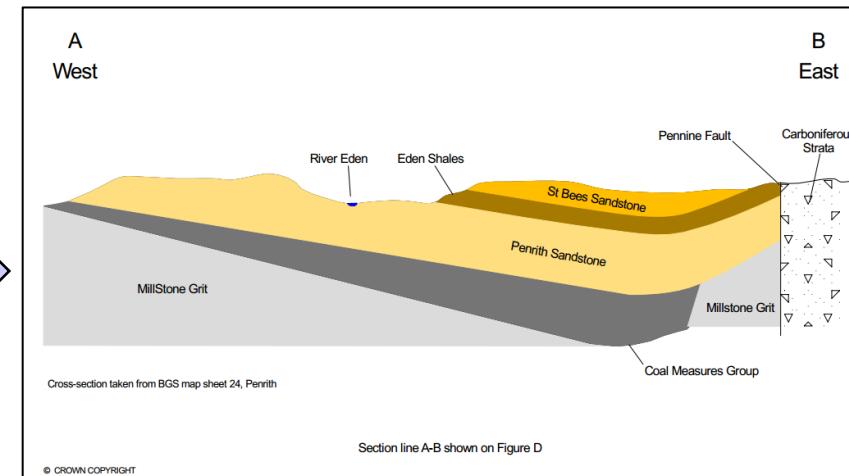
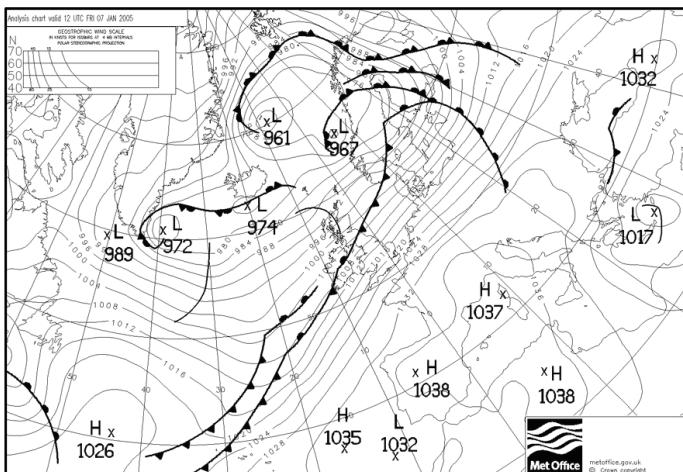


# Paper 1 Topic 1 The changing landscape of the UK – River Management



## Case Study: River Eden floods, Carlisle, UK

**What:** UK Floods **When:** 6<sup>th</sup> to 8<sup>th</sup> January 2005 **Where:** River Eden, Carlisle, Cumbria, Lake District, England **Who:** Population 105,562



# Paper 1 Topic 1 The changing landscape of the UK – River Management



## Case Study: River Eden floods, Carlisle, UK

**What:** UK Floods **When:** 6<sup>th</sup> to 8<sup>th</sup> January 2005 **Where:** River Eden, Carlisle, Cumbria, Lake District, England **Who:** Population 105,562

### Causes:

 **Social:** Carlisle is built on the floodplain of the River Eden and lies at the confluence of the River Eden, River Caldew and River Petterill

 **Technological:** Limited flood management schemes

 **Economic:** Sheep farming compacted soil upstream leading to greater surface run-off

 **Environmental:** Intense low pressure system (depression 980mb) stayed over NW England, precipitation fell constantly for several days, 180mm with some areas experiencing 100mm in 24 hours (7.12.2004), saturated ground on top of impermeable underlying bedrock.

 **Political:** Government was unprepared for one in 200 year weather experience. Lack of funding from local and central government for flood protection schemes

### Impacts:

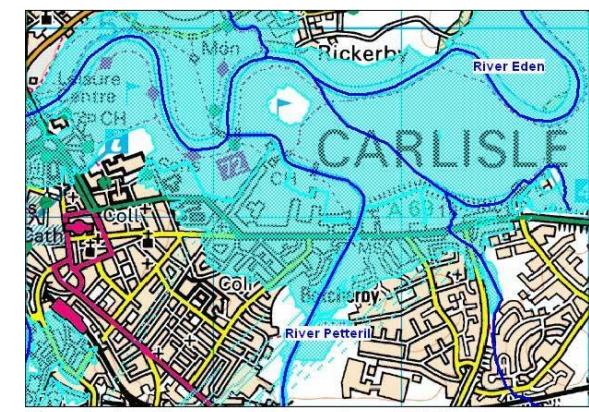
 **Social:** 3 people died, 2,700 homes affected, 50% of residents had not signed up to receive flood warning messages, several schools temporarily closed

 **Technological:** Transport systems damaged as impassable, no electricity for several days

 **Economic:** Cost estimated at over £400 million, many local businesses affected including McVities biscuit factory, where several people lost their jobs, many homes were not insured or under insured

 **Environmental:** Up to 2.5m of water in some places, increased bank erosion, drains and sewerage system could not cope

 **Political:** Fire station and police station flooded, people rescued by the coastguard



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# Paper 1 Topic 1 The changing landscape of the UK – River Management



## Case Study: River Eden floods, Carlisle, UK

**What:** UK Floods **When:** 6<sup>th</sup> to 8<sup>th</sup> January 2005 **Where:** River Eden, Carlisle, Cumbria, Lake District, England **Who:** Population 2005 = 105,562

### Management:

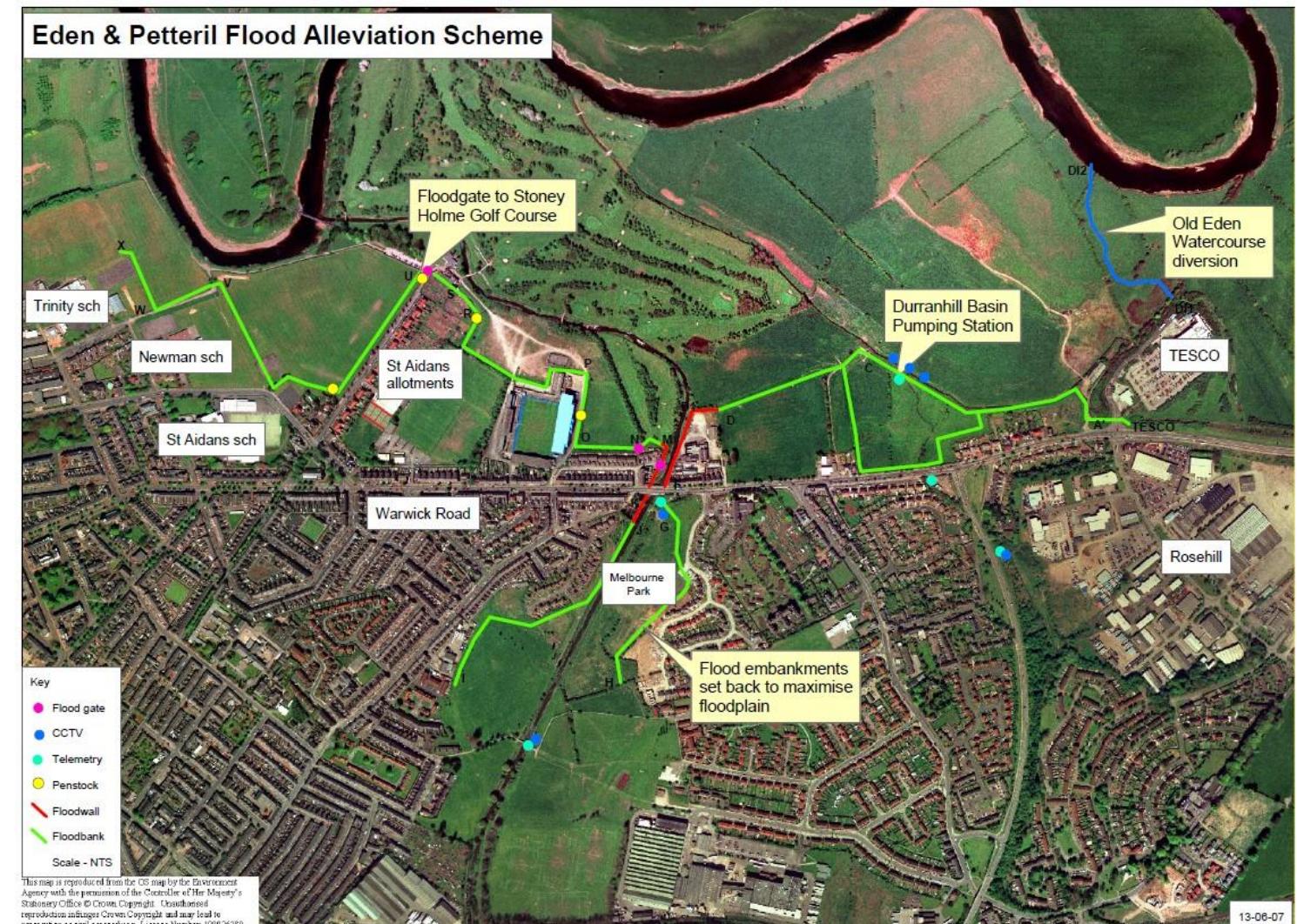
Rivers Eden and Peterill Flood Alleviation Scheme

- Raised embankments
- Flood gates
- Diversion of river course
- Flood warning system
- Flood storage areas allocated
- River wall at Carlisle United FC ground
- New sewers
- £36 million project

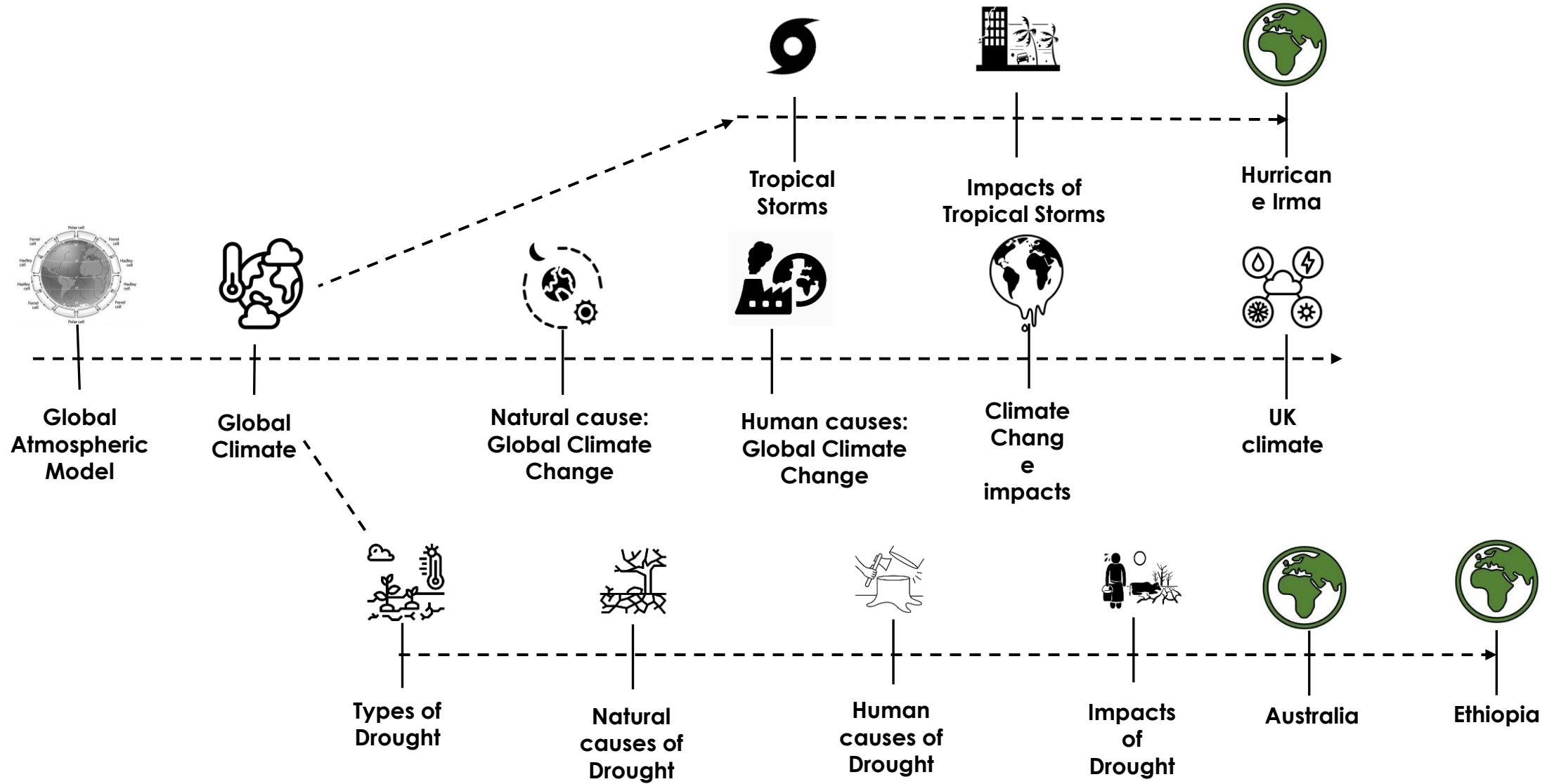
### Floods since 2005:

2009 150 flooded homes

2015 Storm Desmond 7,500 flooded properties



# Paper 1 Topic 2 Weather hazards and climate change



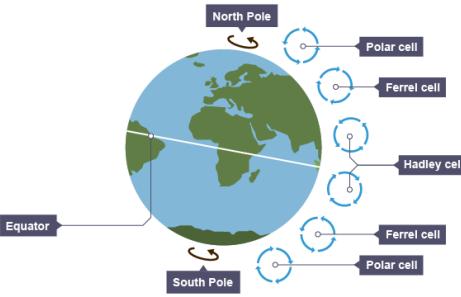
# Paper 1 Topic 2 Weather hazards and climate change - GAC

The movement of air across the planet occurs in a specific pattern. The whole system is driven by the equator, which is the hottest part of the Earth. Air rises at the equator, leading to low pressure and rainfall. When the air reaches the edge of the atmosphere, it cannot go any further and so it travels to the north and south. The air becomes colder and denser, and falls, creating high pressure and dry conditions at around 30° north and south of the equator. Large cells of air are created in this way. Air rises again at around 60° north and south and descends again around 90° north and south. The names of the cells are shown in the diagram.

## The Hadley cell

The first cell is called the Hadley cell. At the equator, the ground is intensely heated by the sun. This causes the air to rise which creates a **low-pressure** zone on the Earth's surface. As the air rises, it cools and forms thick cumulonimbus (storm) clouds. The air continues to rise up to the upper atmosphere, and the following then happens:

- The air separates and starts to move both north and south towards the poles.
- When it reaches about 30° north and south, the air cools and sinks towards the ground forming the subtropical **high-pressure** zone.
- As the air sinks, it becomes warmer and drier. This creates an area of little cloud and low rainfall, where deserts are found.
- The Hadley cell is then complete. The air completes the cycle and flows back towards the equator as the **trade winds**.
- In the northern hemisphere, the winds flow to the right and are called northeast trade winds. In the southern hemisphere the winds flow to the left and are called the southeast trade winds. This is down to the **Coriolis force** and friction.



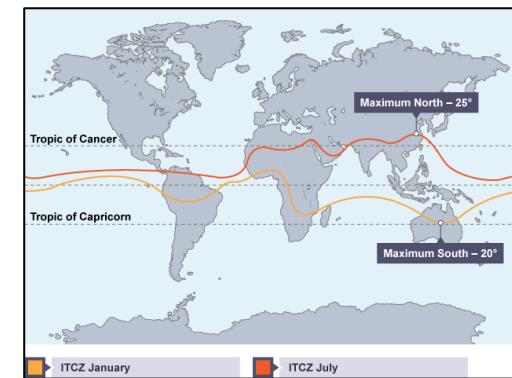
Global atmospheric circulation creates winds across the planet and leads to areas of high rainfall, like the tropical rainforests, and areas of dry air, like deserts.

## The Ferrel cell

The Ferrel cell occurs at higher latitudes (between 30 degrees and 60 degrees N and 30 degrees and 60 degrees S):

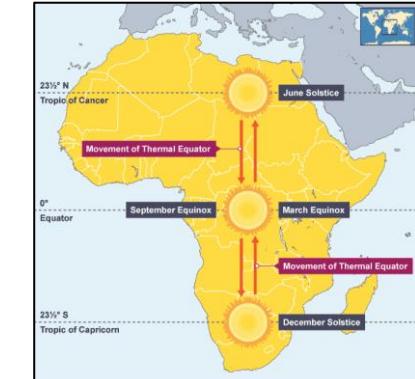
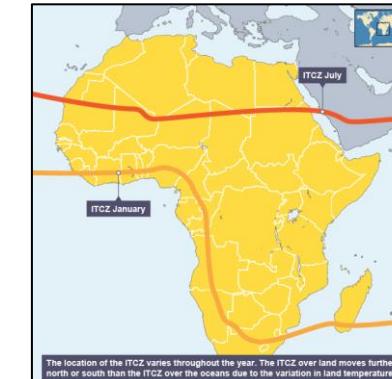
- Air on the surface is pulled **towards** the poles, forming the warm south-westerly winds in the northern hemisphere and north-westerly winds in the southern hemisphere.
- These winds pick up moisture as they travel over the oceans. At around 60 degrees N and 60 degrees S, they meet cold air, which has drifted from the poles.
- The warmer air from the tropics is lighter than the dense, cold polar air and so it rises as the two air masses meet.
- This uplift of air causes low pressure at the surface and the unstable weather conditions that are associated with the **mid-latitude depressions**. Much of our wet and windy weather in the UK is determined by this.

The **ITCZ** is a zone of convergence at the thermal equator where the trade winds meet. It is a low pressure belt and migrates with the changing position of the thermal equator. The thermal equator receives the **most intense heat** from the Sun. Around 20th June each year the Sun is overhead at 23½° North, the Tropic of Cancer. Around 20th December the Sun is overhead at 23½° South, the Tropic of Capricorn.



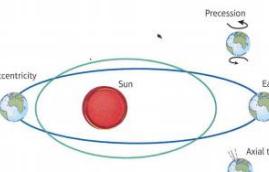
## The Polar cell

At the poles, air is cooled and sinks towards the ground forming high pressure, this known as the **Polar high**. It then flows towards the lower latitudes. At about 60 degrees N and S, the cold polar air mixes with warmer tropical air and rises **upwards**, creating a zone of low pressure called the **subpolar low**. The boundary between the warm and cold air is called the **polar front**. It accounts for a great deal of the unstable weather experienced in these latitudes.



# Paper 1 Topic 2 Weather hazards and climate change – Natural causes

**Climate change** – is the average climate conditions of the planet. They vary over time. The earth has a history of going between warm (interglacial) and cold (glacial) periods. **Climate change can be caused by both natural events and humans**

Factor	Effect
Milankovitch Cycles	<p>These are natural changes to the earth's orbit and position that affect how much solar radiation we receive from the sun</p> <ul style="list-style-type: none"> <li>Eccentricity – The orbit becomes elliptical so at times the earth is further from the sun causing it to be much cooler</li> <li>Axial tilt – The angle of the earth's tilt changes so summers and winters are more extreme when this happens</li> <li>Precession – The earth sometimes wobbles on its axis and it changes seasons slightly.</li> </ul> 
Solar Variation	The amount of radiation the sun produces varies over time. Lower solar activity are likely to end in glacials.
Volcanism	Large-scale eruptions can lead to lots of ash in the atmosphere, sometimes it's so great it can block out the sunlight reducing global temperatures
Surface impact	Asteroids and comets can impact the earth's surface and cause lots of ash blocking out sunlight and reducing global temperatures

## What is the evidence?

### Ice Cores

Ice sheets in Greenland or Antarctica have built up over many years. In some places ice can be 3,000m deep. As snow falls and compacts as ice, it traps air bubbles – these contain a sample of what the atmosphere was like at that time.

Water in the ice also contains isotopes – scientists can measure the temperature of the earth at the time



### Historical Sources:

Historical documents such as diaries, paintings etc. can describe what the climate is like at the time



### Tree rings:

As trees grow they produce growth rings. In warmer climates growth rings are further apart. In cooler climates they are closer together.

These can indicate what the climate was like 100,1000 years ago

# Paper 1 Topic 2 Weather hazards and climate change – Human causes

## Transport:

As cars are more affordable now than ever – more people are buying and using them. As well as this, flights are now cheaper so people fly more. All modes of transport rely on fossil fuels



## Energy:

The demand for electricity is growing because of increasing population, standard of living improves, technology improves and people because richer



# How do humans cause global warming?



## Industry:

As people have more disposable income increases, so does the demand for the production of industrial goods. This leads to more fossil fuels being used



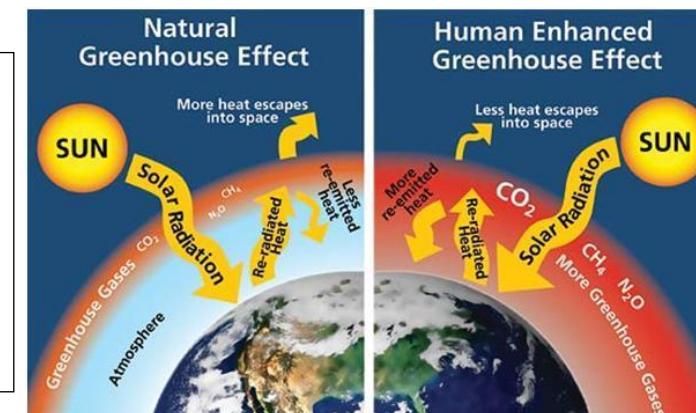
## Agriculture:

Increased population growth means there is an increased need for food. This then leads to more intensive agricultural practises that require machinery which use fossil fuels

## The natural greenhouse Effect:

This is a **natural process**, which keeps the earth warm.

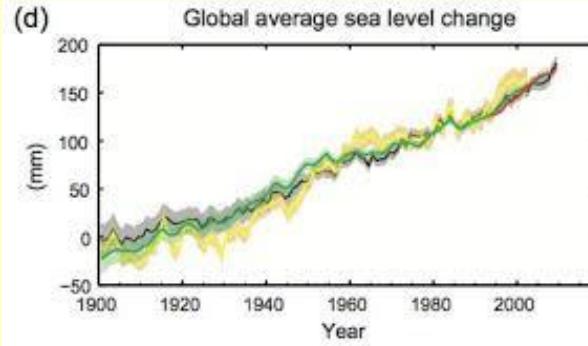
Greenhouse gases (carbon dioxide, methane, nitrogen) trap some of the heat that is radiated from the surface which would have been lost into space. Without this the temperature of the earth would be a lot cooler



## The enhanced greenhouse Effect:

Human activity has resulted in an increased amount of greenhouse gases in the atmosphere. This means the earth absorbs **more** solar radiation and less radiation is able to escape – this causes an increase in temperatures.

# Paper 1 Topic 2 Weather hazards and climate change – Evidence



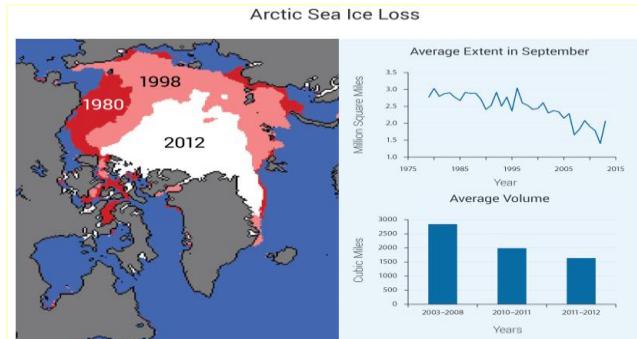
**Sea Level Change:**

- Long-term measurement of sea levels shows there has been 20cm increase since 1900
- Rises have increased recently to 3.2mm per year and are more in some areas.

## Evidence of climate change

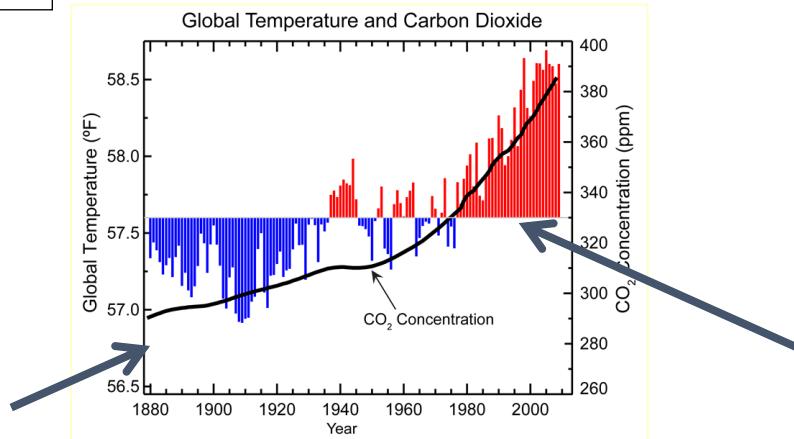
### Melting Ice Caps:

- Sea level change is caused by **thermal expansion** – when water warms up it expands
- The Arctic Ice Caps have decreased. Warmer temperatures meant that sea ice has declined



**Warmer Global temperatures and Carbon Dioxide**

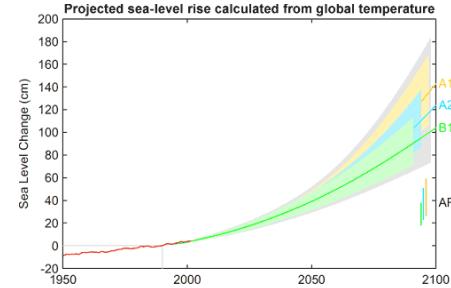
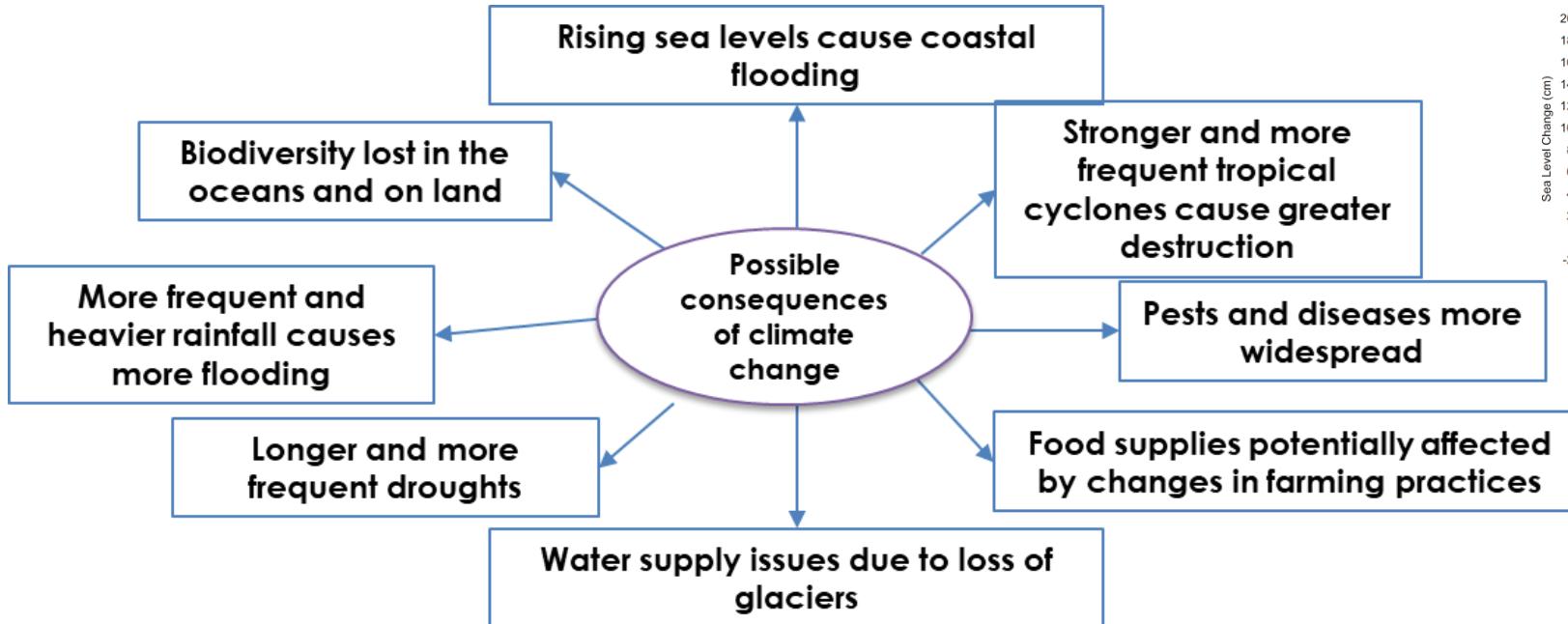
- The rise in global temperatures is closely linked to the increase of carbon dioxide.
- The increase in carbon dioxide since 1950 has been much higher and much more rapid than anything recorded for the last 400,000 years.
- Human activity is the reason for much of this increase.



**Warmer Global temperatures:**

- Measurements of average global atmospheric temperatures show a steep rise from around the 1950s to the present. Although temperatures have risen before it is unusual for the increase to be so rapid

# Paper 1 Topic 2 Weather hazards and climate change – Impacts



## Sea Level Rises:

Around 23% of the world's population live within 100km of the coast – this means lots of people are at risk of coastal flooding

The effects of 1m rise in sea level is:

- Low-lying islands will be submerged (e.g. Maldives) – causing land to be abandoned
- New sea defences will need to be built – costing millions!
- Salt water intrusions will contaminate farmland and groundwater supplies (making water unusable)

## Future projections:

Future predictions are difficult to predict because it changes (will greenhouse gases continue to rise or will we find ways to reduce emissions?)

Climate change organisations have modelled 4 scenarios:

- Emissions peak at 2020 then decline
  - Emissions peak at 2040 then decline
  - Emissions peak at 2080 then decline
  - Emissions continue to rise
- The loss of Greenland's ice sheet would raise sea levels by 7m
  - The Antarctic ice sheets would add 13m
  - Sea level rise will be higher in some areas than others due to prevailing winds and currents. Also where the land is sinking sea level will be higher

## Increased Temperatures:

Warmer temperatures can impact on food production as some areas will experience drought conditions.

More pests will spread quicker due to the warmer weather

Ecosystems and habitats suffer as temperatures increase as animals and plants struggle to adapt leading to a loss of biodiversity

## Extreme weather events:

Experts believe there will be a rise in extreme weather events: Tropical Cyclones, drought, intense prolonged rainfall and heavy snowfall. This leads to a greater number of people at risk

# Paper 1 Topic 2 Weather hazards and climate change – Tropical storms

## Hurricanes

The strongest tropical storms are called **hurricanes**, **typhoons** or **tropical cyclones**. The different names all mean the same thing, but are used in different parts of the world. If these huge storms start in the Atlantic, off the west coast of Africa, they are called **hurricanes**.

In an average year, over a dozen hurricanes form over the Atlantic Ocean and head westwards towards the Caribbean, the east coast of Central America and the southern USA (Florida in particular). Hurricanes may last as long as a month and although they travel very slowly - usually at about 24 km/h (15 mph) - wind speeds can reach over 120 km/h (75 mph).

## How hurricanes form

When this warm and wet air rises, it condenses to form towering clouds, heavy rainfall. It also creates a low pressure zone near the surface of the water.

Rising warm air causes the pressure to decrease at higher altitudes. Warm air is under a higher pressure than cold air, so moves towards the 'space' occupied by the colder, lower pressure, air. So the low pressure 'sucks in' air from the warm surroundings, which then also rises. A continuous upflow of warm and wet air continues to create clouds and rain.

Air that surrounds the low pressure zone at the centre flows in a spiral at very high speeds - anti-clockwise in the northern hemisphere - at speeds of around 120 km/h (75 mph).

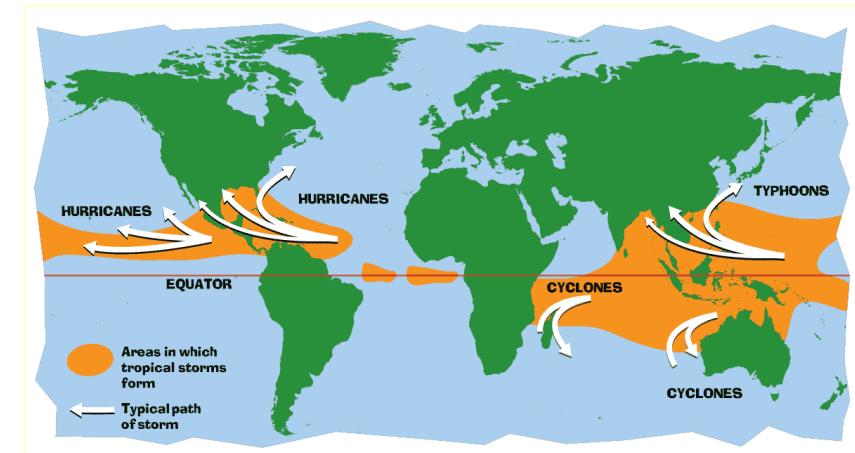
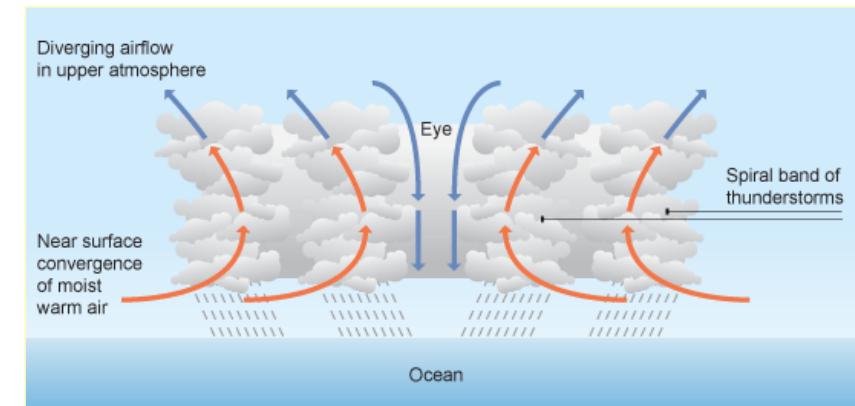
Air is ejected at the top of the storm – which can be 15km high – and falls to the outside of the storm, out and over the top, away from the eye of the storm. As this happens, it reduces the mass of air over the 'eye of the storm' - causing the wind speed to increase further. Some ejected air also cools and dries, and sinks through the eye of the storm, adding to the low pressure at the centre.

The faster the winds blow, the lower the air pressure in the centre, and so the cycle continues. The hurricane grows stronger and stronger.

Seen from above, hurricanes are huge circular bodies of thick cloud around 450 km (300 miles) wide. The cloud brings heavy rain, thunder and lightning.

In the centre is the **eye of the hurricane**, about 45 km across (30 miles) across. Often there will be no clouds in the eye. Seen from below it will seem calmer, with a circle of blue sky above. The eye is formed because this is the only part of the hurricane where cold air is descending.

In the northern hemisphere, the prevailing easterly tropical winds tend to steer hurricanes toward land - although their course is unpredictable. As hurricanes move inshore, their power gradually reduces because their energy comes from sucking up moist sea air.



# Paper 1 Topic 2 Weather hazards and climate change – Tropical storms

	Description	Impact on people	Impact on environment
High Winds	Winds from 119 – 250 kmph	<ul style="list-style-type: none"> <li>• Infrastructure such as power lines damaged</li> <li>• Buildings destroyed</li> <li>• Loss of life/injury</li> </ul>	<ul style="list-style-type: none"> <li>• Trees uprooted</li> </ul>
Intense Rainfall	Heavy rainfall causing surface flooding	<ul style="list-style-type: none"> <li>• Damage property</li> <li>• Injury</li> <li>• Potential loss of life</li> </ul>	<ul style="list-style-type: none"> <li>• Flooding</li> <li>• Pollution of water systems</li> </ul>
Storm Surges	Low pressure allows local sea level to rise, the winds help push the water up on land	<ul style="list-style-type: none"> <li>• Coastal defences destroyed</li> <li>• Flooded inland areas contaminating farmland</li> <li>• Damage to properties</li> </ul>	<ul style="list-style-type: none"> <li>• Beaches and coastal habitats destroyed</li> </ul>
Coastal Flooding	Intense rain and storm surges leads to coastal flooding	<ul style="list-style-type: none"> <li>• Peoples lives and properties at risk of destruction</li> <li>• Farming, tourism and industry at risk of flooding</li> </ul>	<ul style="list-style-type: none"> <li>• Salt water intrusion</li> <li>• Habitats destroyed</li> <li>• Water contamination</li> </ul>
Landslides	Intense rain in high relief areas can saturate the soil quickly, making it heavy. This can mean the soil can't hold together	<ul style="list-style-type: none"> <li>• Settlements destroyed/damaged</li> <li>• Transport routes cut off</li> <li>• Loss of life and injury</li> <li>• Displacement</li> </ul>	<ul style="list-style-type: none"> <li>• River flooding if a channel is blocked</li> <li>• Habitats destroyed</li> <li>• Debris contaminate water</li> </ul>

**Physical vulnerability:**

Coastal areas are more at risk as tropical cyclones form over oceans and seas. Island nations (e.g. Maldives and the Philippines) are more vulnerable as they are surrounded by warm water and are low-lying. They are more likely to suffer flooding, storm surges and high wind speeds. Some areas are also at risk from heavy rain and landslides

**Economic vulnerability:**

Countries with higher levels of development are more likely to have better technology to prediction and monitoring systems and are therefore able to prepare for tropical cyclones by evacuating areas and putting up coastal defences and preparing emergency response teams

**Social vulnerability:**

Areas with high poverty are more vulnerable as infrastructure (buildings etc) are not very stable and will be easily damaged or destroyed. The after effects also worse in poorer areas as there might not be access to food, water, medical supplies etc often resulting in higher losses of life. Age is another social inequality, older and younger people are more vulnerable as they are likely to suffer an injury during evacuation and have more difficulty in evacuation too. Young and old are more likely to catch illnesses and diseases

# Paper 1 Topic 2 Weather hazards and climate change – Case Study Hurricane Irma

**What:** Hurricane Irma, Category 5  
**When:** 8<sup>th</sup> to 11<sup>th</sup> September 2017  
**Where:** Gulf of Mexico  
**Who:** Barbuda, Caribbean Islands, Florida, USA



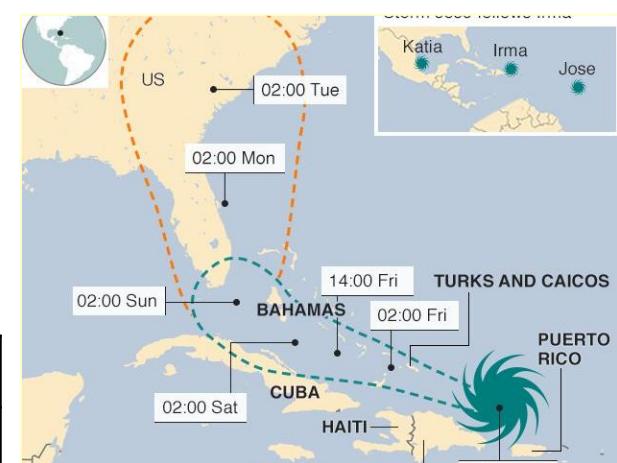
## Why/How: Causes

### Description:

Tropical depression formed in the Atlantic Ocean. Spinning vortex of winds as heat energy is evaporated from the ocean to fill gap of very low air pressure.

Sea temperatures 32°C in Gulf of Mexico. Air pressure 915mb. Trade winds blowing away from the Equator.

Developing country	Developed country
<p><b>Caribbean – Barbuda</b></p> <ul style="list-style-type: none"> <li>Up to 185mp winds</li> <li>600 students had to go to school on other islands</li> <li>90% properties damages</li> <li>68 sq. miles covered by Category 5 hurricane</li> <li>No water or communications – island considered uninhabitable</li> <li>3 deaths</li> <li>Most people evacuated from Barbuda to Antigua</li> <li>\$250 million in damages = 12% of islands GDP</li> <li>1,800 residents evacuated</li> <li>3m storm surge causing significant flooding</li> <li>60 tons of relief supplies sent by USA and British Aid Agencies</li> </ul>	<p><b>USA – Florida Keys</b></p> <ul style="list-style-type: none"> <li>7 direct deaths in USA 85 indirect deaths of which 80 were in Florida</li> <li>77,000 people in shelters</li> <li>6.5 million ordered to evacuate</li> <li>70% buildings built before 1994</li> <li>6.9 million homes left without power</li> <li>2 – 3 m storm surge causing significant flooding</li> <li>250 to 300mm rainfall an hour</li> <li>\$62.5 million in damages</li> <li>Loss of tourism trade</li> </ul>



# Paper 1 Topic 2 Weather hazards and climate change – Droughts

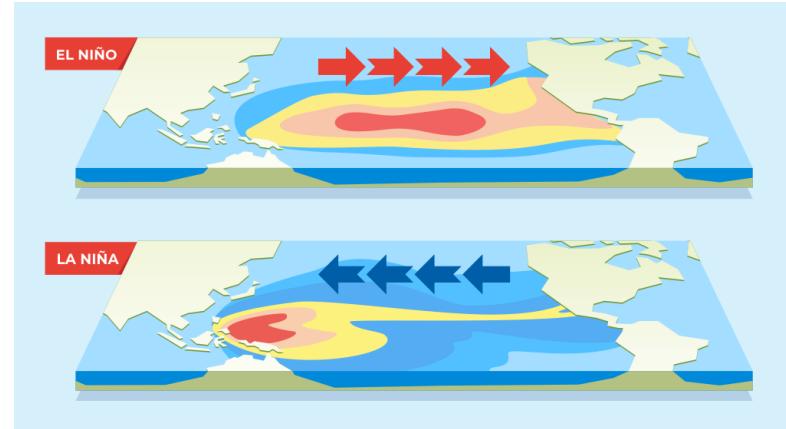
## Characteristics and types of droughts

Droughts occur when there is abnormally low rainfall for an extended period of time. This means that a desert would not be considered in drought unless it had less rainfall than normal, for a long period of time. Droughts can last from weeks to months and even years.

## Why are some areas more vulnerable to droughts?

Droughts can occur all over the world. However, there is a link between drought and some climate patterns.

- A lack of water vapour in the atmosphere means there is less **precipitation** and more chance of drought. High-pressure systems reduce evaporation and moisture in the atmosphere.
- **El Niño** – as the surface temperature of the Pacific Ocean around the central South American coast **increases**, storm patterns are disrupted. This phenomenon is thought to create droughts in Indonesia and Australia.
- **La Niña** - as the surface temperature of the Pacific Ocean around the central South American coast **decreases**, storms are again disrupted and North and South America are prone to



## Types of droughts

There are three main types of drought:

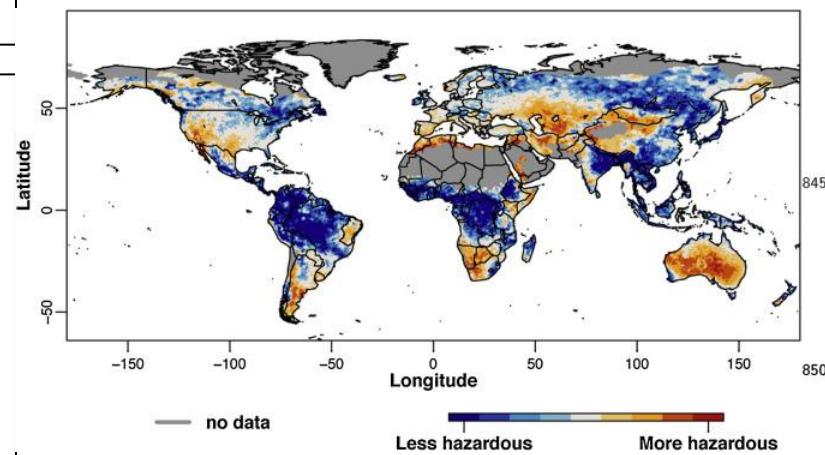
- **Meteorological drought** – when the amount of precipitation received in a specific area is less than the average.
- **Hydrological drought** – when reduced precipitation impacts on **water supply**, eg there is decreased streamflow, soil moisture, reservoir and lake levels, and groundwater.
- **Agricultural drought** – when the above two types of drought impact on agricultural activities, eg reduced soil moisture or reservoir levels required for **irrigation**.

## Hazardous impacts of droughts

Droughts, unlike **earthquakes** and **volcanic eruptions**, are not a sudden hazard event. Instead, their beginning and end are hard to gauge and they can last for months and even years.

Approximately 780 million people worldwide lack a reliable and sufficient water supply. This can have many serious impacts:

- A lack of clean and reliable water can cause people in developing countries to drink contaminated water which could cause a range of diseases such as cholera and typhoid.
- Commercial and **subsistence farmers** can experience high crop or livestock losses and a reduction in the land's value. Subsistence farmers may experience **famine**.
- With less moisture and rainfall, wildfires can become common, damaging crops, buildings and even causing death.
- Businesses and services which rely on clean water may be closed, eg hospitals and restaurants.
- Conflicts or war between people and countries can occur when pressure is put on water supplies. It can also lead to people having to migrate away from drought-stricken areas.



# Paper 1 Topic 2 Weather hazards and climate change – Case Study Australia

**What:** Worst drought in 125 years  
**When:** 2002 to 2009  
**Where:** South-east Australia  
**Who:** Everyone, especially farmers

## Why/How: Causes

### Description:

This was credited to El Niño, where moist trade winds are reversed, so instead of bringing rainfall to Australia they travelled west towards South America, leaving south-east Australia with a lack of rainfall. Some scientists believe climate change exacerbated this drought by also reducing rainfall.

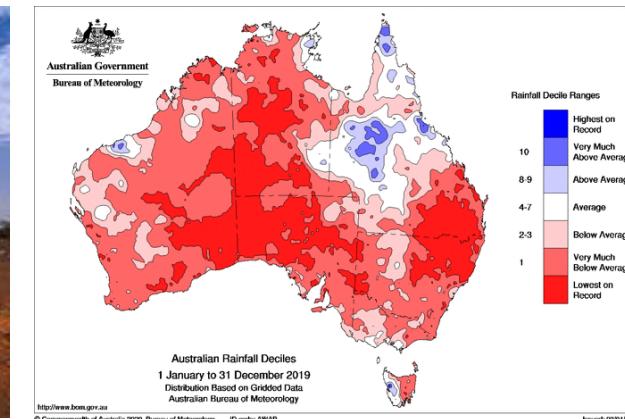
The region most affected was the Murray-Darling River Basin in New South Wales. This area usually provides 75% of Australia's water, 40% of Australia's agricultural produce and is home to nearly 2 million people.

### This drought had severe **agricultural impacts**:

- Significant loss of livestock and crops. Some farmers had to sell machinery, land or even move elsewhere and lose their livelihood.
- With fewer crops and livestock, Australia had to import more food. This increased the price of food for the whole country.
- Droughts degrade the quality of the soil, affecting farming for years to come.

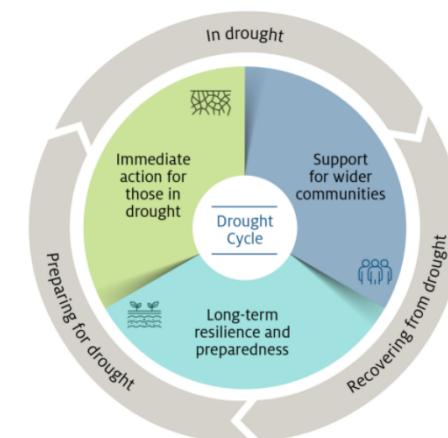
### This drought had severe impacts on the **natural ecosystem**:

- Wildfires caused by drought destroyed vegetation and animals' habitats.
- Creeks and rivers dried up causing the organisms relying on them to die or migrate.
- Increased soil erosion destroyed vegetation and the creatures which relied on it to survive.



## Responses

\$11.1 billion in Australian Government funding committed to drought-related programs since 2018-19 (as at 31 December 2021)



### Support for wider communities affected by drought

- 57,000+ households assisted to pay urgent expenses
- Support for 180 local government areas (infrastructure & other projects)
- Support for 250 schools
- \$10+ million in cash and/or voucher support for farmers

### Long-term resilience and preparedness

- \$5 billion Future Drought Fund
- 8 drought resilience hubs
- 80 soil and agricultural landscapes projects
- Immediate action for those in drought
- 2,567 drought loans to farmers
- 124 drought loans to small businesses
- 11,389 rebates for on-farm emergency water infrastructure
- 16,800+ farmers received Farm Household Allowance (since 2014)
- 1,591 small regional businesses accessed rural financial counselling
- 57 regional climate guides

# Paper 1 Topic 2 Weather hazards and climate change – Case Study The Sahel Ethiopia

The Sahel is located directly south of the Sahara desert and stretches from the east to the west of Africa. The Sahel is semi-arid, receiving between 250 and 450 mm of rainfall in total in an average year, however it only falls in one or two months. This region provides Africa with food and cash crops such as millet and cotton.

Since the 1970s, the Sahel has experienced drought conditions on a regular basis. This is down to physical and human factors:

- **Overgrazing** and **deforestation** on **marginal land** can lead to **desertification**. With less vegetation there is less **transpiration** and **evaporation** from the soil, causing less rainfall.
- Changes in surrounding ocean temperature – the temperatures of the south Atlantic and Indian Oceans increased, with a smaller temperature gap between land and ocean, and **monsoon** rains were reduced.
- Some scientists believe climate change has reduced rainfall or made it less predictable.

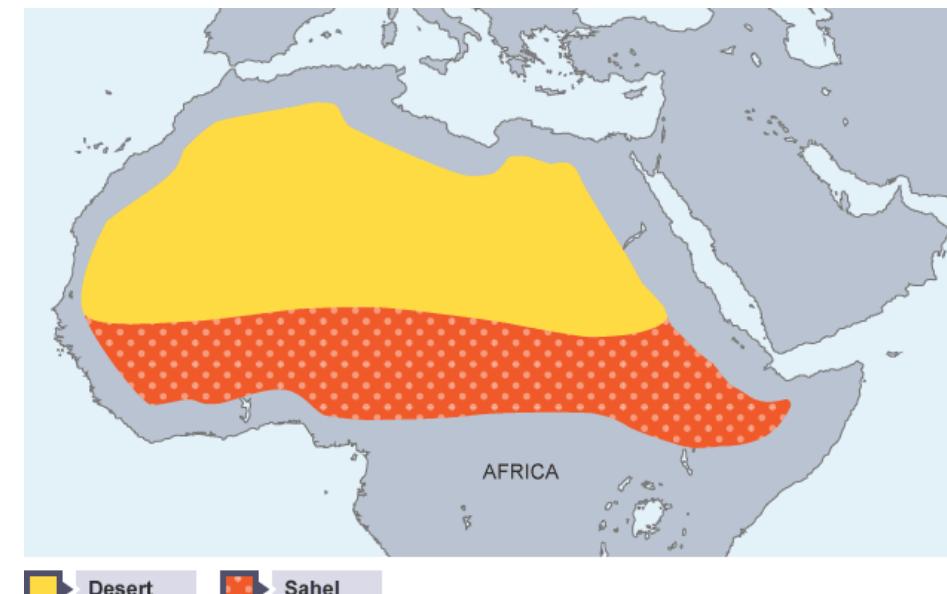
## The social and economic impacts of drought in the Sahel

### Social impacts

- Subsistence farmers' crops fail and livestock dies. This can lead to famine and hunger.
- Commercial farms growing cash crops such as cotton lose income, which may cause unemployment.
- With less food being grown and an increase in demand, food prices increase.
- Increased soil erosion makes the land less fertile, creating a long-term issue for the farming community.
- Clean water is not available for people to drink, increasing the use of contaminated water and diseases such as cholera.
- People (usually women and children) travel further to find water, which means children miss school and the carrying of heavy loads can lead to back problems.

### Environmental impacts

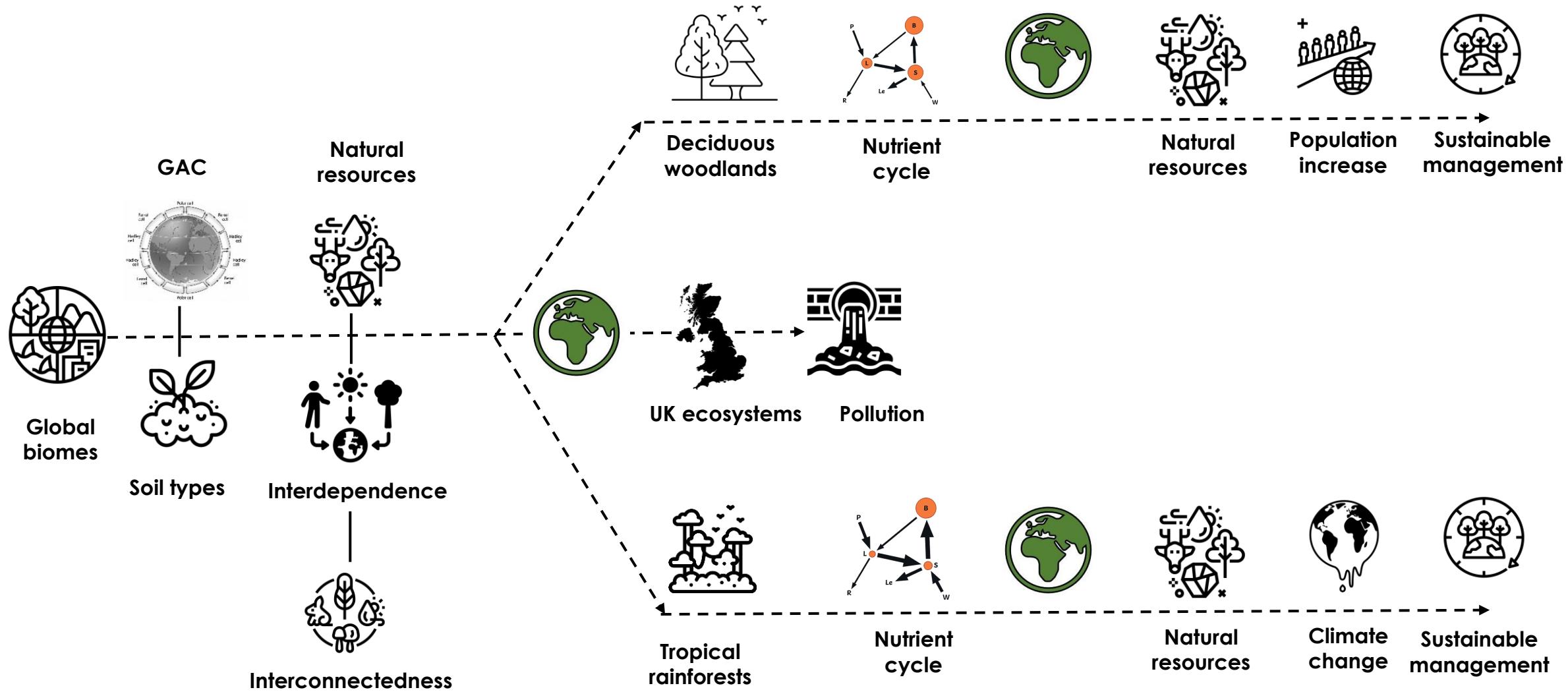
- Seasonal rivers and water holes dry up, so organisms which live in them or rely on them for water may die.
- Vegetation dies causing animals depending on it for food or shelter to perish or migrate.
- Increased soil erosion. Eroded material is washed into rivers or water holes resulting in contamination.



### Attempted solutions

- Encouraging farmers to grow drought-resistant crops.
- Improving knowledge and understanding of droughts across the region by launching the Africa Climate Exchange
- Use of drip irrigation systems to reduce water usage.
- Lines of rocks are placed across the land to slow flowing rainwater and encourage the **deposition** of sediments (rich in nutrients). This is a cost-effective option.

# Paper 1 Topic 3 Ecosystems, biodiversity and management



# Paper 1 Topic 3 Ecosystems, biodiversity and management

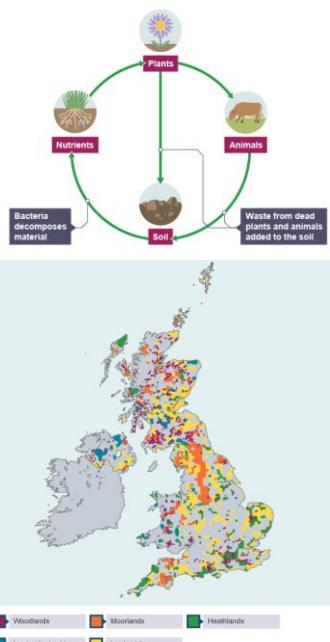
An **ecosystem** is a natural environment and includes the **flora** (plants) and **fauna** (animals) that live and interact within that environment. Flora, fauna and **bacteria** are the **biotic** or **living components** of the ecosystem. Ecosystems are dependent on the following **abiotic** or **non-living components**:

- **climate** - the temperature and amount of rainfall are very important for determining what **species** can survive in the ecosystem

- **soil** - the soil type is important as this provides nutrients that will support different plants

- **water** - the amount of water available in an ecosystem will determine what plants and animals can be supported

The biotic parts of the ecosystem, which include bacteria, flora and fauna, have a complex relationship with the abiotic components - changing one will lead to a change in the other.



**Ecosystems** are very sensitive to change. The **living** and **non-living components** of the ecosystem can be altered by either **natural factors** or **human management**.

Changes to the ecosystem caused by **natural factors** include:

- drought
- flood
- fire
- disease

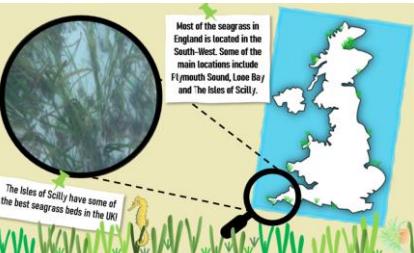
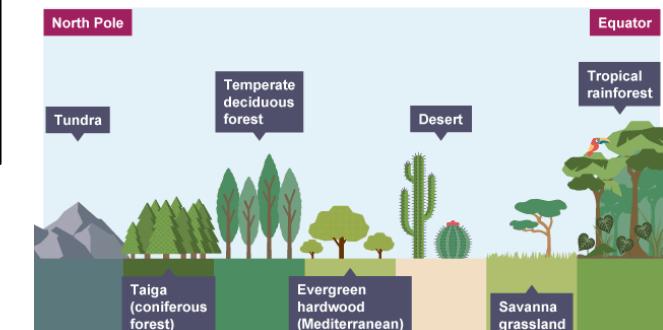
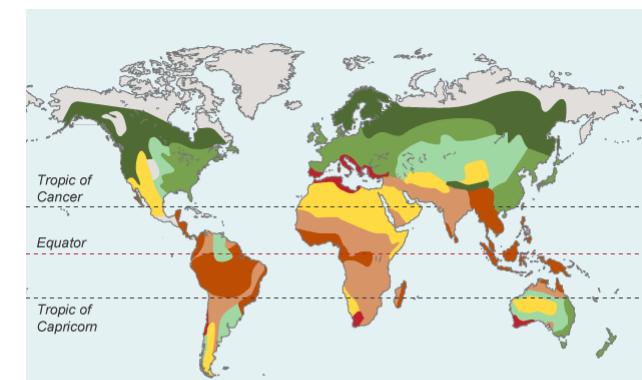
Changes to the ecosystem caused by **human management** include:

- introducing more fish (fish stocking)
- altering the drainage of the land which may influence the amount of water
- changing the **pH level** of the water
- altering the nutrient levels of the water if fertilisers are **leached** into the water resulting in **eutrophication**

Any of these changes can have a negative impact on the ecosystem and could result in the collapse of a **food chain**.

Only 12% of the land area of the UK is made up of woodland. 80% of these are less than 100 years old and only 5% could be considered 'ancient' woodlands. In England they are mainly made up of broadleaf **deciduous** trees such as oak and ash, whilst in Wales, Scotland and Northern Ireland the trees are mainly **coniferous** such as firs and pines. The largest forests are Galloway Forest Park in Scotland, Kielder Forest Park in north-east England and the New Forest in southern England.

The UK has some of the best **marine ecosystems** in Europe, with a wide diversity of underwater habitats and species. Many of our marine habitats and species are particularly rare and therefore of international importance, for example, the bottlenose dolphin. These marine ecosystems are under threat from bycatch, overfishing, pollution and shipping



# Paper 1 Topic 3 Ecosystems, biodiversity and management – tropical rainforests

Tropical rainforests have distinct characteristics that support a wide variety of different **species**. This means that they have a high **biodiversity**. The **biotic** or living components of the ecosystem and the **abiotic** or non-living components of the ecosystem depend on one another - a change in one leads to a change in the other.

## Climate

- Very wet with over 2,000 mm of rainfall per year.
- Very warm with an average daily temperature of 28°C. The temperature never drops below 20°C and rarely exceeds 35°C.
- The atmosphere is hot and **humid**.
- The climate is consistent all year round. There are no seasons.

## Soil

- Most of the soil is not very **fertile**.
- A thin layer of fertile soil is found at the surface where the dead leaves decompose.
- It is red in colour because it is rich in iron.
- Due to heavy rainfall the nutrients are quickly washed out of the soil.

## Plants and animals

- The warm and very wet climate provides perfect conditions for plant growth.
- The wide range of plant **species** supports many different animals, birds and insects.
- Species have **adapted** to the conditions of the rainforest, eg trees and plants have shallow-reaching roots to absorb nutrients from the thin fertile layer in the soil.

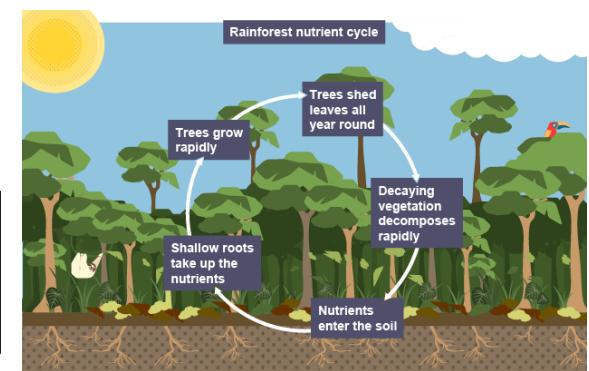
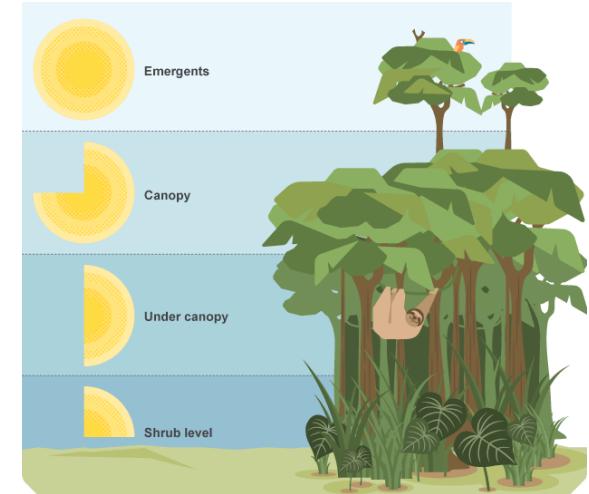
## Structure of a tropical rainforest

A tropical rainforest is made up of the following layers:

- ground level
- shrub layer
- under canopy
- (main) canopy
- emergents

Tropical rainforests act as life support systems for the planet as they:

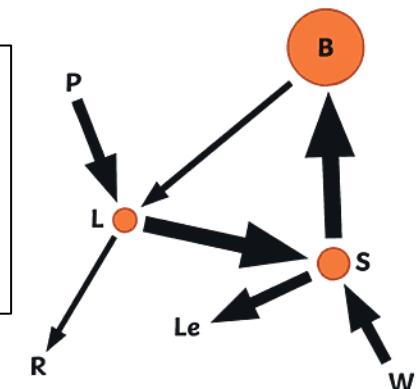
- **regulate the atmosphere**
- **maintain soil health**
- **influence the hydrological cycle**
- **Provide food, cash crops, medicines and raw materials**



Both plants and animals have adapted to live in the tropical rainforest but climate change threatens their habitats

Threats to the tropical rainforests through deforestation include:

- **agriculture**
- **logging**
- **mining**
- **roads**
- **HEP**
- **population growth**



# Paper 1 Topic 3 Ecosystems, biodiversity and management – Case Study Ecuador

Since the 1960s millions of hectares of rainforest have been cut down to make way for oil and mineral extraction, logging, cattle ranching and plantations. Today deforestation continues at an alarming rate – an area the size of Wales is lost every year. The promise of riches has also brought millions of new workers and colonists to the Amazon changing the lives indigenous peoples forever.

## Threats and challenges

**Political and economic primary causes** - Government sanctioned oil extraction from 1960's by PetroAmazonas (TNC) was expected to increase GDP but each oil well needs around 2 hectares of forest to be cut down, waste products were pumped to the surface to mix with waste water creating toxic soil, liquid leeches through the soil into rivers leading to no fish, destroying the food chain.

**Political and economic secondary causes** - creation of roads through the rainforest led to barriers for movement of animals reducing breeding spaces, population increase of 'colonists' (described as neo-colonial environmentalism) into the rainforest who removed the smaller trees for building and using 'slash and burn' techniques for small-scale farming, leading to nutrient-poor soil commercial loggers removed larger trees, often illegally, poor soil led to large-scale cattle ranchers rearing beef for sale in Europe and the US.

**Palm oil plantations (cash crop)** - in many products used world-wide are not native to the rainforest and so require very large areas of rainforest to be cleared, reducing biodiversity (monoculture) (130 000 hectares cleared for palm oil production) and using pesticides to control plagues, which further leeches into the water system. Oil has increased Ecuadorian economy but more than 80% of indigenous people in the oil producing areas live below the poverty line.



## Political sustainable management

**Government policies** - creation of Yasuni National Park - proposed the international community pay Ecuador 3.6 billion US\$ to leave the oil and its carbon emissions in the ground which would be used to help indigenous communities and reforest the area but limited economic response from other governments and oil extraction began in 2014. Following decline in oil prices Ecuadorian government sanctioned Fruta Del Norte to mine for gold in attempt to reduce poverty. Signed global agreements such as the Paris Agreement to limit CO<sub>2</sub> emissions.

**Large-scale NGOs** - RAMSAR sites - Limoncocha National Park and Nature Reserve attracts 10,000 tourists a year allowing protection of endangered species, protecting the forest against development, protecting biodiversity and local communities

**Small-scale NGO's** - Sumak Allpa - conservation and protection of, for example, Woolley monkeys and red-tailed Boa Constrictor funded by private individuals, or NGOs like the WWF

**Economic policies** - Yachana Lodge - sustainably built log cabins using solar panels to generate electricity and rainwater collections for showers and toilets, tourists are confined to guided trails

**Microfinance** - small scale loans to assist individuals to start up sustainable logging and agriculture businesses

**Education policies** - Yachana Foundation - runs residential training courses for local communities providing further employment opportunities, training courses in sustainable crop management and Forest Stewardship courses in sustainable logging

# Paper 1 Topic 3 Ecosystems, biodiversity and management – deciduous woodlands

Deciduous woodlands have distinct characteristics that support a variety of different **species**. This means that they have a moderate **biodiversity**. The **biotic** or living components of the ecosystem and the **abiotic** or non-living components of the ecosystem depend on one another - a change in one leads to a change in the other.

## Climate

- no extremes of temperature or rainfall - 4 seasons
- average summer temperature 15-17° C, winter is cooler but usually above freezing, leading to long growing season
- rainfall quite high, about 1000mm a year.

## Soil

- fallen leaves decompose quite quickly forming think layer of organic matter (humus) enriching the soil
- earthworms and other decomposers mix humus with minerals from bedrock to create thick, rich soil called brown

## Plants and animals

- dominated by tall, broad-leaved trees - leaf loss in autumn, stratified layers
- stratified layers provide a variety of habitats for birds, insects and small mammals, larger animals such as foxes and rabbits burrow in the ground under the trees
- ancient woodlands used by humans for wood fuel, nuts, fruit, tree sap, timber and recreation

## Structure of a tropical rainforest

A deciduous woodland is made up of the following layers:

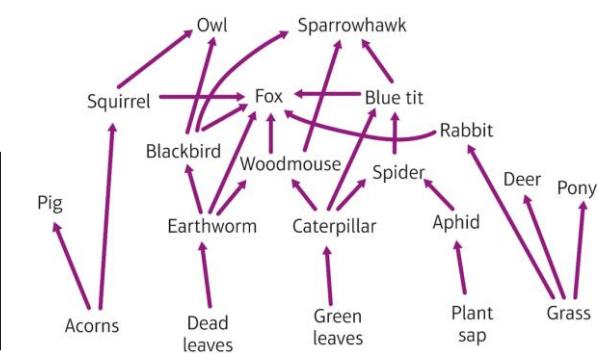
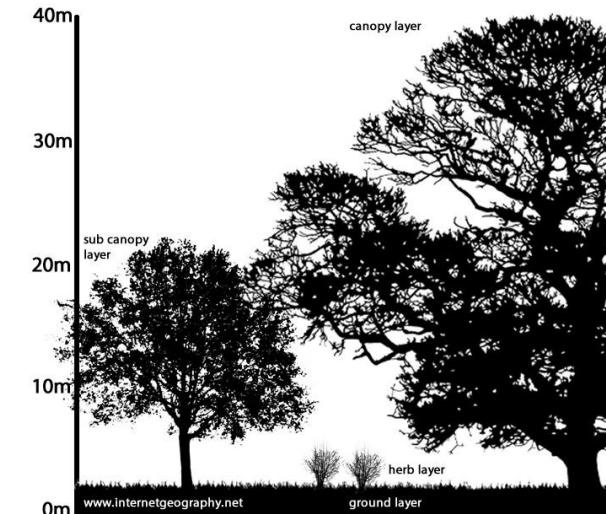
- ground level
- herb layer
- sub canopy
- (main) canopy

Deciduous woodlands provide many natural resources including:

- **timber**
- **fuel**
- **conservation**
- **recreation**

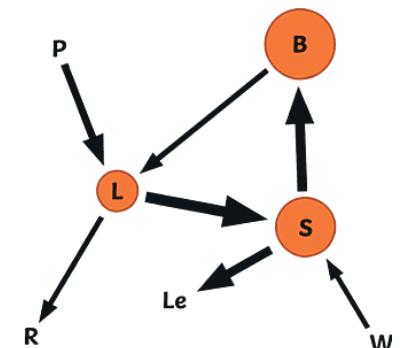


Both plants and animals have adapted to live in the deciduous woodlands but climate change and population growth threatens their habitats



Threats to deciduous woodlands through deforestation include:

- **agriculture**
- **population growth**
- **urbanisation**
- **timber extraction**
- **HEP**
- **population growth**



# Paper 1 Topic 3 Ecosystems, biodiversity and management – Case Study The New Forest

The New Forest is a National Park in Hampshire, south east England, awarded status in 2005. About 175,000 people live in the area and up to 15 million people visit the area annually.

## Threats and challenges

### Social causes of deforestation

**Increasing population numbers** in the UK means that more land is required for housing. The government need to build around 240,000 homes a year to cope with demand. Forests are cleared in order to accommodate this

**Increasing urbanisation** in the UK has led to forested areas being converted for additional land use including the expansion of cities to create jobs for people

**Traffic congestion** is an increasing problem and so areas of woodland are cleared to make carriageways wider

### Economic causes of deforestation

**Tourists** can damage plants by trampling, footpaths are eroded by walking, cycling, horse-riding and car parking on verges and risk of starting fires with barbeques

**Timber** is extracted from both softwood (coniferous) and hardwood (deciduous) trees. Non-native conifers are easier and faster growing which means a faster profit.

Over 40% of the New Forest is **privately owned** and not managed.

**Pesticides and herbicides** used to control weeds in agricultural areas damages edges of woodlands



## Sustainable Management

**Controlled tree felling** - trees are selectively cleared and replaced by other deciduous species in higher numbers

**Limit pesticide use** to prevent damage to plant and animal species

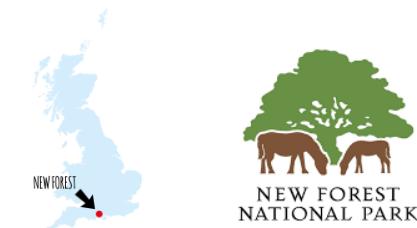
**National Park Authority** set up to raise awareness through campaigns

**Landowners funded to plant trees**, encourages better use of the land

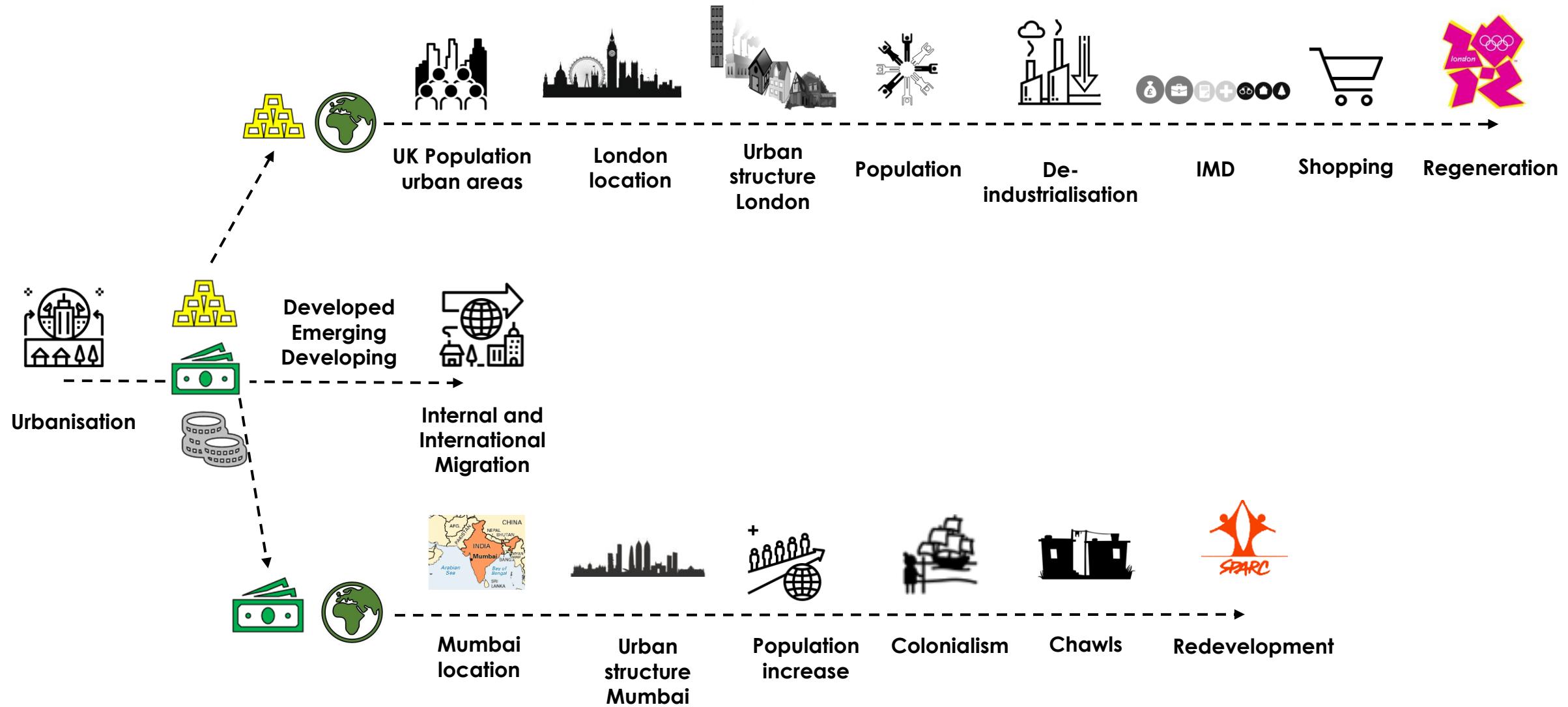
**Sustainable transport schemes** – electric scooters, bikes and tour buses

**Green leaf tourism** – limits tourists numbers, ensures hotels operate in a 'greener' way, promotes use of local products

**Restrict logging** April-August to protect nesting birds



## Paper 2 Topic 4 Changing Cities



# Paper 2 Topic 4 Changing Cities

The world's population is growing rapidly and reached 7.3 billion people in 2011. The highest rates of population growth are occurring in **developing countries**, such as Zimbabwe, Malawi and Niger. Some countries are experiencing population decline, for example Japan, Russia and Ukraine. Today more than 50% of the world's population live in **urban areas**. The number of cities with over 10 million people is increasing. These are called **megacities**. There are now 34 megacities in the world. The table and map below shows the top 10 megacities.



Top ten megacities (Source: Demographia World Urban Areas 2015)

Rank	Urban area	Country	Population estimate
1	Tokyo-Yokohama	Japan	37,843,000
2	Jakarta	Indonesia	30,539,000
3	Delhi	India	24,998,000
4	Manila	Philippines	24,123,000
5	Seoul-Incheon	South Korea	23,480,000
6	Shanghai	China	23,416,000
7	Karachi	Pakistan	22,123,000
8	Beijing	China	21,009,000
9	New York	United States	20,630,000
10	Guangzhou-Foshan	China	20,597,000

## Causes of urban growth

The population of cities usually changes in one of two ways:

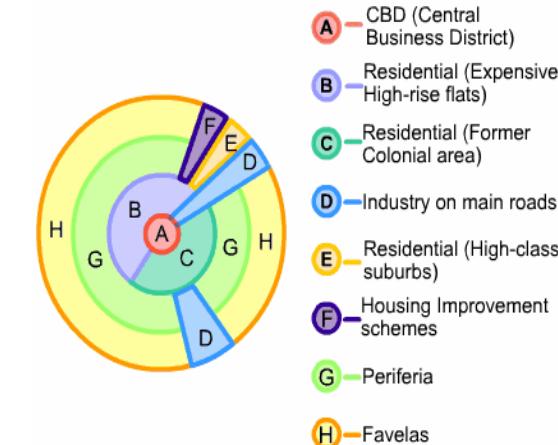
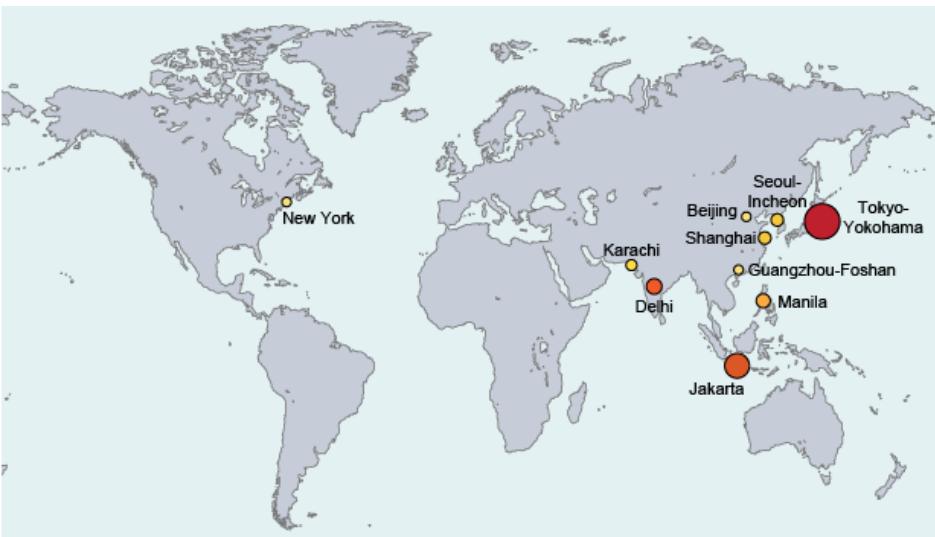
**1. Natural increase** (or decrease) - this is the difference between the number of births and the number of deaths.

**2. Migration** - this is the movement of people into or out of the city.

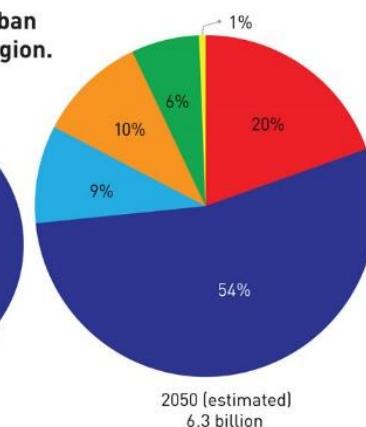
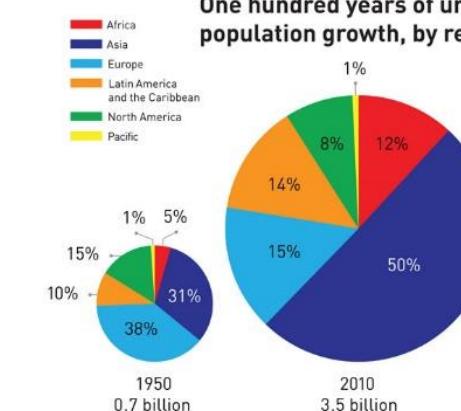
More and more people are leaving **rural areas** and moving to cities. This is called rural to urban **migration**. People move because of **push** and **pull factors**.

**Push factors** are things that **make people want to leave** rural areas and **pull factors** are the things that **attract people** to a city.

Poorer rural to urban migrants in developing and emerging countries tend to cluster in **spontaneous settlements** on land that is not suitable for wanted for urban dwelling to work in the **informal economy**. This land is often at **greater risk** from natural hazards such as flooding or landslides and is often contaminated land.

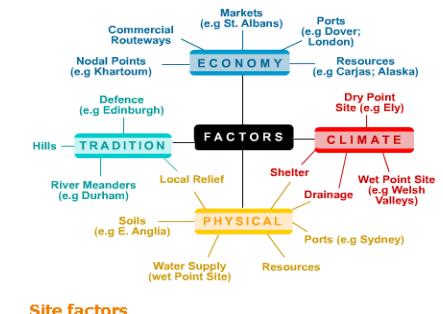
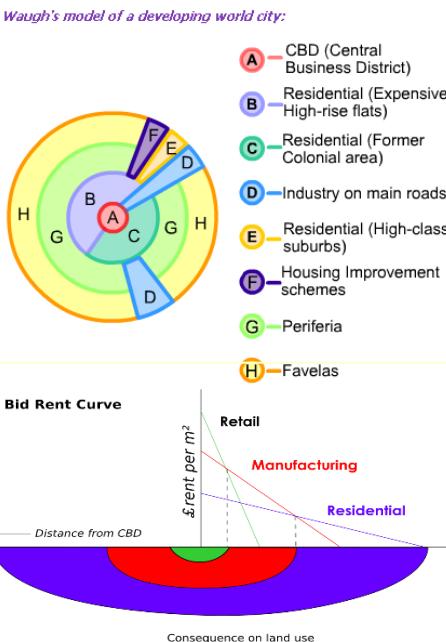
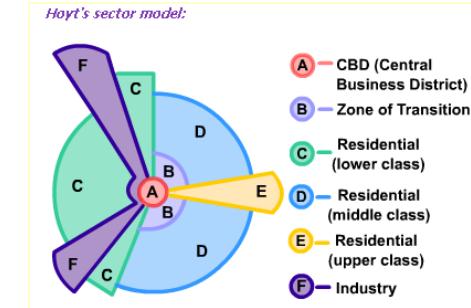
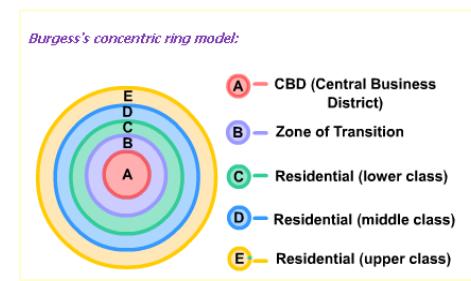
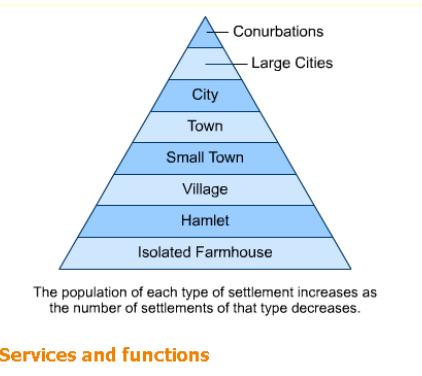


One hundred years of urban population growth, by region.



# Paper 2 Topic 4 Changing Cities – Site, Situation and Structure

The **Site** of a settlement describes the physical nature of where it is located. Factors such as water supply, building materials, quality of soil, climate, shelter and defence were all considered when settlements were first established. **Settlements** can be described as being part of the **urban hierarchy**. Where they stand on the hierarchy depends on a number of factors, the main ones being population, the number of services a settlement has and its sphere of influence. The **function** of a settlement describes all the main activities that occur in it e.g residential, recreational, retail, government, entertainment and industrial.



Most **inner cities** of large urban areas in **developed countries** once had industry located there, however this has almost totally moved out. The Victorian terraces built to house the factory workers remain in many inner cities, however in some they have been replaced by huge tower blocks.

Although seemingly the solution to the problems produced by the terraces, the tower blocks also caused a wide range of social problems. Recently inner city planning has centred around **rejuvenating** the area in alternative ways, to try to encourage the growth of these declining areas.

## Urban zoning



**Shanty Towns** are the illegal squatter settlements in LEDC's. Huge numbers of people migrate from the rural areas to the cities.

- The cities most likely to have shanty towns are centres for commercial and industrial activity as well as being transport centres. They are very attractive to in-migrants.
- Most of the new in-migrants have very few skills, education or money.
- Shanty towns develop on marginal land, often close to where the in-migrants hope to get work. The high cost of land near the CBD means that shanty towns are either built on the periphery of the city or in hazardous areas closer to the city centre.

**Greenbelts** were established to prevent the continued growth of many of the largest cities of England and Scotland. They are rings of heavily protected open land circling an urban area. They aim to **protect the surrounding countryside** from development, and in some cases stop two large cities from merging. **Planning permission** is not usually granted for schemes on green belt land, although there is often great pressure to allow some proposals through. The M25 is built through much of London's greenbelt. One of the main problems of the greenbelts is that they have led to people commuting further into work.

## **Paper 2 Topic 4 Changing Cities – Case Study London**

**London** has local, regional and even world importance

- **Internal and international accessibility** - London has great importance due to its high connectivity.
  - M25 orbital motorway connected to other major cities
  - Rail network with terminus for Eurostar
  - 5 international airports

**World network of financial centres** - London has become the international financial centre for Europe and is one of three world financial cities alongside New York and Tokyo. Many global banks have headquarters here.

- **Transnational corporations (TNCs)** - 500 TNC's in the UK with 271 HQs in London and further 28% along M4 corridor.

- **Market** - London is the largest and most affluent market in the UK and therefore top international retailers have locations in London to take advantage of this market.

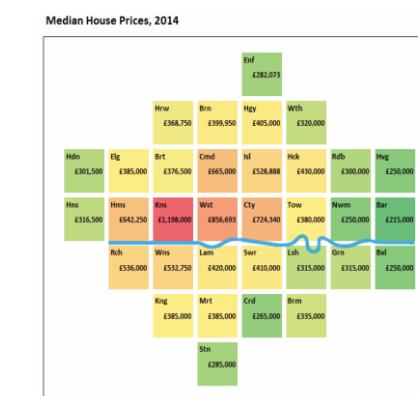
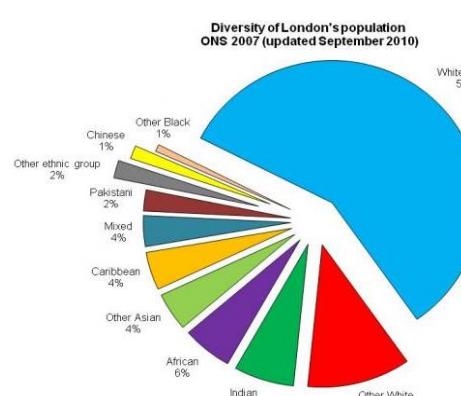
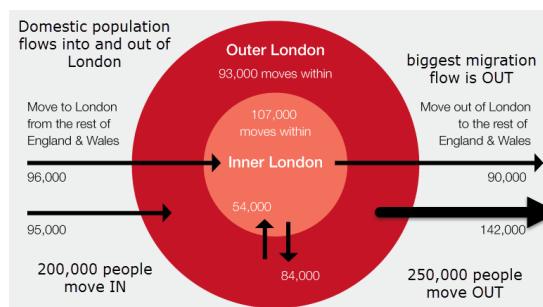
## **Urban sustainability**

Urban areas can be made more **sustainable** by encouraging:

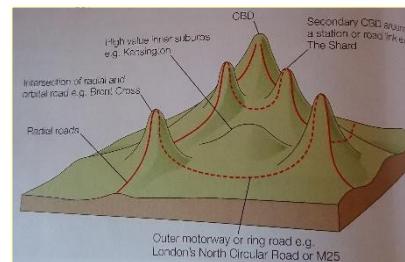
- **water conservation**
  - **energy conservation**
  - **waste recycling creating**

green spot  
Transport

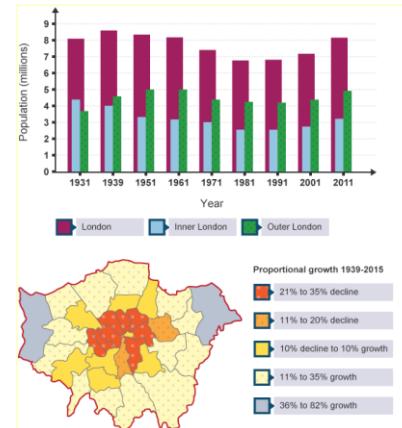
- London Underground
  - Oyster card
  - Congestion Charging zone
  - Bike sharing scheme



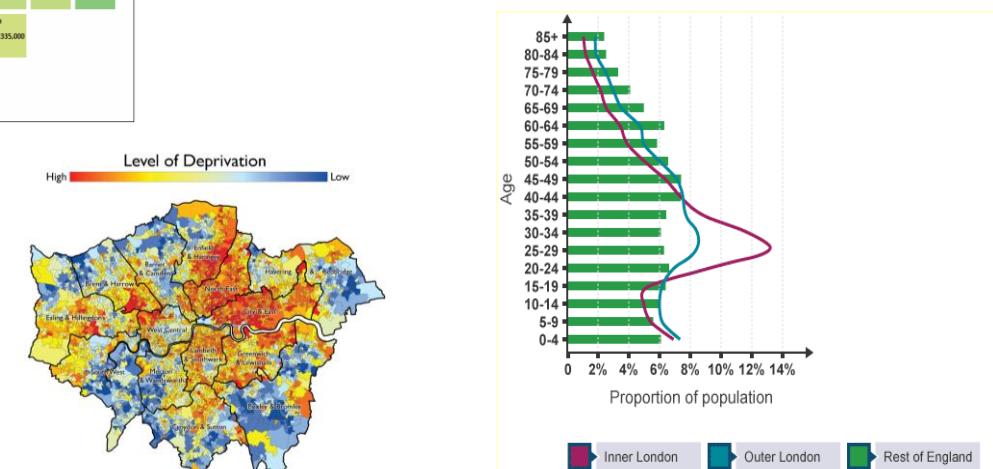
**Deprivation** (using the IMD) highlights areas where there is, in some cases, considerable lack of **quality of life**. This would include increased **crime** rates, poor access to **health, housing** and **education** services, **lower income** through low-paid, low-skilled jobs and a poorer environmental quality and **lack of green spaces**.



**House and land prices** vary across the capital with jobs, education, connectivity and environment all being major contributing factors.



Changes in **population** are the result of the changes in the economic structure of London. For example, as the docks closed, manufacturing was lost, particularly in the Lea Valley. This led to many job losses in inner London and migration out of the city, resulting in a loss of population in inner London.



Changes through FDI and TNC investment has encouraged **international migration** in London. This has created one of the most **diverse** and **densely populated** cities in the world. Increased **urbanisation** of London has also led to **counter-urbanisation** as people move out of the city for a 'quieter life' which, in turn, has led to **urban growth** and the increase in house prices and the number of services provided on the **periphery** of the city.

# Paper 2 Topic 4 Changing Cities – Case Study Stratford, London

**What:** Redevelopment

**When:** 2005 - 2012

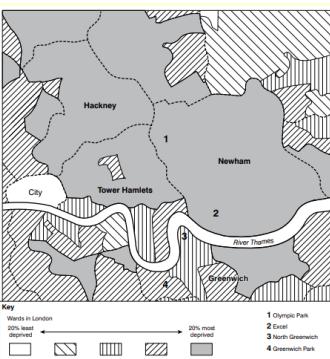
**Where:** Stratford

**Who:** London Olympic Committee/UK govt. London Mayor, local communities, global media

**Why:** Stratford, East London was chosen as the host city for the London 2012 Olympics in 2005.

Stratford, in the Lower Lea Valley, lies to the north of the London Docklands. It had one of the most **deprived** communities in the country, where unemployment was high and levels of health were poor. There was a lack of **infrastructure** and the environmental quality was poor.

The 2012 London Olympics bid was partly successful on the understanding that a sporting complex would be created in Stratford for the Games and regenerated for local people to use after the competitors had left. After the Olympic Games were over, the park was named the Queen Elizabeth Olympic Park.



## Impacts:

**Social:** by 2030, more than 10,000 new homes will have been built in the park. Five new neighbourhoods, with lots of green spaces planned in, will be built and around a third of those houses will be affordable. A new academy has been built, which is used to educate around 2,000 pupils between the ages of 3 and 18.

**Economic:** Stratford is now a well-connected area of London, which allows **commuters** to travel to work easily. New jobs in construction and tourism have created a **multiplier effect**. It is estimated that over 20,000 jobs could be created by 2030, bringing more than £5 billion into the area.

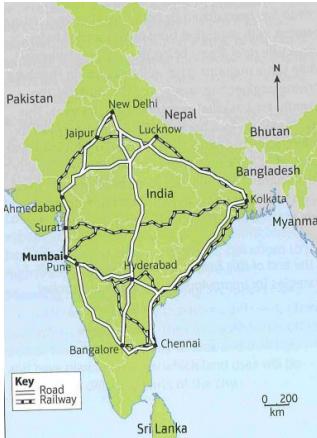
**Environmental:** the Olympic bid was partly successful on the basis of **sustainability**. The park is sustainable in a number of ways, eg walking and cycling routes, the provision of public transport, the water-efficient design of homes and the protection of green spaces and natural **habitats**.

**Objections:** Areas such as the Carpenter Estate have not yet been **regenerated** and remain in poor condition. But demolition is expected to go ahead in certain areas.

The **redevelopment** of Carpenters Estate will bring many benefits to new and existing residents of Carpenters and Newham including:

- around 3,000 new homes including more than 1,000 high quality affordable homes
- improvements to the quality of public space
- better connections to surrounding areas including access to Stratford Station
- the re-provision and expansion of Carpenters Primary School
- the creation of long term jobs with 20,000sqm of commercial space.

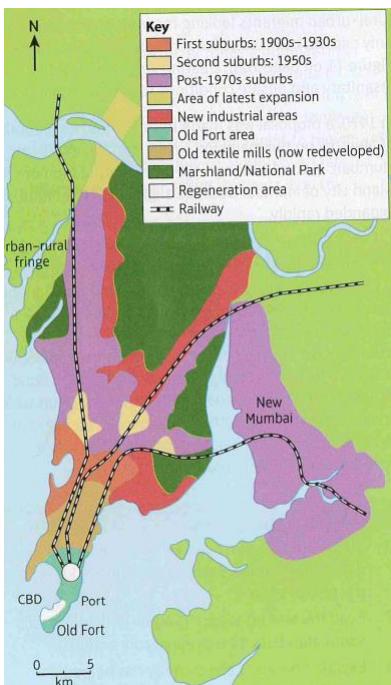
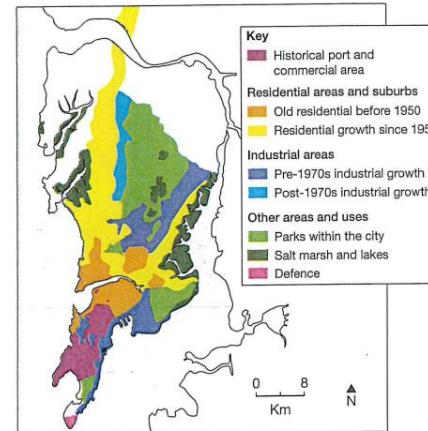
# Paper 2 Topic 4 Changing Cities – Case Study Mumbai



**Site** - low-lying city on an island, just above sea-level, with a natural, deep harbour on the west coast of India

**Situation** - facing the Arabian Sea, leading to Arabian and European markets

**Connectivity** - about 9 hours flight time to the UK and about 4 hours to Singapore making it a 'trading bridge' between European and other Asian markets



**CBD** - not in the centre as it was built around the harbour, but near the island tip, containing a mixture of old colonial buildings and new high-rise office blocks, plus main commercial centre, some industrial areas near the port, but as land is so expensive many have moved out to places such as Navi Mumbai where the land is cheaper

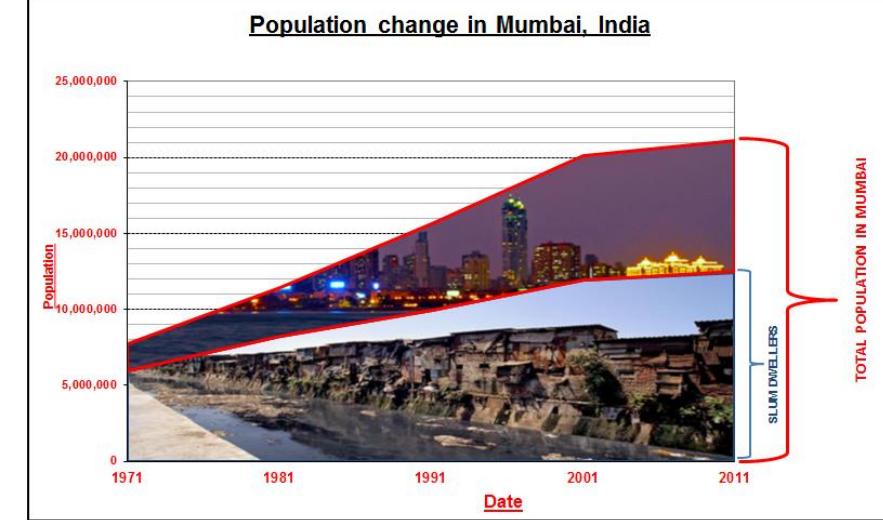
**Inner City** - old residential (pre-1950s) - wealthy areas along harbour or coastal waterfronts

**Inner suburbs** - poor quality permanent housing further from the CBD - low income groups live in 'chawls' - low quality multi-storey buildings where 80% are single rooms

**Outer suburbs/rural-urban fringe** - spontaneous shanty towns - poorest 60% of people live in informal housing, most are squatter shacks on the outskirts of the city

**Homeless** - thousands of homeless people live on Mumbai's streets

**Industry** - developed in strips out from the CBD along transport corridors leading to main roads and airports - increased since economic growth from the 1970s onwards



Estimated population in 2020: 20.6 million

Population in 1991: 9.9 million

Population growth rate: 2.9%

**Migration** - 1000 national migrants from other parts of India per day, looking for employment - 90% of migrants are from rural areas of India

**Natural increase** - more important as a cause of population growth in older, congested parts of the city

**Economic opportunities** - need for homes and infrastructure has created opportunities for economic development including FDI (Foreign Direct Investment) and outsourcing of employment from foreign businesses, attracting high quality, highly educated migrants to the city

Urban growth first began with **British colonial trading** and textile production. Today, migrants come from all over India to work in various industries, such as aerospace, engineering and medical research - led to development of new high-rise, high-quality apartments in the inner city and increase in services, including entertainment and high-class shopping centres

**Spontaneous settlements** - growing as more migrants move to the city from rural areas - lack of basic amenities and services

# Paper 2 Topic 4 Changing Cities – Case Study Mumbai



**Housing** - rapid population growth means lack of affordable housing resulting in spontaneous settlements - built on unsuitable land, liable to flooding, lack of clean water, electricity, rubbish collection or organised sewage disposal meaning a breeding ground for disease



**Employment** - many employed in informal, low-paid employment providing basic services in very poor conditions, some employment in 'sweatshops' also in poor conditions, with no contract or employment rights, poverty makes crime difficult to avoid



**Pollution** - lack of sanitation and pollution from local factories lead to water and land pollution, air pollution from high volumes of traffic, heavy industry and power stations



**Inadequate services** - lack of healthcare, education and transport links

## Inequalities

### Life at the bottom - Dharavi

Spontaneous settlements - made from any resources available, high population density (at least 300000 people per km<sup>2</sup>) people per home is between 13 and 17 with very limited sanitation and clean water supply, lack of healthcare and low literacy rates - many in informal, low-paid service industry

### Life in the middle - inner suburbs

Small flats, often converted from colonial times, one family, kitchen, bathroom, living room, regular, clean water, middle income, some technology available, electricity, access to healthcare but still limited income

### Life at the top - inner city and CBD

Highly educated, young, often speaks English, luxury high-spec apartments, gated communities, often employed in IT or media, able to 'shop' for consumer goods

**Improving housing** - (top-down) upgrading squatter settlements with proper building materials, (top-down) clearing squatter settlements (Dharavi) and rehousing residents in new blocks, (bottom-up) giving squatter-settlement residents legal ownership of their land and help in improving their homes, (top-down) providing electricity, sanitation and water to squatter settlements

Example

### SPARC - Society for the Promotion of Area Resource Centres

Provide small-scale loans to build new toilet blocks and other services in slum areas, making them safer and clear to use, community-led re-housing projects, giving people more rights over where and how they live, acting as an advocate for those affected by squatter resettlement

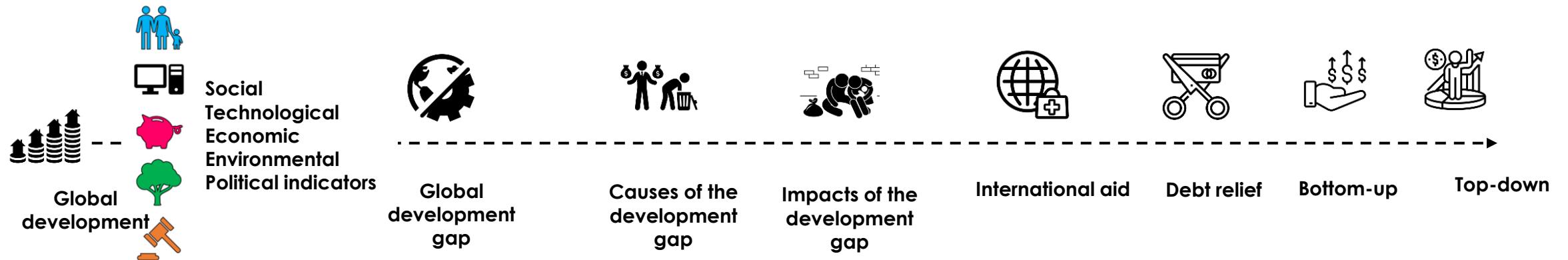


**Mumbai Slum Electrification Project** - to provide safe and reliable electricity to individual squatter houses. Connection costs are 50% lower in the squatter settlements than the main city, but daily charges can still be a battle

**Mumbai Slum Sanitation Program** - aims to build toilets for up to 1 million squatter dwellers. Since 1990, authorities have built over 350 blocks containing around 7,000 toilets

**Renovation and Redevelopment Plans** - clearance of squatter settlements and rebuild with small apartments, with more facilities, however this can break apart local community networks

# Paper 2 Topic 5 Development Dynamics



# Paper 2 Topic 5 Development Dynamics

There is no single way to calculate the level of development because of the variety of economies, cultures and peoples.

## The North South Divide

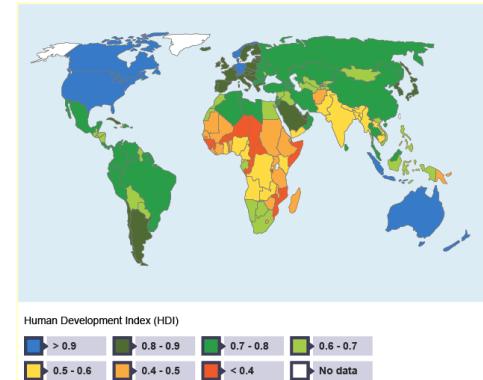
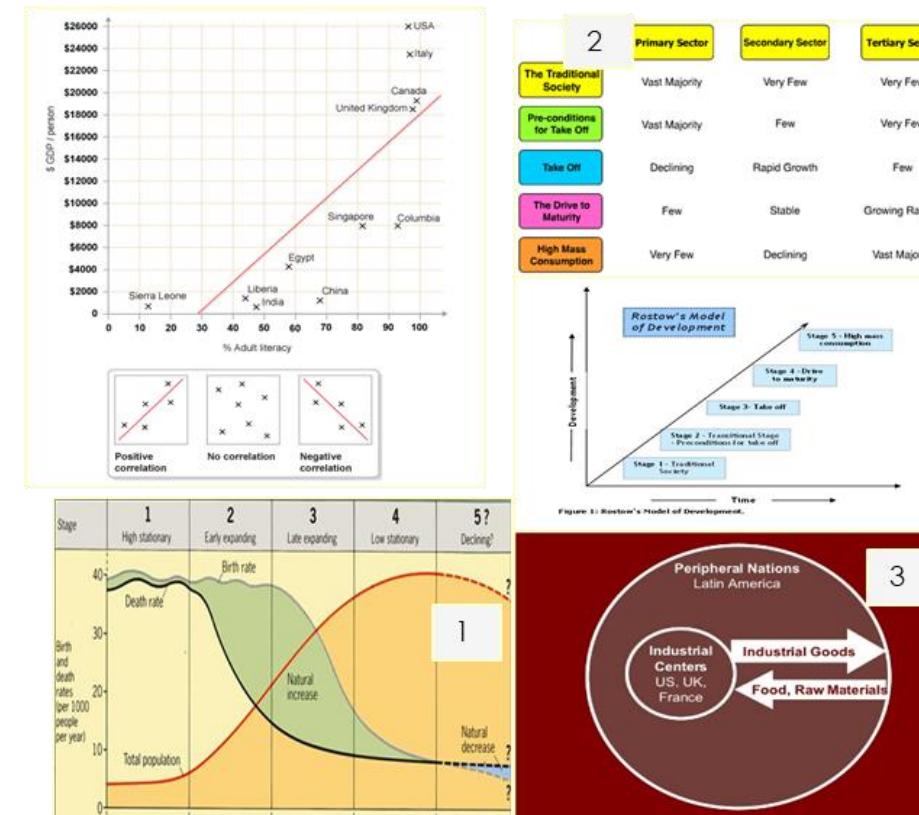
**Developed countries** are countries which have a high standard of living and a large GDP.

**Emerging countries** are countries who are going through a transition stage as they industrialise and trade more.

**Developing countries** are countries with a low standard of living and a much lower GDP.

The main indicators

- **Gross Domestic Product (GDP)** - this is the value of all goods and services produced within a country. It is usually measured in US\$ and calculated per capita.
- **Gross National Product (GNP)** also includes goods and services produced by that country overseas
- **Infant mortality:** this is the number of infants that die prematurely. Could be the numbers that die before they are one or five. Could be as a % of the births or a per 1,000 figure.
- **Birth Rate**, the number of people born per 1,000 people per year
- **Death rate:** the number of people who die per 1,000 people per year. It will be a clear indicator of the level of health care, quality of water, sanitation, accommodation, and food supply.
- **Literacy rates:** the percentage of people that can read and write
- **Human development index:** Uses wealth, health and education. It is calculated each year. The best country get "1" the worst "0". This score is compared to GDP tables.



## Reasons for lack of development:

**Social:** High birth rates, lack of contraception, children needed to work on farms, lack of women's rights

**Economic:** Lack of trading opportunities, concentration of primary jobs, overseas debt

**Environmental:** Lack of natural resources, lack of trade routes, poor climate, poor soil, landlocked countries, small island communities

**Political:** Colonialism, war, local conflict, the Slave Trade, corruption

1. **DTM – Demographic Transition Model** – shows as industrialisation and healthcare improves death rate and birth rate falls
2. **Rostow** – shows 5 stages industrialised developed countries have gone through to become developed.
3. **Gunder Frank** – suggest core developed countries are reliant on periphery developing or emerging countries to provide raw materials and developing or emerging periphery countries are reliant on developed core countries to provide work and manufactured goods to develop themselves.

# Paper 2 Topic 5 Development Dynamics Top-down and bottom-up aid

## There are three main ways to give aid:

A country can give directly to another. This is called **bilateral aid**.

Alternatively, **multi-lateral aid** is that which is given to several countries from an international organisation like the World Bank.

Finally, there are **non-governmental organisations** that we refer to as **charities**. These try to direct the money generated by charity at the needs of the poor, local communities or environment.



### Top-down development

Three Gorges Dam, Yangtze River, China.

Government imposed development – controlled flooding of river valleys and communities to build a dam to provide hydro-electric power to major cities in the east of the country.

### Bottom-up development

WaterAid, Malawi

NGO's with donations from government and the public in developed countries provide ground-water pumps which use sustainable, suitable technology and education about use of water, health, education.



	Positives	Negatives
<b>Social</b>	<ul style="list-style-type: none"> <li>Protects 100 million people from seasonal flooding</li> </ul>	<ul style="list-style-type: none"> <li>1.3 million people (communities) displaced with little compensation</li> </ul>
<b>Economic</b>	<ul style="list-style-type: none"> <li>Generates 22,500MW electricity</li> <li>Multiplier effect of jobs for people in power companies and cities upstream</li> <li>Increased trade upstream as container ships can now travel on the Yangtze</li> </ul>	<ul style="list-style-type: none"> <li>Tourism may be negatively affected</li> <li>US\$26 billion cost</li> </ul>
<b>Environmental</b>	<ul style="list-style-type: none"> <li>Protects large areas of the river valley from seasonal flooding.</li> <li>Reduces the need for coal-fired power stations limiting air pollution</li> </ul>	<ul style="list-style-type: none"> <li>1300 archaeological sites flooded</li> <li>Yangtze river dolphin extinct</li> <li>River pollution from sewerage, farm &amp; industrial waste</li> <li>Farmers no longer floodwaters</li> </ul>
<b>Political</b>	<ul style="list-style-type: none"> <li>FDI investment from global developed economies</li> </ul>	<ul style="list-style-type: none"> <li>Govt did not listen to local residents views</li> </ul>

	Positives	Negatives
<b>Social</b>	<ul style="list-style-type: none"> <li>Less time needed to collect water</li> <li>Reduction in water-borne diseases</li> <li>Children able to go to school instead of collecting water</li> </ul>	<ul style="list-style-type: none"> <li>Need to train villagers to maintain and repair pumps</li> </ul>
<b>Economic</b>	<ul style="list-style-type: none"> <li>Cost £292 per pump provided by NGO's</li> <li>Limited repair costs</li> <li>Women able to use their time more productively and provide for themselves through trade of goods</li> </ul>	<ul style="list-style-type: none"> <li>Reliant on charitable donations from NGO's.</li> <li>Does not increase country trade output as only localised</li> </ul>
<b>Environmental</b>	<ul style="list-style-type: none"> <li>Clean water provided for many rural villages</li> <li>Uses groundwater - can be replenished by rainfall</li> </ul>	<ul style="list-style-type: none"> <li>Rains may not replenish groundwater</li> <li>Can become over-used</li> </ul>
<b>Political</b>	<ul style="list-style-type: none"> <li>Sustainable, renewable technology allows 'ownership' by the villagers</li> </ul>	<ul style="list-style-type: none"> <li>Government does not receive money so does not benefit whole country</li> </ul>

# Paper 2 Topic 5 Development Dynamics - Case Study India

Site and Situation	
	
<b>India is the 7<sup>th</sup> largest country in the world by land mass</b>	
<b>Continent:</b> Asia <b>Nearby countries:</b> Pakistan, Sri Lanka, Bangladesh, Nepal <b>Nearby oceans:</b> Indian Ocean, Arabian Sea, Bay of Bengal	
<b>Think like a geographer:</b> <u>How does India's location promote economic development?</u> <ul style="list-style-type: none"> <li>• <b>What other major economies are nearby?</b> China! Now a major economy and superpower. India and China have existing political tensions. India is a former British colony.</li> <li>• <b>Is India landlocked? Which countries are easily accessed?</b> India is not landlocked, meaning it can easily transport goods internationally by boat. India aims to become a major transport hub within south east Asia.</li> <li>• <b>Is India a large or small country? What about its population?</b> India is a large country, with good access to resources such as coal. India's population is rapidly growing, totals 1.324 billion (2016). This makes India the second most populous country in the world.</li> </ul>	

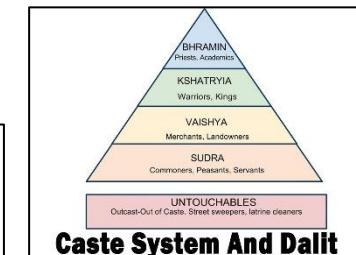
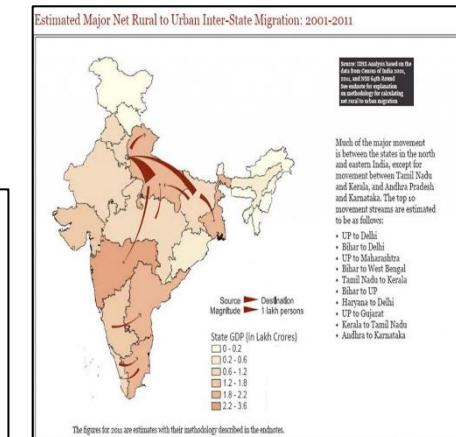
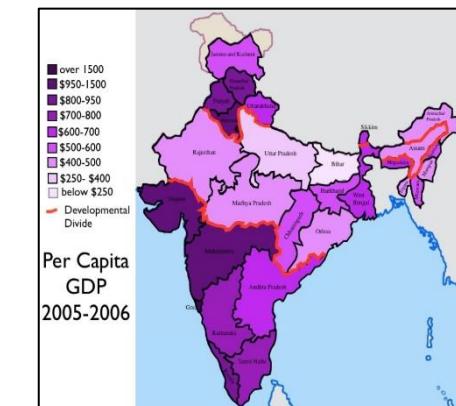
**India's caste system is among the world's oldest forms of surviving social stratification.** The caste system divides Hindus into four main categories - Brahmins, Kshatriyas, Vaishyas and the Shudras. This was encouraged by the British colonizers in order to control the majority of people. In recent decades, with the spread of secular education and growing urbanisation, the influence of caste has somewhat declined, especially in cities where different castes live side-by-side and inter-caste marriages are becoming more common.

Development Indicators		
Development Indicator	Social, Economic or Environmental	Value
<b>HDI (Human Development Index)</b>	Social, Economic and Environmental	0.621 (131 <sup>st</sup> in the world)
<b>Life Expectancy</b>	Social	68 years
<b>Adult Literacy</b>	Social	74%
<b>Infant Mortality</b>	Social	34 per 1000 birth
<b>GDP (Gross domestic Product per capita)</b>	Economic	\$1,709

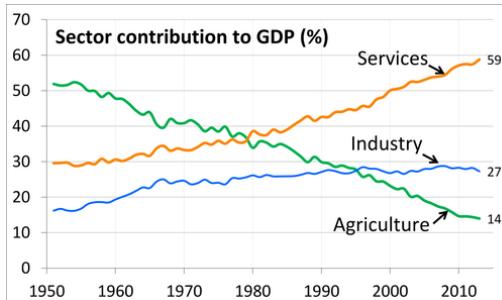
India has experienced rapid economic development since **1991** when it 'opened up' for trade. However, this has led to **uneven development** across the country with **urbanised core** regions such as **Maharashtra and Tamil Nadu** having 6 times more GDP per capita than **rural periphery** regions such as **Bihar**. This has led to, amongst other **social disparities**, a difference in **fertility rates** across the country.

State	Fertility rate 2013
West Bengal	1.60
Punjab	1.70
Tamil Nadu	1.70
Delhi	1.70
Kerala	1.80
Andhra Pradesh	1.80
Gujarat	2.30
Assam	2.30
Rajasthan	2.80
Uttar Pradesh	3.10
Bihar	3.40

The general trend in employment has been a loss of **primary employment**, with an expansion of the **services sector**. This, in turn, has encouraged **rural to urban migration**, leading to **urban expansion** and **slum developments**.



# Paper 2 Topic 5 Development Dynamics - Case Study India



- A smaller proportion of people under 15 as the infant mortality rate drops
- A large proportion of people between (15 and 64) as dependency ratio decreases
- More people over the age of 65+ as life expectancy has improved

Since India gained its independence in 1947 from the British and a shift in policy since the 1980s encouraging FDI, there have been significant changes in its economic sectors:  
**Primary** – agriculture has halved to a quarter of its GDP owing to mechanisation as people migrate from rural areas to cities in search of work

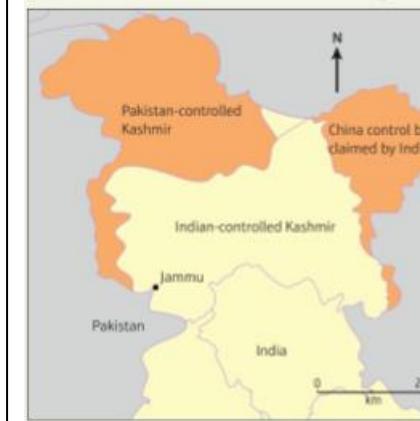
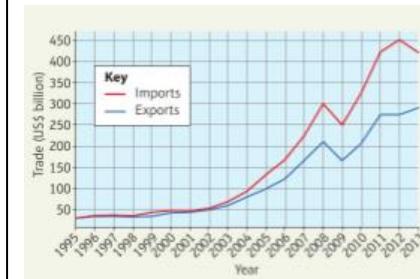
**Secondary** – industrialisation is increasing. However, it is causing air pollution and increasing the population density in cities (spontaneous developments)

**Tertiary** – services have doubled to over 50% of GDP owing to increased job opportunities

**Quaternary** – one of the fastest growing telecommunication markets in the world creating over 1 million ICT jobs

**Formal employment** - increasing through the number of TNC's now located in core regions

**Informal employment** - increasing through demand for low-paid, low-skilled services



Changes to India's trading policy have led to a rapid rise in imports and exports. India's key imports are oil, gold, silver, and electrical goods. India's key exports are oil products, gems and jewellery. As India has developed, international aid has decreased. It now sends aid to poorer countries such as Nepal



India has agreed to invest in renewable energy such as solar power and plant more forest to absorb carbon emissions. India is also a member of the G20, having a greater influence in global politics

**Geopolitics** is the impact of a country's human and physical geography on its international politics and relations. The impacts of India's relationships:

**Foreign policy** – India is building links with France and Canada to encourage defence, energy and infrastructure

**Military pacts** – India is building links with Russia to supply them with missiles and jets

**Defence** – India is building links with the USA to provide warships and planes for assistance and disaster relief

**Territorial disputes** – India is in disputes with China. Dams limit each other's water supply and a continued dispute with Pakistan over Kashmir since independence in 1947



## Social

Better jobs, income and healthcare

Lack of housing – shanty towns

Younger men benefit from jobs

## Economic

Larger workforce, stronger economy

Increase in tourism - jobs

Cost of new infrastructure

## Environmental

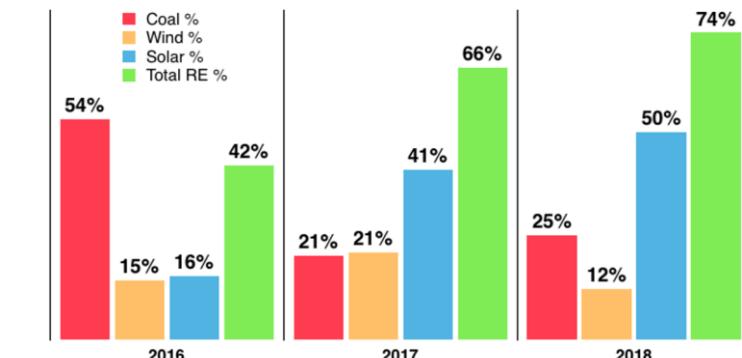
Potential to invest in renewables

Deforestation and desertification

Increased CO<sub>2</sub> emissions

## Growing gap between core and periphery regions

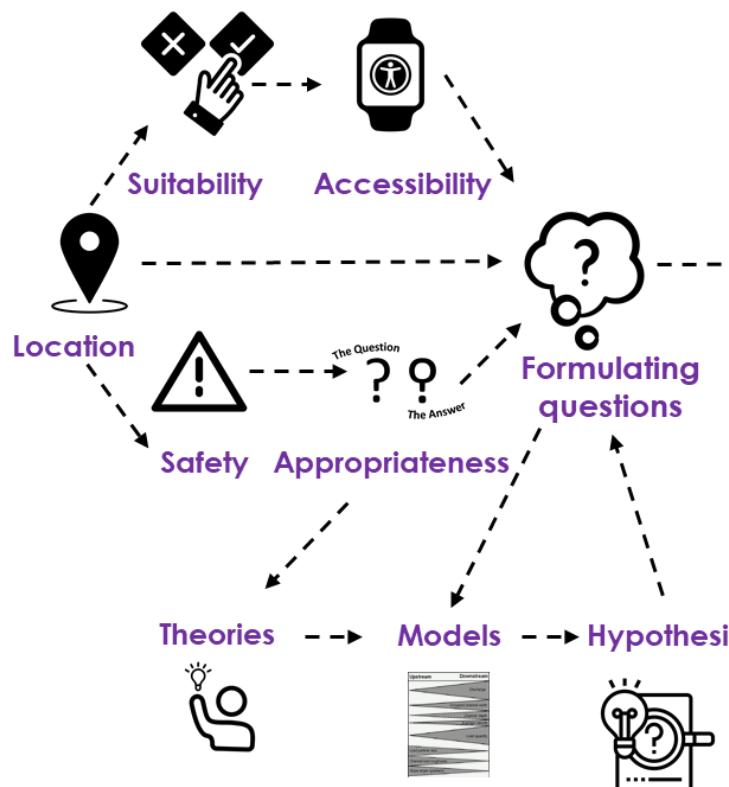
### Share of various technologies in new power capacity additions in India



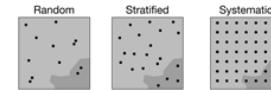
# Paper 3 Topic 7a Investigating physical environments - rivers landscapes



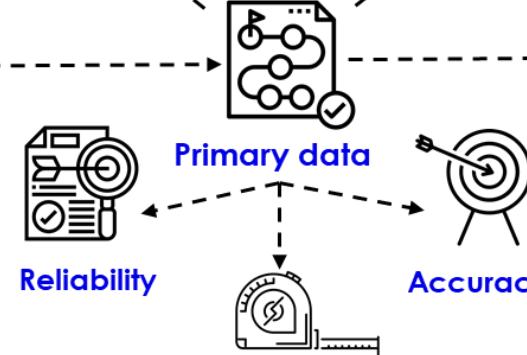
## Stage 1 Formulating questions



## Stage 2a Primary data

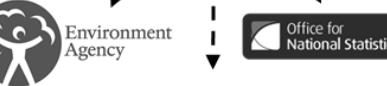


### Sampling



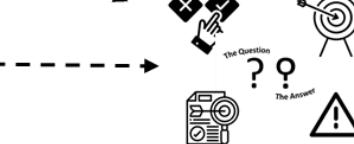
### Equipment

## Stage 2b Secondary data

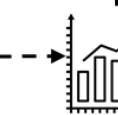


### Secondary data

### Research



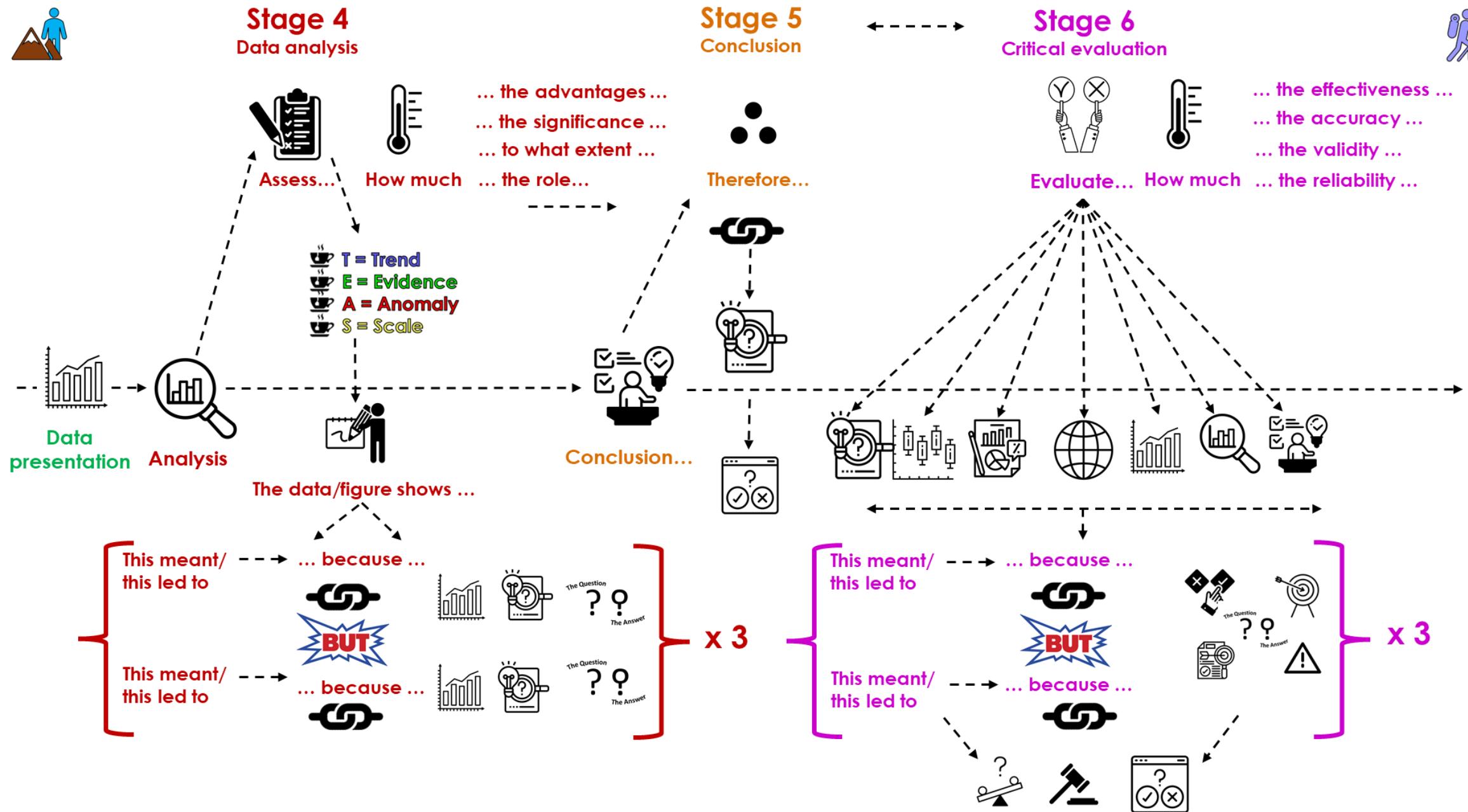
## Stage 3 Data presentation



### Data presentation



# Paper 3 Topic 7a Investigating physical environments - rivers landscapes



# Rivers Fieldwork - Primary Data Collection



Hypothesis



Location - Evaluation



Risk - Evaluation



Methods used - Channel Characteristics



Width – water level



Methods used - Velocity



Flow meter



Methods used - Flood Risk



Field sketch



Width – bankfull level



Stopwatch



Photographs

Depth – water level

Depth – bankfull level



Pebble size



Method Evaluation – Velocity



Land Use



GIS



Pebble shape



Method Evaluation – Flood risk



# Rivers Fieldwork – Data Presentation Methods, Evaluation and Secondary Data

## ?

### Hypothesis

#### Data Presentation Methods

Channel Characteristics



Cross-section



Pebble size and shape



Velocity



Flood Risk

#### Data Presentation Evaluation



Channel Characteristics 



Cross-section



Pebble size and shape



Velocity



Flood Risk



#### Secondary Data Collection



Environment Agency Flood Risk Map Evaluation



Ordnance Survey Map Evaluation



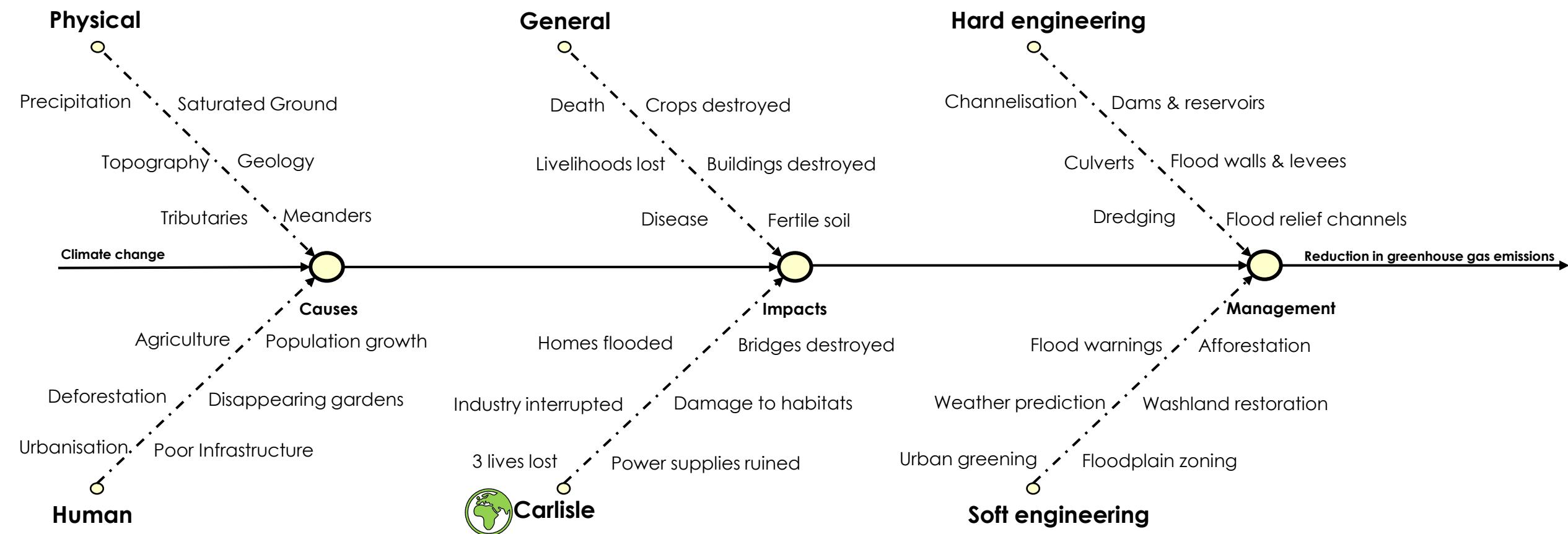
River Levels UK Website Evaluation



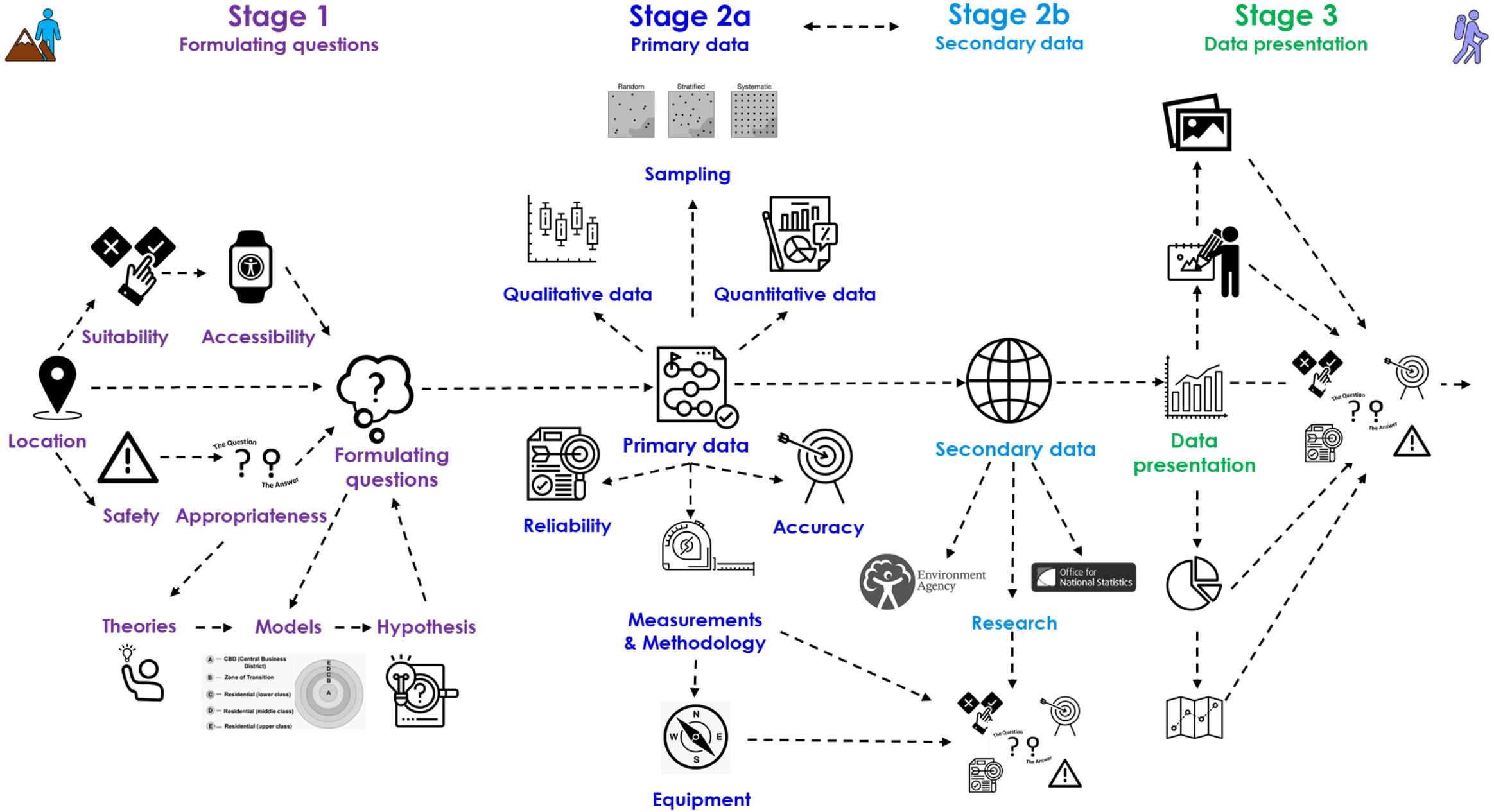
EA Drainage Basin Map Evaluation



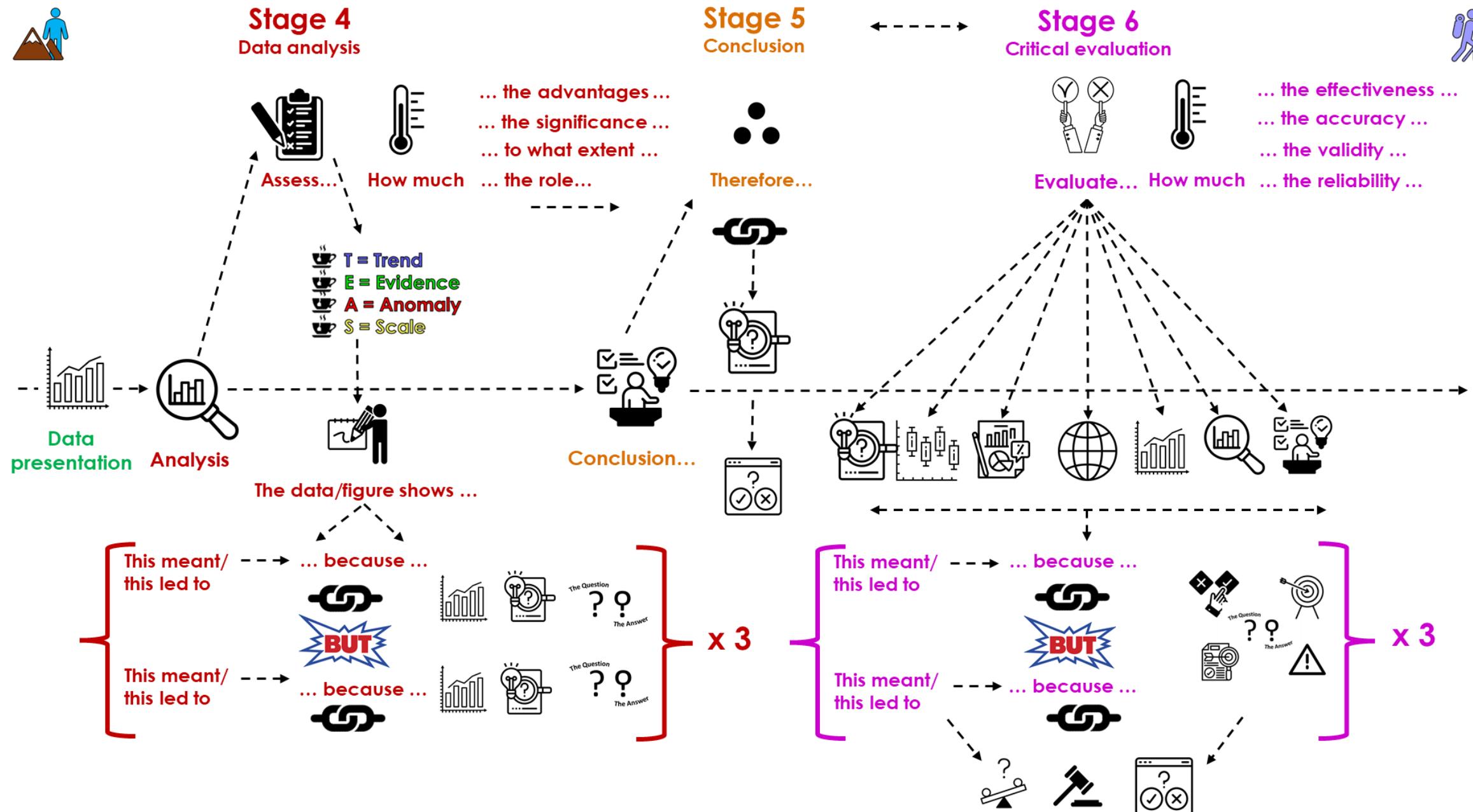
# River Flooding



## Paper 3 Topic 7b Investigating human environments - urban areas



# Paper 3 Topic 7b Investigating human environments - urban areas



# Urban Fieldwork - Primary Data Collection



Hypothesis



Location - Evaluation



Risk - Evaluation



# Urban Fieldwork – Data Presentation Methods, Evaluation and Secondary Data

## ?

### Hypothesis

#### Data Presentation Methods



Observation data



Questionnaire data



Fieldsketch



Qualitative Data



Quantitative Data

#### Data Presentation Evaluation



Observation data



Questionnaire data



Fieldsketch



Qualitative Data



Quantitative Data



#### Secondary Data Collection



Social indicators



Newham's Legacy Story



Office of National Statistics



Met Police Crime Statistics



# Urban Fieldwork – Data Analysis, Conclusion and Overall Evaluation



## Hypothesis



### Analysis – what does our data show?

Social quality of life

Economic quality of life

Environmental quality of life



### Analysis – how and why does our data show this?

Social quality of life

Economic quality of life

Environmental quality of life



### Conclusion

Does quality of life vary in urban areas? How do you know?



### Overall Evaluation of your fieldwork

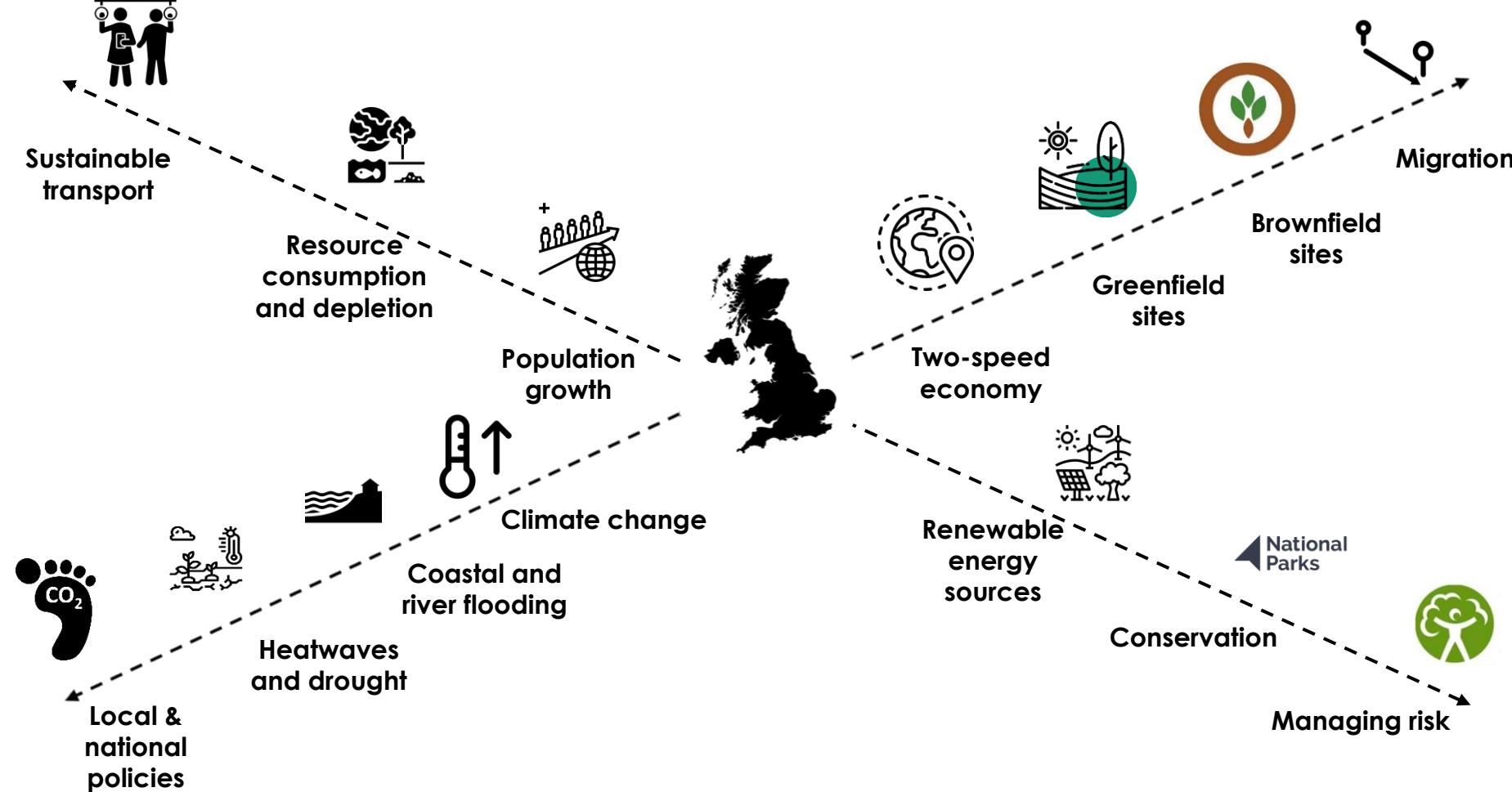


How could the data collection be improved?



How could your study be extended?

# Paper 3 Topic 8 UK Challenges



# Paper 3 Topic 8 UK Challenges

## Population, consumption & resource challenges

Table 1 Projected population for the UK (millions)

	2010	2015	2020	2025	2030	2035	2050
*UK	62.3	64.8	67.2	69.4	71.4	73.2	77.0
England	52.2	54.5	56.6	58.6	60.4	62.1	
Wales	3.0	3.1	3.2	3.2	3.3	3.4	
Scotland	5.2	5.4	5.5	5.6	5.7	5.8	
Northern Ireland	1.8	1.9	1.9	2.0	2.0	2.0	

\*The figures for England, Wales, Scotland and Northern Ireland may not add up to the total for the UK. This is because the numbers have been rounded up.

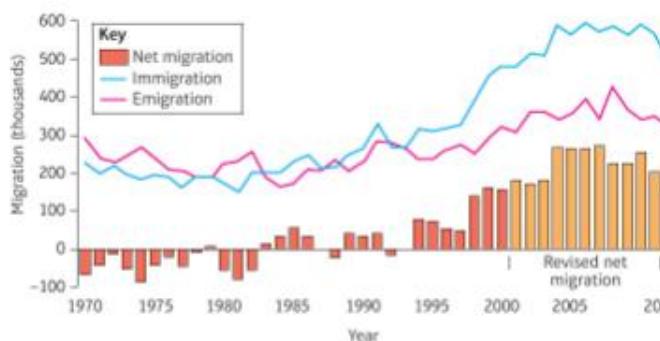


Figure 4 Net migration statistics for the UK between 1970 and 2012

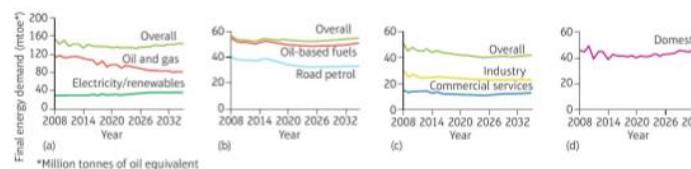


Figure 1 Projected energy requirements by sector. (a) Summary of demand by fuel type. (b) Final energy demand by transport. (c) Final energy demand by industry and services. (d) Domestic final energy demand

The UK is becoming **overpopulated**. By 2030, the UK's population is expected to exceed 70 million owing to natural increase and migration. This will put further strain on natural resources and ecosystems

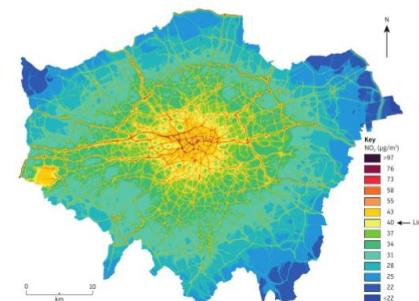
## Settlement & environmental challenges



Figure 3 House price map of England and Wales, January 2014

### Authorities with the most homes at high risk\* of flooding

As at March 2019



A '**two-speed economy**' refers to the uneven growth of the UK economy, with the south-east developing fastest. A possible solution to help close the gap between the south-east and the rest of the UK is to improve transportation links e.g. HS2.

Awareness of **transport impacts** has lead to many urban areas implementing charges for travelling within the city and an increase in public transport options

Pressures of a growing population and increased land and house prices means developers are looking to build on both **greenfield** and **brownfield** sites and on land that is at high risk from flooding

# Paper 3 Topic 8 UK Challenges

## Landscape challenges



Figure 5 Locations of UK National Parks

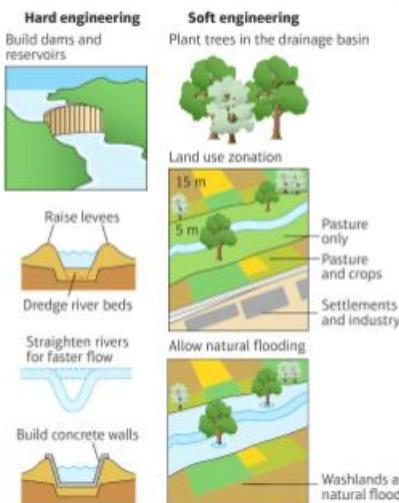


Figure 6 Dealing with floods: what are the options?

	Advantages	Disadvantages
Greenfield sites	<ul style="list-style-type: none"> <li>1 Relatively cheap and rates of house building faster</li> <li>2 The layout is not hampered by previous development so can easily be made efficient and pleasant</li> <li>3 Healthier environment</li> <li>4 Encourages <b>suburban sprawl</b></li> </ul>	<ul style="list-style-type: none"> <li>1 Valuable farm or recreational land lost</li> <li>2 Wildlife and their habitats lost or disturbed, partly due to more noise and light pollution</li> <li>3 Often far from work and services, generating more traffic</li> </ul>
Brownfield sites	<ul style="list-style-type: none"> <li>1 Reduces the loss of countryside and land that might be put to agricultural or recreational use</li> <li>2 Helps revive old and disused urban areas</li> <li>3 Services such as water, electricity, gas and sewerage already in place</li> <li>4 Located nearer to main areas of employment, so commuting reduced</li> </ul>	<ul style="list-style-type: none"> <li>1 Often more expensive because old buildings have to be cleared and land cleaned of pollutants</li> <li>2 Sometimes surrounded by rundown areas so does not always appeal to more wealthy people as a residential location</li> <li>3 Higher levels of pollution; less healthy</li> </ul>

**National Parks**, first established in 1951, aim for sustainable development, balancing the needs of visitors and residents whilst conserving landscapes and habitats through working with local businesses and landowners.

By creating jobs in **conservation**, education and land management this goes someway in reducing rural to urban migration and reduces the North-South divide.

The Environment Agency is responsible for protecting and maintaining all waterways and coastal landscapes and reducing flood risk

## Climate change challenges

The long-term impacts of **climate change** are still uncertain but Changes to the UK's climate is already being felt. Warmer, drier winters and warmer, wetter summers have resulted in changes to the growing seasons of plants and crops and the changes to the intensity and frequency of extreme weather events such as storms and droughts has meant more people, animals and plants are at risk.

**Water insecurity** has meant more freshwater is being transported from the north and west of the UK to the densely populated south and east.

Changes to individual lifestyles and government policies could have a positive impact.

Increased use of **renewable energy sources**, such as wind and tidal power to generate electricity, changes to transport and car legislation and new household heating boilers are also designed to reduce the country's carbon footprint and CO<sub>2</sub> emissions.

**International agreements** to reduce global emissions and keep global warming at 1.5° C are in place but as seen as the recent COP26 conference in Glasgow, conflicts can arise between those who will be impacted the economically and those who will be impacted physically.

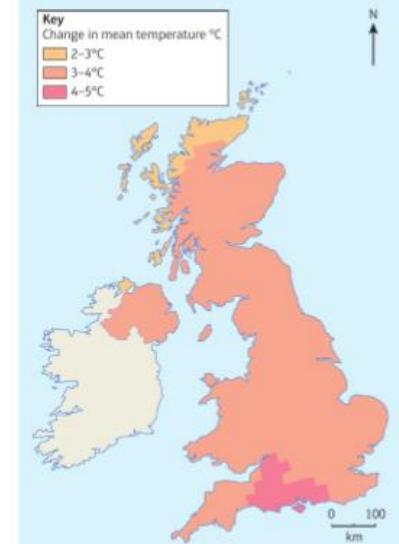


Figure 8 Change in mean temperatures in the UK in 2080, middle range prediction



Figure 10 Satellite photo showing energy usage at night in Europe, the Middle East and North Africa