The structure of the Earth

The Crust	Varies in thickness (5-10km) beneath the ocean. Made up of several large plates.
The Mantle	Widest layer (2900km thick). The heat and pressure means the rock is in a liquid state that is in a state of convection.
The Inner and outer Core	Hottest section (5000 degrees). Mostly made of iron and nickel and is 4x denser than the crust. Inner section is solid whereas outer layer is liquid.

Convection Currents

The crust is divided into tectonic plates which are moving due to convection currents in the mantle.

1	Radioactive decay of some of the elements in the core and mantle generate a lot of heat.
2	When lower parts of the mantle molten rock (Magma) heat up they become **less dense** and **slowly rise**.
3	As they move towards the top they cool down, become **more dense** and **slowly sink**.
4	These **circular movements** of semi-molten rock are **convection currents**
5	Convection currents create **drag** on the base of the tectonic plates and this causes them to move.

Types of Plate Margins

Destructive Plate Margin

When the denser plate subducts beneath the other, friction causes it to **melt and become molten magma**. The magma forces its ways up to the surface to form a volcano. This margin is also responsible for **devastating earthquakes**.

Constructive Plate Margin

Here two plates are **moving apart** causing new magma to reach the surface through the gap. Volcanoes formed along this crack cause a submarine mountain range such as those in the **Mid Atlantic Ridge**.

Conservative Plate Margin

A conservative plate boundary occurs where plates **slide past each other** in opposite directions, or in the same direction but at different speeds. This is responsible for earthquakes such as the ones happening along the San Andreas Fault, USA.

Volcanic Hazards

Ash cloud	Small pieces of pulverised rock and glass which are thrown into the atmosphere.
Gas	Sulphur dioxide, water vapour and carbon dioxide come out of the volcano.
Lahar	A volcanic mudflow which usually runs down a valley side on the volcano.
Pyroclastic flow	A fast moving current of super-heated gas and ash (1000°C). They travel at 450mph.
Volcanic bomb	A thick (viscous) lava fragment that is ejected from the volcano.

What is a Natural Hazard

A natural hazard is a natural process which could cause death, injury or disruption to humans, property and possessions.

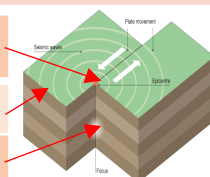| Geological Hazard	Meteorological Hazard
These are hazards caused by land and tectonic processes.	These are hazards caused by weather and climate.

Causes of Earthquakes

Earthquakes are caused when two plates become **locked** causing **friction** to build up. From this **stress**, the **pressure** will eventually be released, triggering the plates to move into a new position. This movement causes energy in the form of **seismic waves**, to travel from the **focus** towards the **epicentre**. As a result, the crust vibrates triggering an earthquake.

The point directly above the focus, where the seismic waves reach first, is called the **EPICENTRE**.

SEISMIC WAVES (energy waves) travel out from the focus.

The point at which pressure is released is called the **FOCUS**.

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Unit 1a
The Challenges of Natural Hazards

LIC -CS: Nepal Earthquake 25th April 2015

Causes
On a destructive plate margin, involving the Indian & Eurasian plates. The magnitude 7.8 earthquake was only 48 miles from the capital Kathmandu. With a very shallow focus of 15km deep.

Effects
9,000 people deaths. Many emotionally affected. 600,000 buildings collapsed or were damaged. **Millions homeless**. Rubble blocked roads.
Damage estimated to cost between $5-10bn.

Responses
Individuals tried to recover people. Army **responded with rescue teams** **$330m aid raised in 2 weeks**. Difficulty reaching remote villages due to lack of transport.

Managing Volcanic Eruptions

Warning signs	Monitoring techniques
Small earthquakes are caused as magma rises up.	Seismometers are used to detect earthquakes.
Temperatures around the volcano rise as activity increases.	Thermal imaging and satellite cameras can be used to detect heat around a volcano.
When a volcano is close to erupting it starts to release gases.	Gas samples may be taken and chemical sensors used to measure sulphur levels.

Preparation	
Creating an exclusion zone around the volcano.	Being ready and able to evacuate residents.
Having an emergency supply of basic provisions, such as food	Trained emergency services and a good communication system.

Earthquake Management

PREDICTING

Methods include:
- Satellite surveying (tracks changes in the earth's surface)
- Laser reflector (surveys movement across fault lines)
- Radon gas sensor (radon gas is released when plates move so this finds that)
- Seismometer
- Water table level (water levels fluctuate before an earthquake)
- Scientists also use seismic records to predict when the next event will occur.

PROTECTION

You can't stop earthquakes, so earthquake-prone regions follow these three methods to reduce potential damage:
- Building earthquake-resistant buildings
- Raising public awareness
- Improving earthquake prediction

HIC - CS: New Zealand Earthquake, 22nd Feb 2011

Causes
10km SE of Christchurch. 6.3m on the Richter scale.
Focus of 5km.
Caused by a **fault line** within the Pacific plate

Effects
185 deaths
Severe **liquefaction** caused buildings to become unsteady and collapse.
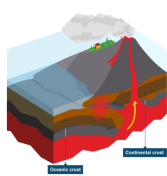80% of the city without power.

Responses
Short term
Temporary housing. Toilets for 30,000.
Long term
Water and sewers restored by August. Roads and houses cleared of silt from liquefaction.

Global pattern of air circulation

Atmospheric circulation is the large-scale movement of air by which heat is distributed on the surface of the Earth.

| Hadley cell	Largest cell which extends from the **Equator** to between **30° to 40° north & south**.
Ferrel cell	Middle cell where air flows **poleward** between **60° & 70°** latitude.
Polar cell	**Smallest & weakness** cell that occurs from the poles to the Ferrel cell.
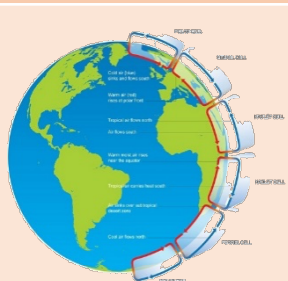
Distribution of Tropical Storms.

They are known by many names, including hurricanes (North America), cyclones (India) and typhoons (Japan and East Asia). They all occur in a band that lies roughly 5-15° either side of the Equator.

High and Low Pressure

Low Pressure	High Pressure
Caused by hot air rising. Causes stormy, cloudy weather.	Caused by cold air sinking. Causes clear and calm weather.
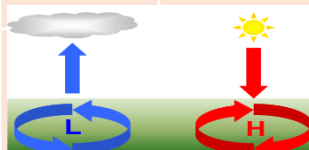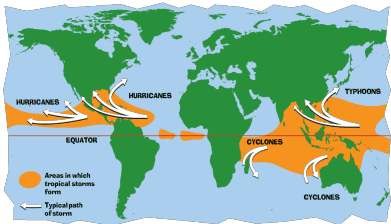
Formation of Tropical Storms

1	The sun's rays heats large areas of ocean in the summer and autumn. This causes **warm, moist air** to rise over the particular spots
2	Once the **temperature is 27⁰**, the rising warm moist air leads to a **low pressure**. This eventually turns into a thunderstorm. This causes air to be sucked in from the **trade winds**.
3	With trade winds blowing in the opposite direction and the rotation of earth involved (Coriolis effect), the thunderstorm will eventually start to **spin**.
4	When the storm begins to **spin faster than 74mph**, a tropical storm (such as a hurricane) is officially born.
5	With the tropical storm growing in power, **more cool air sinks** in the centre of the storm, creating calm, clear condition called the **eye of the storm**.
6	When the tropical storm hits land, it **loses its energy source** (the warm ocean) and it begins to lose strength. Eventually it will 'blow itself out'.

Changing pattern of Tropical Storms

Scientist believe that global warming is having an impact on the frequency and strength of tropical storms. This may be due to an increase in ocean temperatures.

Management of Tropical Storms

Protection
Preparing for a tropical storm may involve construction projects that will improve protection.

Aid
Aid involves assisting after the storm, commonly in LIDs.

Development
The scale of the impacts depends on the whether the country has the resources cope with the storm.

Planning
Involves getting people and the emergency services ready to deal with the impacts.

Prediction
Constant monitoring can help to give advanced warning of a tropical storm

Education
Teaching people about what to do in a tropical storm.

Primary Effects of Tropical Storms

- The intense winds of tropical storms can destroy whole **communities, buildings** and **communication networks**.
- As well as their own destructive energy, the winds can generate abnormally high waves called **storm surges**.
- Sometimes the most destructive elements of a storm are these subsequent **high seas and flooding** they cause to coastal areas.

Secondary Effects of Tropical Storms

- People are **left homeless**, which can cause distress, poverty and ill health due to lack of shelter.
- **Shortage of clean water** and **lack of proper sanitation** makes it easier for diseases to spread.
- **Businesses are damaged** or destroyed causing employment.
- Shortage of food as **crops are damaged**.

Case Study: Hurricane Katrina 2005

Causes
Started as a tropical depression on **2ⁿᵈ November 2013** and gained strength. Became a Category 5 **"super typhoon"** and made landfall on the Pacific islands of the Philippines.

Effects
- Almost **6,500 deaths**.
- **130,000 homes destroyed.**
- Water and sewage systems destroyed had caused **diseases**.
- **Emotional grief** for dead.

Management
- The UN raised **£190m in aid**.
- USA & UK **sent helicopter carrier ships** deliver aid remote areas.
- **Education** on typhoon preparedness.

Case Study: UK Heat Wave 2003

Causes
The heat wave was caused by an anticyclone (areas of high pressure) that stayed in the area for most of August. This blocked any low pressure systems that normally brings cooler and rainier conditions.

Effect
- People suffered from heat strokes and dehydration.
- 2000 people died from causes linked to heatwave.
- Rail network disrupted and crop yields were low.

Management
- The NHS and media gave guidance to the public.
- Limitations placed on water use (hose pipe ban).
- Speed limits imposed on trains and government created 'heatwave plan'.

What is Climate Change?

Climate change is a large-scale, long-term shift in the planet's weather patterns or average temperatures. Earth has had tropical climates and ice ages many times in its 4.5 billion years.

Recent Evidence for climate change.

Global temperature	Average global temperatures have increased by more than **0.6°C since 1950**.
Ice sheets & glaciers	Many of the world's glaciers and ice sheets are melting. E.g. the Arctic sea ice has declined by **10% in 30 years**.
Sea Level Change	Average global **sea level has risen by 10-20cms** in the past 100 years. This is due to the additional water from ice and thermal expansion.

Enhanced Greenhouse Effect

Recently there has been an increase in **humans burning fossil fuels** for energy. These fuels (gas, coal and oil) emit **greenhouse gases**. This is making the Earth's atmosphere thicker, therefore trapping more solar radiation and causing **less to be reflected**. As a result, the Earth is becoming warmer.

Evidence of natural change

Orbital Changes	Some argue that climate change is linked to how the Earth orbits the Sun, and the way it wobbles and tilts as it does it.
Sun Spots	Dark spots on the Sun are called Sun spots. They increase the **amount of energy Earth receives** from the Sun.
Volcanic Eruptions	Volcanoes release large amounts of **dust containing gases**. These can **block sunlight** and results in cooler temperatures.

Managing Climate Change

Carbon Capture
This involves new technology designed to reduce climate change.

Planting Trees
Planting trees increase the amount of carbon is absorbed from atmosphere.

International Agreements
Countries aim to cut emissions by signing international deals and by setting targets.

Renewable Energy
Replacing fossil fuels based energy with clean/natural sources of energy.

What is an Ecosystem?

An ecosystem is a system in which organisms interact with each other and with their environment.

Ecosystem's Components

Abiotic	These are **non-living**, such as air, water, heat and rock.
Biotic	These are **living**, such as plants, insects, and animals.

|		
	Flora	**Plant life** occurring in a particular region or time.
	Fauna	**Animal life** of any particular region or time.
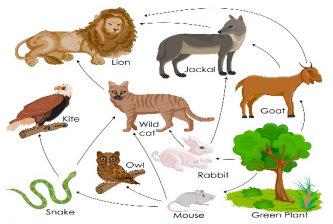
Food Web and Chains

Simple **food chains** are useful in explaining the basic principles behind ecosystems. They show only one species at a particular trophic level. **Food webs** however consists of a network of many food chains interconnected together.

Nutrient cycle

Plants take in **nutrients** to build into new organic matter. Nutrients are taken up when animals eat plants and then returned to the soil when animals die and the body is broken down by **decomposers**.
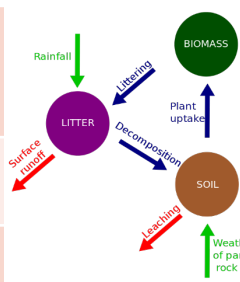
Litter	This is the **surface layer** of vegetation, which over time breaks down to become **humus**.
Biomass	The total **mass of living organisms** per unit area.

BIOMASS · LITTER · SOIL
Rainfall · Littering · Plant uptake · Decomposition · Surface runoff · Leaching · Weathering of parent rock

Biomes

A biome is a **large geographical area of distinctive plant and animal groups**, which are adapted to that particular environment. The climate and geography of a region determines what type of biome can exist in that region.
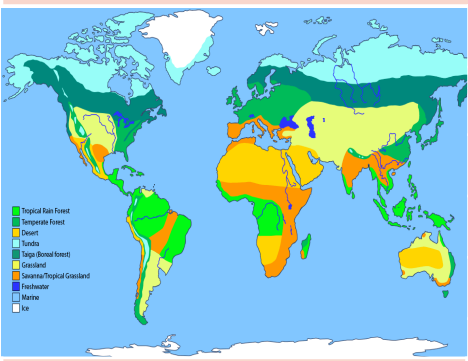
	Coniferous forest
	Deciduous forest
	Tropical rainforests
	Tundra
	Temperate grasslands
	Tropical grasslands
	Hot deserts

The **most productive biomes** – which have the greatest biomass- grow in climates that are **hot and wet.**

Biome's climate and plants

Biome	Location	Temperature	Rainfall	Flora	Fauna
Tropical rainforest	Centred along the Equator.	Hot all year (25-30°C)	Very high (over 200mm/year)	Tall trees forming a canopy; wide variety of species.	Greatest range of different animal species. Most live in canopy layer
Tropical grasslands	Between latitudes 5°- 30° north & south of Equator.	Warm all year (20-30°C)	Wet + dry season (500-1500mm/year)	Grasslands with widely spaced trees.	Large hoofed herbivores and carnivores dominate.
Hot desert	Found along the tropics of Cancer and Capricorn.	Hot by day (over 30°C) Cold by night	Very low (below 300mm/year)	Lack of plants and few species; adapted to drought.	Many animals are small and nocturnal: except for the camel.
Temperate forest	Between latitudes 40°-60° north of Equator.	Warm summers + mild winters (5-20°C)	Variable rainfall (500-1500m /year)	Mainly deciduous trees; a variety of species.	Animals adapt to colder and warmer climates. Some migrate.
Tundra	Far Latitudes of 65° north and south of Equator	Cold winter + cool summers (below 10°C)	Low rainfall (below 500mm/ year)	Small plants grow close to the ground and only in summer.	Low number of species. Most animals found along coast.
Coral Reefs	Found within 30° north – south of Equator in tropical waters.	Warm water all year round with temperatures of 18°C	Wet + dry seasons. Rainfall varies greatly due to location.	Small range of plant life which includes algae and sea grasses that shelters reef animals.	Dominated by polyps and a diverse range of fish species.

# Unit 1b
The Living World

AQA

Tropical Rainforest Biome

Tropical rainforest cover about **2 per cent** of the Earth's surface yet they are home to **over half of the world's plant and animals**.

Interdependence in the rainforest

A rainforest works through **interdependence**. This is where the plants and animals **depend on each other** for survival. If one component changes, there can be **serious knock-up effects** for the entire ecosystem.
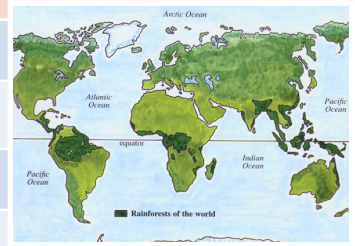
Distribution of Tropical Rainforests

Tropical rainforests are **centred along the Equator** between the Tropic of Cancer and Capricorn. Rainforests can be found in South America, central Africa and South-East Asia. **The Amazon** is the world's largest rainforest and takes up the majority of northern South America, encompassing countries such as Brazil and Peru.

Rainforest nutrient cycle

The **hot, damp conditions** on the forest floor allow for the **rapid decomposition** of dead plant material. This provides plentiful nutrients that are easily absorbed by plant roots. However, as these nutrients are in high demand from the many fast-growing plants, they do not remain in the soil for long and stay close to the surface. If vegetation is removed, the soils quickly become **infertile**.

Climate of Tropical Rainforests

- Evening temperatures rarely fall below **22°C.**
- Due to the **presence of clouds**, temperatures rarely rise above **32°C.**
- Most afternoons have heavy showers.
- At night with no clouds insulating, temperature drops.


2104mm of annual rainfall

CASE STUDY: UK Ecosystem: Epping Forest, Essex

This is a typical English lowland deciduous woodland. **70% of the area** is designated as a **Site of Special Scientific Interest (SSI)** for its biological interest, with **66 %** designated as a **Special Area of Conservation (SAC).**

Components & Interrelationships

		Management
Spring	**Flowering plants** (producers) such as bluebells store nutrients to be eaten by consumers later.	- Epping has been managed for centuries.
Summer	Broad tree leaves grow quickly to **maximise photosynthesis.**	- Currently now used for **recreation** and **conservation**.
Autumn	Trees shed leaves to **conserve energy** due to sunlight hours decreasing.	- Visitors **pick fruit** and berries, helping to **disperse seeds.**
Winter	Bacteria **decompose** the leaf litter, releasing the nutrients into the soil.	- Trees cut down to encourage **new growth for timber.**

Layers of the Rainforest
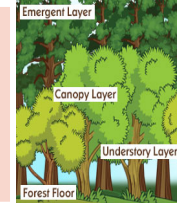
Emergent	Highest layer with trees reaching **50 metres.**
Canopy	Most life is found here as It receives **70% of the sunlight** and **80% of the life.**
U-Canopy	Consists of trees that reach **20 metres high.**
Shrub Layer	Lowest layer with **small trees** that have adapted to living in the **shade.**
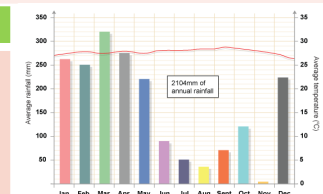
Tropical Rainforests: Amazon Rainforest

The Amazon rainforest is spread across many South American countries but is primarily located in Northern Brazil. Brazil is an NEE and almost 20% of the rainforest has been lost since 1970.

Adaptations to the rainforest

Dart Frog	Poison on skin to ward off predators.
Drip Tips	Allows heavy rain to **run off leaves easily**.
Lianas & Vines	**Climbs** trees to reach sunlight at canopy.

Rainforest inhabitants

Many tribes have developed sustainable ways of survival. The rainforest provides inhabitants with…
- **Food** through hunting and gathering.
- **Natural medicines** from forest plants.
- **Homes and boats** from forest wood.

Issues related to biodiversity

Why are there high rates of biodiversity?
- **Warm and wet climate** encourages a wide range of vegetation to grow.
- There is **rapid recycling of nutrients** to speed plant growth.
- Most of the rainforest is **untouched.**

Main issues with biodiversity decline
- **Keystone species** (a species that are important of other species) are extremely important in the rainforest ecosystem. Humans are threatening these vital components.
- **Decline in species** could cause tribes being unable to survive.
- **Plants** & **animals** may become **extinct.**
- Key medical **plants** may become **extinct.**

What are the causes of deforestation?

Logging
- Most widely reported cause of destructions to biodiversity.
- Timber is harvested to create **commercial items** such as furniture and paper.
- **Violent confrontation** between indigenous tribes and logging companies.

Agriculture
- Large scale **'slash and burn'** of land for cattle ranches and palm oil.
- Increases **carbon emission.**
- **River saltation** and **soil erosion** increasing due to the large areas of **exposed land.**
- Increase in **palm oil** is making the **soil infertile.**

Mineral Extraction
- **Precious metals** are found in the rainforest.
- Areas **mined** can experience **soil and water contamination**.
- **Indigenous people** are becoming **displaced** from their land due to roads being built to transport products.

Tourism
- **Mass tourism** is resulting in the building of hotels in extremely **vulnerable areas**.
- Lead to **negative relationship** between the government and indigenous tribes
- Tourism has **exposed animals** to human **diseases.**

Energy Development
- The **high rainfall** creates ideal conditions for **hydro-electric power (HEP).**
- The **Jirau Dam** in Brazil is key for creating energy in this developing country, however, both people and environment

Road Building
- **Roads** are needed to bring supplies and **provide access** to new mining areas, settlements and energy projects.
- In Brazil, logging companies use an **extensive network of roads** for heavy machinery and to

Impacts of deforestation

Economic development
+ Mining, farming and logging creates employment and tax income for government.
+ Products such as palm oil provide valuable income for countries.
- The loss of biodiversity will reduce tourism.

Soil erosion
- Once the land is **exposed by deforestation,** the soil is more **vulnerable to rain**.
- With **no roots to bind soil together**, soil can easily **wash away.**

Climate Change
- When rainforests are cut down, the climate becomes **drier.**
- Trees are **carbon 'sinks'**. With greater deforestation comes more greenhouse emissions in the atmosphere.
- When trees are burnt, they **release more carbon in the atmosphere**. This will enhance the **greenhouse effect.**

Sustainability for the Rainforest

Uncontrolled and unchecked exploitation can cause irreversible damage such as loss of biodiversity, soil erosion and climate change.

Possible strategies include:
- **Agro-forestry** - Growing trees and crops at the same time. It prevents soil erosion and the crops benefit from the nutrients.
- **Selective logging** - Trees are only felled when they reach a particular height.
- **Education** - Ensuring those people understand the consequences of deforestation
- **Afforestation** - If trees are cut down, they are replaced.
- **Forest reserves** - Areas protected from exploitation.
- **Ecotourism** - tourism that promotes the environments & conservation

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Hot Desert: Case Study Western Desert Region (USA)

The Western Desert region is a region of 3 hot deserts located in the South West of the USA. They are the Sonaran, Mojave and Chihuahuan.

Distribution of the world's hot deserts
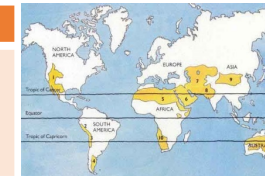
Most of the world's hot deserts are found in the **subtropics** between **20 degrees and 30 degrees north & south** of the Equator. The **Tropics of Cancer and Capricorn** run through most of the worlds major deserts.

Major characteristics of hot deserts
- **Aridity** – hot deserts are extremely dry, with annual rainfall below **250 mm**.
- **Heat** – hot deserts rise over **40 degrees**.
- **Landscapes** – Some places have dunes, but most are **rocky** with **thorny bushes.**

Hot Deserts inhabitants
- Whitewash walls to keep houses cool **from the Sun.**
- Air conditioning and piped water.
- Flat roofs for collecting water.

Climate of Hot Deserts
- **Very little rainfall** with less than **250 mm per year.**
- It might only **rain once every two to three years.**
- Temperate are **hot in the day** (45 °C) but are **cold at night** due to little cloud cover (5 °C).
- In winter, deserts can sometimes receive occasional frost and snow.

T = 25.9 °C P = 18 mm
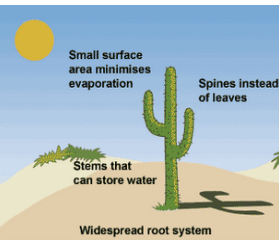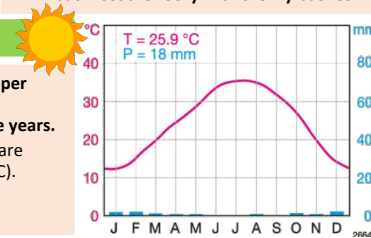
Adaptations to the desert

Cactus	• **Large roots** to absorb water soon after rainfall. • **Needles** instead of leaves to reduce surface area and therefore **transpiration.**
Camels	• Hump for storing **fat (NOT water).** • **Wide feet** for walking on sand. • **Long eyelashes** to protect from sand.

Small surface area minimises evaporation — Spines instead of leaves — Stems that can store water — Widespread root system

Desert Interdependence

Different parts of the hot desert ecosystem **are closely linked together and depend on each other,** especially in a such a harsh environment.

Opportunities and challenges in the Hot desert

Opportunities
- There are valuable minerals such as copper and uranium.
- HEP from the Hoover Dam.
- Great opportunities for renewable energy such as solar power. The Sonoran Solar Project will produce enough energy for 100,000 homes.
- The region is home to tourist areas such as the Grand Canyon and Las Vegas .

Challenges
- Populations are very spread out so sharing resources is difficult. Railroads were built to overcome this.
- High evaporation cause difficulties in agriculture.
- Water supplies are limited, creating problems for the increasing number of people moving into area.
- Access through the desert is tricky as roads are difficult to build and maintain.

Causes of Desertification

Desertification means the turning of semi-arid areas (or drylands) into deserts.

Climate Change
Reduce rainfall and rising temperatures have meant less water for plants.

Fuel Wood
People rely on wood for fuel. This removal of trees causes the soil to be exposed.

Overgrazing
Too many animals mean plants are eaten faster than they can grow back. Causing soil erosion.

Over-Cultivation
If crops are grown in the same areas too often, nutrients in the soil will be used up causing soil erosion.

Population Growth
A growing population puts pressure on the land leading to more deforestation, overgrazing and over-cultivation.

Strategies to reduce Desertification
- **Water management** - growing crops that don't need much water.
- **Tree Planting** - trees can act as windbreakers to protect the soil from wind and soil erosion.
- **Soil Management** - leaving areas of land to rest and recover lost nutrients.
- **Technology** – using less expensive, sustainable materials for people to maintain. i.e. sand fences, terraces to stabilise soil and solar cookers to reduce deforestation.

Unit 1c
Physical Landscapes in the UK

AQA

Relief of the UK

Relief of the UK can be divided into uplands and lowlands. Each have their own characteristics.

Key

Lowlands

Uplands

Areas +600m: Peaks and ridges cold, misty and snow common. i.e. Scotland

Areas -200m: Flat or rolling hills. Warmer weather. i.e. Fens

Types of Erosion

The break down and transport of rocks – smooth, round and sorted.

Attrition	Rocks that bash together to become smooth/smaller.
Solution	A chemical reaction that dissolves rocks.
Abrasion	Rocks hurled at the base of a cliff to break pieces apart.
Hydraulic Action	Water enters cracks in the cliff, air compresses, causing the crack to expand.

Types of Transportation

A natural process by which eroded material is carried/transported.

Solution	Minerals dissolve in water and are carried along.
Suspension	Sediment is carried along in the flow of the water.
Saltation	Pebbles that bounce along the sea/river bed.
Traction	Boulders that roll along a river/sea bed by the force of the flowing water.

Mass Movement

A large movement of soil and rock debris that moves down slopes in response to the pull of gravity in a vertical direction.

1	Rain saturates the permeable rock above the impermeable rock making it heavy.
2	Waves or a river will erode the base of the slope making it unstable.
3	Eventually the weight of the permeable rock above the impermeable rock weakens and collapses.
4	The debris at the base of the cliff is then removed and transported by waves or river.

Formation of Coastal Spits - Deposition

Example: Spurn Head, Holderness Coast.

1) Swash moves up the beach at the angle of the prevailing wind.
2) Backwash moves down the beach at 90° to coastline, due to gravity.
3) Zigzag movement (Longshore Drift) transports material along beach.
4) Deposition causes beach to extend, until reaching a river estuary.
5) Change in prevailing wind direction forms a hook.
6) Sheltered area behind spit encourages deposition, salt marsh forms.

Types of Weathering

Weathering is the breakdown of rocks where they are.

Carbonation	Breakdown of rock by changing its chemical composition.
Mechanical	Breakdown of rock without changing its chemical composition.

What is Deposition?

When the sea or river loses energy, it drops the sand, rock particles and pebbles it has been carrying. This is called deposition.

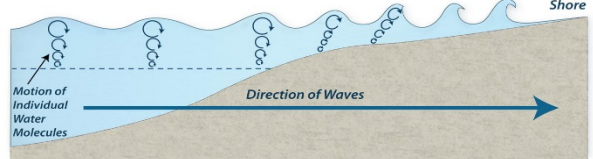## Formation of Bays and Headlands

Bay Soft rock
Hard rock
Headland

1) Waves attack the coastline.
2) Softer rock is eroded by the sea quicker forming a bay, calm area cases deposition.
3) More resistant rock is left jutting out into the sea. This is a headland and is now more vulnerable to erosion.

Formation of Coastal Stack

Example: Old Harry Rocks, Dorset

1) Hydraulic action widens cracks in the cliff face over time.
2) Abrasion forms a wave cut notch between HT and LT.
3) Further abrasion widens the wave cut notch to from a cave.
4) Caves from both sides of the headland break through to form an arch.
5) Weather above/erosion below –arch collapses leaving stack.
6) Further weathering and erosion eaves a stump.

How do waves form?

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.

Why do waves break?

1	Waves start out at sea.
2	As waves approaches the shore, friction slows the base.
3	This causes the orbit to become elliptical.
4	Until the top of the wave breaks over.

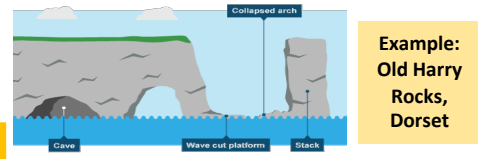## Mechanical Weathering Example: Freeze-thaw weathering

Stage One
Water seeps into cracks and fractures in the rock.

Stage Two
When the water freezes, it expands about 9%. This wedges apart the rock.

Stage Three
With repeated freeze-thaw cycles, the rock breaks off.

Size of waves

- Fetch how far the wave has travelled
- Strength of the wind.
- How long the wind has been blowing for.

Types of Waves

Constructive Waves
This wave has a **swash that is stronger** than the backwash. This therefore builds up the coast.

Destructive Waves
This wave has a **backwash that is stronger** than the swash. This therefore erodes the coast.

Coastal Defences

Hard Engineering Defences

Groynes	Wood barriers prevent longshore drift, so the beach can build up.	✓ Beach still accessible. ✗ No deposition further down coast = erodes faster.
Sea Walls	Concrete walls break up the energy of the wave. Has a lip to stop waves going over.	✓ Long life span ✓ Protects from flooding ✗ Curved shape encourages erosion of beach deposits.
Gabions or Rip Rap	Cages of rocks/boulders absorb the waves energy, protecting the cliff behind.	✓ Cheap ✓ Local material can be used to look less strange. ✗ Will need replacing.

Soft Engineering Defences

Beach Nourishment	Beaches built up with sand, so waves have to travel further before eroding cliffs.	✓ Cheap ✓ Beach for tourists. ✗ Storms = need replacing. ✗ Offshore dredging damages seabed.
Managed Retreat	Low value areas of the coast are left to flood & erode.	✓ Reduce flood risk ✓ Creates wildlife habitats. ✗ Compensation for land.

Case Study: Holderness Coast

Location and Background
County of East Riding of Yorkshire, North East England. North Sea.
Major settlements (north to south) Bridlington, Hornsea, Mappleton and Withernsea.

Geomorphic Processes
1 of Europe's fastest eroding coastlines. Weak bedrock made of Boulder Clay makes it easy to erode.
Strong prevailing winds from the North Sea.

Management
Mappleton had 2 groynes and revetments built. This caused a build up of sand, reducing the erosion of the cliffs.
Despite this success, further south there were increasing rates of erosion as sediment was not being transported to form the beach further south.

Water Cycle Key Terms

Precipitation	Moisture falling from clouds as rain, snow or hail.
Interception	Vegetation prevent water reaching the ground.
Surface Runoff	Water flowing over surface of the land into rivers
Infiltration	Water absorbed into the soil from the ground.
Transpiration	Water lost through leaves of plants.

Physical and Human Causes of Flooding.

Physical: Prolong & heavy rainfall Long periods of rain causes soil to become saturated leading runoff.

Physical: Geology Impermeable rocks causes surface runoff to increase river discharge.

Physical: Relief Steep-sided valleys channels water to flow quickly into rivers causing greater discharge.

Human: Land Use Tarmac and concrete are impermeable. This prevents infiltration & causes surface runoff.

Upper Course of a River

Near the source, the river flows over steep gradient from the hill/mountains. This gives the river a lot of energy, so it will erode the riverbed vertically to form narrow valleys.

Formation of a Waterfall

1) River flows over alternative types of rocks.

2) River erodes soft rock faster creating a step.

3) Further hydraulic action and abrasion form a plunge pool beneath.

4) Hard rock above is undercut leaving cap rock which collapses providing more material for erosion.

5) Waterfall retreats leaving steep sided gorge.

Middle Course of a River

Here the gradient get gentler, so the water has less energy and moves more slowly. The river will begin to erode laterally making the river wider.

Formation of Ox-bow Lakes

Step 1	Step 2
Erosion of outer bank forms river cliff. Deposition inner bank forms slip off slope.	Further hydraulic action and abrasion of outer banks, neck gets smaller.

Step 3	Step 4
Erosion breaks through neck, so river takes the fastest route, redirecting flow	Evaporation and deposition cuts off main channel leaving an oxbow lake.

Lower Course of a River

Near the river's mouth, the river widens further and becomes flatter. Material transported is deposited.

Formation of Floodplains and levees

When a river floods, fine silt/alluvium is deposited on the valley floor. Closer to the river's banks, the heavier materials build up to form natural levees.

✓ Nutrient rich soil makes it ideal for farming.
✓ Flat land for building houses.

River Management Schemes

Soft Engineering	Hard Engineering
Afforestation – plant trees to soak up rainwater, reduces flood risk. **Demountable Flood Barriers** put in place when warning raised. **Managed Flooding** – naturally let areas flood, protect settlements.	**Straightening Channel** – increases velocity to remove flood water. **Artificial Levees** – heightens river so flood water is contained. **Deepening or widening river** to increase capacity for a flood.

Hydrographs and River Discharge

River discharge is the volume of water that flows in a river. Hydrographs who discharge at a certain point in a river changes over time in relation to rainfall

1. **Peak discharge** is the discharge in a period of time.

2. **Lag time** is the delay between peak rainfall and peak discharge.

3. **Rising limb** is the increase in river discharge.

4. **Falling limb** is the decrease in river discharge to normal level.

Case Study: The River Tees

Location and Background
Located in the North of England and flows 137km from the Pennines to the North Sea at Red Car.

Geomorphic Processes
Upper – Features include V-Shaped valley, rapids and waterfalls. Highforce Waterfall drops 21m and is made from harder Whinstone and softer limestone rocks. Gradually a gorge has been formed.
Middle – Features include meanders and ox-bow lakes. The meander near Yarm encloses the town.
Lower – Greater lateral erosion creates features such as floodplains & levees. Mudflats at the river's estuary.

Management
-Towns such as Yarm and Middleborough are economically and socially important due to houses and jobs that are located there.
-Dams and reservoirs in the upper course, controls river's flow during high & low rainfall.
- Better flood warning systems, more flood zoning and river dredging reduces flooding.

KI : Urban change in cities in the UK leads to a variety of social, economic and environmental opportunities and challenges

	Overview of the UK population and major cities in the UK
Population	260 per km² on average 5000 per km² in London and less than 10 per km² in North of Scotland Most in low lying flat areas especially by coasts and rivers
Cities	Fastest growing are in south east. London the fastest growing Sunderland is the only city with a decreasing population

Case study : London	Urban change in cities in the UK leads to a variety of social, economic and environmental challenges and opportunities
Location and importance of city in UK and wider world	• South East England on either side of the River Thames • Capital city – centre of trade, manufacturing and finance • Hub for transport networks • Wealthy city • House prices and earnings increasing • Headquarters of TNCs • Universities, research, tourism, culture, media, communications
Impacts of national and international migration on the growth and character of the city	• 8.6 million in 2015 • Increased during industrial revolution, decreased after WWII, increased since 1991 • Young population in 20s and 30s moving for work. Also pushing up the rate of natural increase • Migrants from worldwide • Multicultural – current influx from Eastern Europe • White British 46%, White other 15%, South Asian 18%, Black 13%, Mixed 5% and other 3%

Key terms	Definition
Brownfield site	Land that has been used, abandoned and now awaits some new use
Dereliction	Abandoned buildings and wasteland
Greenfield site	A plot of land that has not yet been subject to any building development
Inequalities	Differences between poverty and wealth as well as in peoples' wellbeing and access to services
Integrated transport systems	When different transport systems connect together making journeys smoother and public transport more appealing
Rural urban fringe	Zone of transition between the built up area and the countryside
Social deprivation	The degree to which an individual or an area is deprived of services, decent housing, adequate income and local employment
Urban greening	The process of increasing and preserving open space such as public parks and gardens
Urban regeneration	The revival of old parts of the built up area by renewal or redevelopment
Urban sprawl	Unplanned growth of urban areas into the surrounding countryside

Case Study : Shoreditch, London	How urban change creates opportunities
Cultural Mix (Social)	• Older residents and Bangladeshis moving out • Young professionals moving in • Gentrification occurring
Recreation and Entertainment (Social)	• Nightclubs set up • Fashionable shops • Pubs and bars
Employment (Economic)	• Finance and creative industries • High tech companies in area called Silicon Roundabout • Increase in jobs in London in general
Integrated transport systems (Social and economic)	• Increasing number of passengers • 2014 – 75 million on underground and buses • Cross Rail East West route opening 2018 • Cross Rail 2 opening in 2030 with a north south route
Urban greening (Environmental)	• London has 47% greenspace • Central London parks, woodlands, cemeteries and gardens • Produce oxygen, decrease flooding, more habitats, healthy recreation and can grow food • Trying to connect green areas with a green grid

Case Study : London	How urban change has created challenges
Urban deprivation	• 2 million living in poverty

Inequalities in housing, education, health and employment		Kensington and Chelsea	Newham
	Life expectancy	M – 83.7 years F – 87.8 years	M – 75.7 years F – 79.8 years
	Unemployment	3.9%	9.4%
	5 GCSEs	80%	62%
	Earn less than £15000 a year	9%	26%
	Earn more than £60,000 a year	26%	7%

Environmental derelicton	• Air pollution causes 4000 deaths a year • Trying to cycle superhighways (currently 15% cycling)
Building on brownfield / greenfield sites	• 20,000 new homes (London's population increasing by 100,000 a year). Severe housing shortages • Brownfield sites – old industry needs demolishing, less urban sprawl, public transport there, land expensive, can improve environment • Greenfield sites – poor public transport, increases urban sprawl, loss of countryside, loss of habitats
Waste disposal	• 25% to landfill causing methane. Target is 0% by 2030
Impact of urban sprawl on rural urban fringe and growth of commuter villages	• Greenbelt land designated in 1947 at risk of development • Now urban sprawl has shifted to commuter settlements outside the greenbelt • New housing estates and business parks encroach into surrounding countryside

Case Study : London Docklands	An example of a regeneration scheme
Reasons why the area needed regeneration	• 1970s – docks went into decline as too small for larger ships • 1980s – lay empty. Industry gone and traditional jobs lost • Most housing substandard • Declining environment
Main features of the project	• 1981 – London Dockland Development Corporation set up. • Aimed to improve social, economic and environmental conditions in the area • Idea was a mix of government and private funding • Canary wharf area developed • Office blocks – international banks led to 100,000 jobs • Transport links include Dockland light railway, City of London Airport • Shopping malls and International Indoor Water Centre as well as a campus for the University of East London • 22, 000 new homes and 10,000 refurbished • Increase in green space to 130 hectares – 200,000 trees planted

KI : Urban sustainability requires management of resources and transport

Key term	Definitions
Sustainable urban living	Includes the use of renewable resources, energy efficiency, public transport, accessible resources and services
Waste recycling	Process of extracting and reusing useful substances found in waste

Case Study : Curitiba, Brazil	Features of sustainable urban living
Water and energy conservation	• Energy efficient lightbulbs in streetlights • Promote renewable energy by public awareness Energy by products produce electricity • Biodiesel buses • 84% of energy from HEP • Water metres installed • Separate pipes for drinking water and rainwater collection
Waste recycling	• Green exchange - swop waste for food or bus tickets • Recycling centre built from recycled materials • Converted buses used for services and education • Mobile market sells blemished foods • 420,000 tonnes waste split into organic and inorganic • If own old building and can't restore it can trade it with the city
Creating green spaces	• Development of 28 parks – 21 million m² • Cycle paths • 1.5 million trees planted reducing risk of flooding

How urban transport strategies are used to reduce traffic congestion
• Curitiba – Integrated bi-articulate buses. 5 main routes. Interlink.20,000 passengers an hour. 1 a minute. 1.5 million passengers a year. Also 2 airports. 62 miles cycle lanes • Freiburg – 400km cycle paths, 9000 bike parking spaces, 30km tram network connected to 168km bus routes • Singapore – restrict entry to city, electronic pricing system, high petrol prices, quota for new cars, car sharing schemes, overhead railway, efficient bus network, electronic control f traffic systems

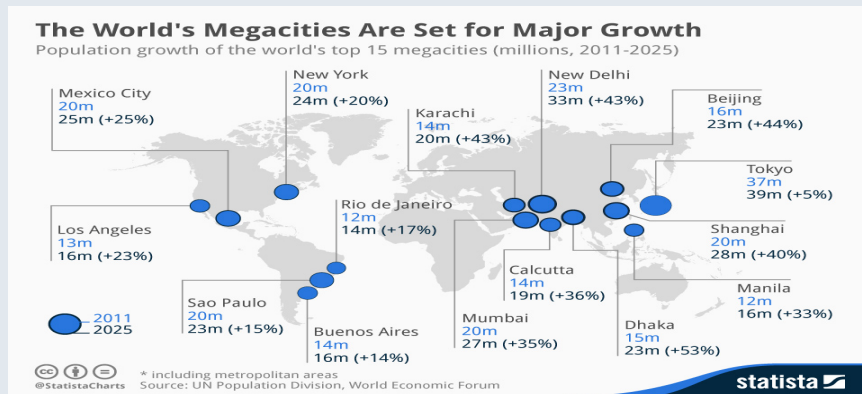## KI : A growing percentage of the world's population lives in urban areas

Key terms	Definitions
Mega cities	Urban area with population in excess of 10 million people
Migration	When people move from one area to another
Natural increase	Birth rate minus death rate
Urbanisation	The process by which an increasing percentage of the country's population comes to live in towns and cities

Global pattern of urban change	• More than 50% of world's population live in urban areas • By 2030 it is expected to be more than 60% • By 2050 expected to be more than 70% • In 1950 there were 4 megacities • Now there are more than 20
Urban trends worldwide	• Highest rate of urbanisation in LICs due to rural to urban migration and high rates of natural increase (birth rate much higher than death rate) • Lower rates in HICs as already urbanised and have aging population • Some NEEs in South America following HICs pattern • Largest increase in India, China and Nigeria – by 2050 urban areas will have grown by 37%
Emergence of megacities	• Asia – huge population. Massive rural to urban migration. Rates fluctuate • China – Pearl River Delta – 120 million people as merging Hong Kong, Shenzhen and Guangzhou • Most megacities will be in China and India

The World's Megacities Are Set for Major Growth
Population growth of the world's top 15 megacities (millions, 2011-2025)

Mexico City 20m 25m (+25%)
New York 20m 24m (+20%)
New Delhi 23m 33m (+43%)
Beijing 16m 23m (+44%)
Karachi 14m 20m (+43%)
Los Angeles 13m 16m (+23%)
Tokyo 37m 39m (+5%)
Rio de Janeiro 12m 14m (+17%)
Shanghai 20m 28m (+40%)
Calcutta 14m 19m (+36%)
Manila 12m 16m (+33%)
Sao Paulo 20m 23m (+15%)
Buenos Aires 14m 16m (+14%)
Mumbai 20m 27m (+35%)
Dhaka 15m 23m (+53%)

2011
2025

@StatistaCharts * including metropolitan areas
Source: UN Population Division, World Economic Forum   statista

KI : Urban growth creates opportunities and challenges for cities in LICs and NEEs

Key terms	Definitions
Economic opportunities	Chances for people to improve their standard of living through employment
Pollution	Presence of chemicals, noise, dirt etc which have harmful or poisonous effects on an environment
Sanitation	Measures designed to protect public health e.g. clean water
Social opportunities	Chances for people to improve their quality of life
Squatter settlement	An area of poor quality housing lacking in amenities which develops spontaneously and illegally
Traffic congestion	Occurs when there is too great a quantity of traffic for roads to cope with

Urban Change in a Major NEE City: RIO DE JANEIRO Case Study

Location and Background

Rio is a coastal city situated in the South East region of Brazil within the continent of South America. It is the second most populated city in the country (6.5 million) after Sao Paulo.

City's Importance

• Has the second largest GDP in Brazil It i headquarters to many of Brazil's main companies, particularly with Oil and Ga
• Sugar Loaf mountain is one of the seven wonders of the world.
• One of the most visited places in the Southern Hemisphere.
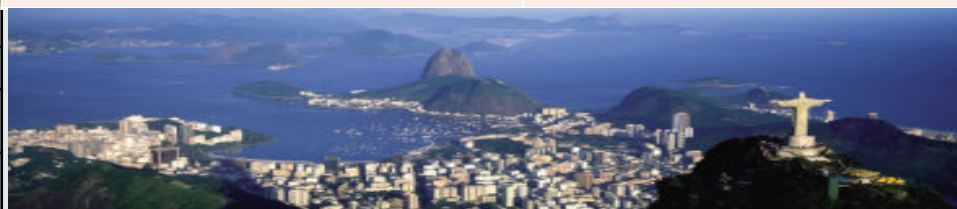• Hosted the 2014 World Cup and 2016 Summer Olympics.

Migration to Rio De Janeiro

The city began when Portuguese settlers with slaves arrived in 1502. Since then, Rio has become home to various ethnic groups.

However, more recently, millions of people have migrated from rural areas that have suffered from drought, lack of services and unemployment to Rio. People do this to search for a better quality of life.

This expanding population has resulted in the rapid urbanisation of Rio de Janeiro.

City's Opportunities

Social: Standards of living are gradually improving. The Rio Carnival is an important cultural event for traditional dancing and r

Economic: Rio has one of the highest incom per person in the country. The city has vari types of employment including oil, retail ar manufacturing.

Environmental: The hosting of the major sporting events encouraged more investme sewage works and public transport system

City Challenges

Social: There is a severe shortage of housing, schools and healthcare centres available. Large scale social inequality, is creating tensions between the rich and poor.

Economic: The rise of informal jobs with low pay and no tax contributions. There is high employment in shanty towns called Favelas

Environmental: Shanty towns called Favelas are established around the city, typically on unfavourable land, such as hills.

Self-help schemes - Rocinha, Bairro Proj

• The authorities have provided basic materials to improve peoples homes w safe electricity and sewage pipes.
• Government has demolished houses ar created new estates.
• Community policing has been establish along with a tougher stance on gangs w military backed police.
• Greater investment in new road and ra network to reduce pollution and increa connections between rich and poor are

What is development?

Development is an improvement in living standards through better use of resources.

Economic	This is progress in economic growth through levels of industrialisation and use of technology.
Social	This is an improvement in people's standard of living. For example, clean water and electricity.
Environmental	This involves advances in the management and protection of the environment.

Measuring development

These are used to compare and understand a country's level of development.

Economic indictors examples

Employment type	The proportion of the population working in primary, secondary, tertiary and quaternary industries.
Gross Domestic Product per capita	This is the total value of goods and services produced in a country per person, per year.
Gross National Income per capita	An average of gross national income per person, per year in US dollars.

### Social indicators examples

Infant mortality	The number of children who die before reaching 1 per 1000 babies born.
Literacy rate	The percentage of population over the age of 15 who can read and write.
Life expectancy	The average lifespan of someone born in that country.

Mixed indicators

Human Development Index (HDI)	A number that uses life expectancy, education level and income per person.

Variations in the level of development

LICs	Poorest countries in the world. GNI per capita is low and most citizens have a low standard of living.
NEEs	These countries are getting richer as their economy is progressing from the primary industry to the secondary industry. Greater exports leads to better wages.
HICs	These countries are wealthy with a high GNI per capita and standards of living. These countries can spend money on services.

Key
- Advanced countries
- Emerging developing countries
- Low-income developing countries
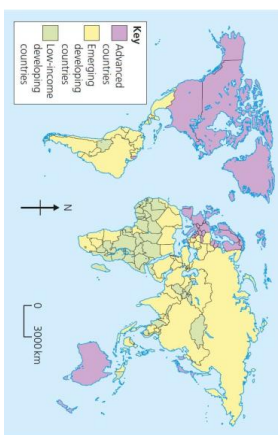
Causes of uneven development

Development is globally uneven with most HICs located in Europe, North America and Oceania. Most NEEs are in Asia and South America, whilst most LICs are in Africa. Remember, development can also vary within countries too.

Unit 2b
The Changing Economic World

AQA

Physical factors affecting uneven development

Natural Resources
- **Fuel sources** such as oil.
- Minerals and metals for fuel.
- **Availability for timber**.
- Access to **safe water**.

Natural Hazards
- Risk of tectonic hazards.
- Benefits from **volcanic material** and **floodwater.**
- Frequent hazards **undermines redevelopment**.

Climate
- **Reliability** of rainfall to benefit farming.
- **Extreme climates** limit industry and affects health.
- Climate can **attract tourists.**

Location/Terrain
- **Landlocked countries** may find trade difficulties.
- Mountainous terrain makes farming difficult.
- **Scenery attracts tourists**.

Human factors affecting uneven development

Aid
- Aid can help some countries develop **key projects** for infrastructure faster.
- **Aid** can improve services such as schools, hospitals and roads.
- Too much **reliance on aid** might stop other trade links becoming established.

Trade
- Countries that export more than they import have a **trade surplus**. This can improve the national economy.
- Having **good trade relationships**.
- **Trading goods** and services is more profitable than raw materials.

Education
- Education creates a **skilled workforce** meaning more goods and services are produced.
- **Educated people earn more money**, meaning they also pay more taxes. This money can help develop the country in the future.

Health
- **Lack of clean water** and poor healthcare means a large number of people suffer from **diseases**.
- People who are ill cannot work so there is little contribution to the economy.
- More money on healthcare means less spent on development.

Politics
- **Corruption** in local and national governments.
- The **stability of the government** can effect the country's ability to trade.
- Ability of the country to **invest into services and infrastructure**.

History
- **Colonialism** has helped Europe develop, but slowed down development in many other countries.
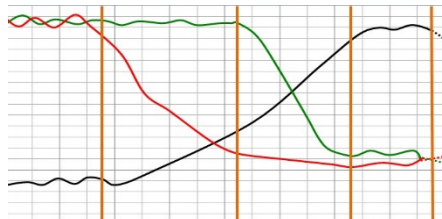- Countries that went through industrialisation a while ago, have now develop further.

Consequences of Uneven Development

Levels of development are different in different countries. This uneven development has consequences for countries, especially in wealth, health and migration.

Wealth	People in more developed countries have higher incomes than less developed countries.
Health	Better healthcare means that people in more developed countries live longer than those in less developed countries.
Migration	If nearby countries have higher levels of development or are secure, people will move to seek better opportunities and standard of living.

The Demographic Transition Model

The demographic transition model (DTM) shows population change over time. It studies how birth rate and death rate affect the total population of a country.

	STAGE 1	STAGE 2	STAGE 3	STAGE 4	STAGE 5
	High DR *High BR* *Steady*	*BR Low Declining DR* *Very High*	*Rapidly falling DR* *Low BR* *High*	*Low DR* *Low BR* *Zero*	*Slowly Falling DR* *Low BR* *Negative*
	e.g. Tribes	e.g. Kenya	e.g. India	e.g. UK	e.g. Japan

Reducing the Global Development Gap

Microfinance Loans

This involves people in LICs receiving smalls loans from traditional banks.

+ Loans enable people to begin their own businesses

- Its not clear they can reduce poverty at a large scale.

Foreign-direct investment

This is when one country buys property or infrastructure in another country.

+ Leads to better access to finance, technology & expertise.

- Investment can come with strings attached that country's will need to comply with.

Aid

This is given by one country to another as money or resources.

+ Improve literacy rates, building dams, improving agriculture.

- Can be wasted by corrupt governments or they can become too reliant on aid.

Debt Relief

This is when a country's debt is cancelled or interest rates are lowered.

+ Means more money can be spent on development.

- Locals might not always get a say. Some aid can be tied under condition from donor country.

Fair trade

This is a movement where farmers get a fair price for the goods produced.

+ Paid fairly so they can develop schools & health centres.

-Only a tiny proportion of the extra money reaches producers.

Technology

Includes tools, machines and affordable equipment that improve quality of life.

+ Renewable energy is less expensive and polluting.

- Requires initial investment and skills in operating technology

CS: Reducing the Development Gap In Jamaica

Location and Background

Jamaica is a LIC island nation part of the Caribbean. Location makes Jamaica an attractive place for visitors to explore the tropical blue seas, skies and palm filled sandy beaches

Tourist economy

-In 2015, **2.12 million** visited.
-Tourism **contributes 27% of GDP** and will increase to **38% by 2025**.
-**130,000 jobs** rely on tourism.
-**Global recession** 2008 caused a **decline in tourism**. Now tourism is beginning to recover.

Multiplier effect

-**Jobs from tourism** have meant **more money** has been spent in shops and other businesses.
-Government has invested in **infrastructure** to support tourism.
-**New sewage treatment** plants have reduced pollution.

Development Problems

- Tourists do not always **spend much money** outside their resorts.
- Infrastructure improvements **have not spread** to the whole island.
- Many people in Jamaica still live in **poor quality housing** and **lack basic services** such as healthcare.

Case Study: Economic Development in Nigeria

Location & Importance

Nigeria is a NEE in West Africa.
Nigeria is just north of the Equator and experiences a range of environments.
Nigeria is the most populous and economically powerful country in Africa. Economic growth has been base on oil exports.

Influences upon Nigeria's development

Political

Suffered **instability** with a **civil war** between 1967-1970.
From 1999, the country became **stable** with **free and fair elections**.
Stability has **encouraged global investment** from China and USA.

Social

Nigeria is a **multi-cultural, multi-faith society**.
Although mostly a strength, diversity has caused **regional conflicts** from groups such as the Boko Haram terrorists.

Cultural

Nigeria's **diversity** has created rich and varied **artistic culture**.
The country has **a rich music, literacy and film industry** (i.e. Nollywood).
A successful national football side.

Industrial Structures

Once mainly based on agriculture, **50% of its economy is now manufacturing and services**.
A thriving manufacturing industry is **increasing foreign investment and employment opportunities**.

The role of TNCs

TNCs such as **Shell** have played an important role in its economy.
+ Investment has **increased employment and income**.
- **Profits move to HICs**.
- Many **oil spills** have **damaged fragile environments**.

Changing Relationships

Nigeria plays a leading role with the **African Union** and **UN**.
Growing links with **China** with huge **investment in infrastructure**.
Main import includes petrol from the EU, cars from Brazil and phones from China.

Environmental Impacts

The 2008/09 **oil spills devastated swamps** and its **ecosystems.**
Industry has caused **toxic chemicals** to be discharged in open sewers - r**isking human health**.
80% of forest have been **cut down**. This also increases CO^2 emissions.

Aid & Debt relief

+ Receives **$5billion** per year in aid.
+ **Aid groups** (ActionAid) have improved health centres, provided anti-mosquito nets and helped to protect people against AIDS/HIV.
- Some aid fails to reach the people who need it due to **corruption**.

Effects of Economic Development

Life expectancy has increased from 46 to 53 years. 64% have access to safe water. Typical schooling years has increased from 7 to 9.

Case Study: Economic Change in the UK

UK in the Wider World

The UK has one of the largest economies in the world.
The UK has huge political, economic and cultural influences.
The UK is highly regarded for its fairness and tolerance.
The UK has global transport links i.e. Heathrow and the Eurostar.

Causes of Economic Change

De-industrialisation and the **decline** of the UK's industrial base.
Globalisation has meant many industries have moved overseas, where labour costs are lower.
Government investing in supporting vital businesses.

Towards Post-Industrial

The **quaternary industry** has **increased**, whilst **secondary** has **decreased**.
Numbers in **primary** and **tertiary industry** has **stayed the steady**.
Big increase in **professional** and **technical jobs**.

Cambridge Science Park

A major **quaternary industry** on the outskirts.
Good transport access to the **A14** and **M11**.
A good **location for sourcing highly educated workers** from **Cambridge University**.
Staff benefit from **attractive working conditions**.
Attracts **clusters** of related **high-tech businesses**.

Change to a Rural Landscape - South Cambridgeshire

Cambridge is one of the fastest growing cities in the UK. Current population is 155,000 but will increase to 175,000 by 2026.

Social

Rising house prices have caused tensions in villages.
Villages are **unpopulated** during the day causing **loss of identity**.
Resentment towards **poor migrant communities**.

Economic

Lack of affordable housing for local first time buyers.
Sales of farmland **has increased rural unemployment**.
Influx of poor migrants puts **pressures** on local services.

Improvements to Transport

A **£15 billion 'Road Improvement Strategy'**. This will involve 10 new roads and 1,600 extra lanes**.**
£50 billion HS2 railway to improve connections between key UK cities.
£18 billion on Heathrow's controversial **third runway**.
UK has many **large ports** for importing and exporting goods.

UK North/South Divide

- Wages are **lower** in the North.
- Health is **better** in the South.
- Education is **worse** in the North.
+ The government is aiming to support a **Northern Powerhouse** project to resolve regional differences.
+ More **devolving of powers** to disadvantaged regions.

Resource Challenges

Resources are things that humans require for life or to make our lives easier. Humans are becoming increasingly dependent on exploiting these resources, and as a result they are in high demand.

Significance of Water

Resources such as food, energy and water are what is needed for basic human development.

FOOD	WATER	ENERGY
Without enough nutritious food, people can become **malnourished**. This can make them ill . This can prevent people working or receiving education.	People need a supply of **clean and safe water** for drinking, cooking and washing. Water is also needed for food, clothes and other products.	A good supply of energy is needed for a basic standard of living. People need **light and heat** for cooking or to stay warm. It is also needed for industry.

Demand outstripping supply

The demand for resources like food, water and energy is rising so quickly that supply cannot always keep up. Importantly, access to these resources vary dramatically in different locations

1. Population Growth
- Currently the global population **is 7.3 billion**.
- Global population has risen **exponentially** this century.
- Global population is expected to reach **9 billion by 2050**.
- With more people, the **demand** for food, water, energy, jobs and space **will increase**.

2. Economic Development
- As **LIDs** and **NEEs** develop further, they require **more energy** for industry.
- **LIDs** and **NEEs** want similar lifestyles to **HICs**, therefore they will need to **consume more resources**.
- Development means **more water is required** for food production as diets improve.

Resource Reliance Graph

Consumption – The act of using up resources or purchasing goods and produce.
Carry Capacity – A maximum number of species that can be supported.

Resource consumption exceeds Earth's ability to provide!

Earth's carrying capacity

Population

Resource consumption

Time

3. Changing Technology and Employment
- The demand for resources has driven **the need for new technology** to reach or gain more resources.
- More people in the **secondary and tertiary industry** has increased the **demand for resources** required for electronics and robotics.

Food in the UK

Growing Demand
- The UK imports about 40% of its food. This increases people's **carbon footprint**.
- There is growing demand for greater choice of **exotic foods** needed all year round.
- Foods from abroad are more affordable.
- Many food types are unsuitable to be grown in the UK.

Impact of Demand
Foods can travel long distances (food miles). Importing food adds to our carbon footprint.
+ Supports workers with an income
+ Supports families in LICs.
+ Taxes from farmers' incomes contribute to local services.
- Less land for locals to grow their own food.
- Farmers exposed to chemicals.

Agribusiness
Farming is being treated like a large industrial business. This is increasing food production.
+ Intensive faming maximises the amount of food produced.
+ Using machinery which increases the farms efficiency.
- Only employs a small number of workers.
- Chemicals used on farms damages the habitats and wildlife.

Sustainable Foods
Organic foods that have little impact on the environment and are healthier have been rising.
Local food sourcing is also rising in popularity.
- **Reduces emissions** by only eating food from the UK.
- **Buying locally sourced** food supports local shops and farms.
- A third of people **grow their own food**.

Unit 2c

# The Challenge of Resource Management

Energy in the UK

Growing Demand
The UK **consumes less energy** than compared to the 1970s despite a smaller population. This is due to the **decline of industry**.

Energy Mix
The majority of UK's energy mix comes from **fossil fuels**. By 2020, the UK aims for 15% of its energy to come from **renewable sources**. These renewable sources do not contribute to **climate change**.

Changes in Energy Mix
- 75% of the UK's oil and gas has been used up.
- Coal consumption has declined.
- UK has become too dependent on imported energy.

2009 **2020**

Oil	Gas	Renewable
Nuclear	Coal	Other
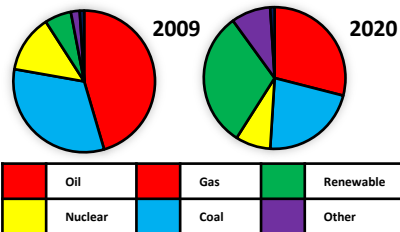
Water in the UK

Growing Demand
The average water used per household has risen by 70%. This growing demand is predicted to increase by 5% by 2020.
This is due to:
- A growing UK population.
- Water-intensive appliances.
- Showers and baths taken.
- Industrial and leisure use.
- Watering greenhouses.

Deficit and Surplus
The north and west have a **water surplus** (more water than is required).
The south and east have a **water deficit** (more water needed than is actually available).
More than half of England is experiencing **water stress** (where demand exceeds supply).

Pollution and Quality
Cause and effects include:
- Chemical run-off from farmland can destroy habitats and kills animals.
- Oil from boats and ships poisons wildlife.
- Untreated waste from industries creates unsafe drinking water.
- Sewage containing bacteria spreads infectious diseases.

Water stress in the UK

Average rainfall increase 2008 figures

- Normal range
- Above average
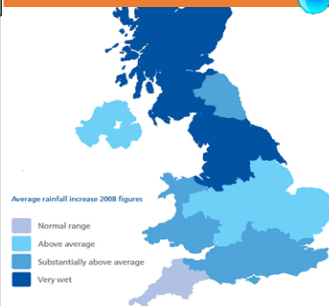- Substantially above average
- Very wet

Management
UK has **strict laws** that limits the amount of discharge from factories and farms.
Education campaigns to inform what can be disposed of safety.
Waste water treatment plants remove dangerous elements to then be used for safe drinking. Pollution traps catch and filter pollutants.

Water Transfer
Water transfer involves moving water through pipes from areas of surplus (Wales) to areas of deficit (London).
Opposition includes:
- Effects on **land and wildlife**.
- High maintenance **costs**.
- The **amount of energy** required to move water over long distances.

Energy in the UK (continued)

Significance of Renewables
+ The UK government is investing more into low carbon alternatives.
+ UK government aims to meet targets for reducing emissions.
+ Renewable sources include wind, solar and tidal energy.
- Although infinite, renewables are still expensive to install.
- Shale gas deposits may be exploited in the near future

Exploitation

Nuclear
New plants provide job opportunities.
Problems with safety and possible harm to wildlife.
Nuclear plants are expensive.

Wind Farm
Locals have low energy bills.
Reduces carbon footprint.
Construction cost is high.
Visual impacts on landscape.
Noise from wind turbines.

Option 2: WATER

Water security is when people have good access to enough clean water to sustain well-being and good health. Water insecurity is when areas are without sufficient water supplies. Water Stress is when less than 1700m³ is available per person.

Human

- **Pollution caused** from human and industrial waste being dumped into peoples water sources.
- **Poverty prevents** low income families affording water.
- **Limited infrastructure** such as a lack of water pipes and sewers.
- **Over-abstraction** is when more water is taken than is replaced.

Physical

- **Climate** needs to provide enough rainfall to feed lakes and rivers. Droughts affect supply if water.
- **Geology** can affect accessibility to water. Permeable rock means sourcing water from difficult aquifers, whereas impermeable allows water to run-off into easily collected basins.

Impact of Water Insecurity

Food production	Industrial output
The less water available for irrigating crops the less food that will be produced. This could lead to starvation.	Manufacturing industries depend heavily on water. A severe lack of water can impact economic output.

Disease and Water Pollution	Water conflict
Inadequate sanitation systems pollutes drinking water causing diseases such as cholera and typhoid.	Water sources that cross national borders can create tensions and even war between countries.

Increasing Water Supply

Water diversion - Involves diverting water to be stored for longer periods. Often water is pumped underground to prevent evaporation.
Dams and Reservoirs - Dams control flow and storage of water. Water is released during times of water deficit.
Water transfer – includes schemes to move water from areas of surplus to areas of deficit.
Desalination – Involves the extraction of salt from sea water to produce fresh drinking water.

C.S. China South-North Water project

Transfer scheme of water from south to the north (Beijing). Cost of $62bn.

Advantages
-Provides reliable water supply to deficient North
-Water used in irrigation and industry

Disadvantages
-Displacement of 300,000 people
-Could create shortages in the south
-Wildlife disturbed by construction

Sustainable Water Supply

Ensures water supplies don't cause damage to the environment whilst also supporting the local economy.

Water conservation - Aims to reduce the amount of water wasted.
Groundwater Management - Involves the monitoring of extracting groundwater. Laws can be introduced.
Recycling and 'Grey' Water - Means taking water that has already been used and using it again rather than returning it to a river or the sea. This includes water taken from bathrooms and washing machines.

C.S. Hitosa water scheme

Hitosa in Ethiopia A gravity based system that brings water from the wet highlands to the dry lowlands.
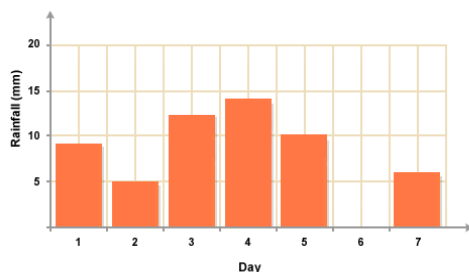
Advantages
-65,000 people supplied with 25 litres of clean water a day
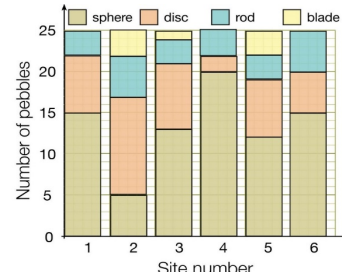-managed by local communities.

Disadvantages
-Lifetime of pipeline is only 30 years.
- Hygiene around taps has been neglected so disease is still an issue.
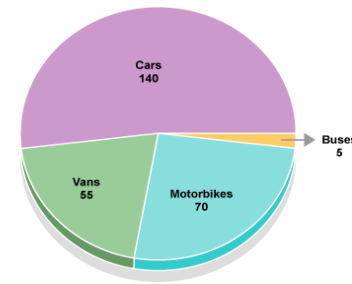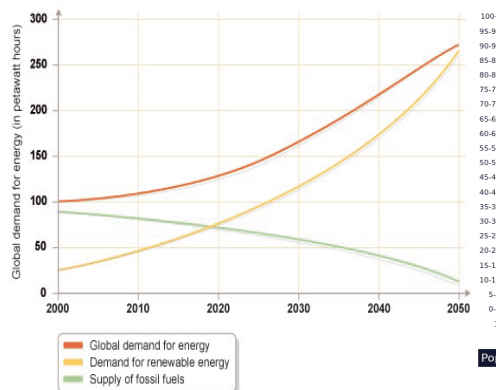-Led to migration so demand has increased.

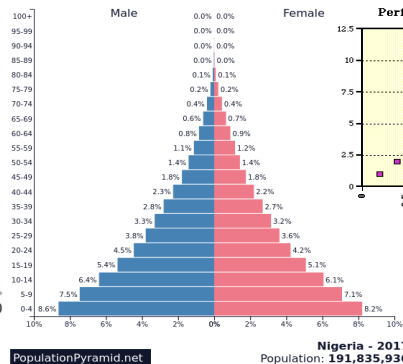## Graphs you need to know
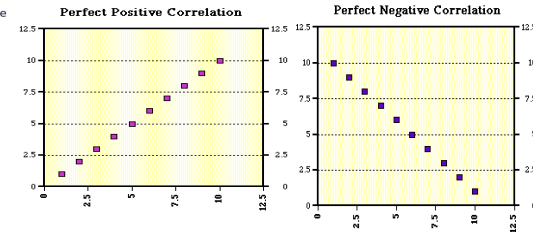

Bar graph

Divided bar graph

Pie chart

Line graph
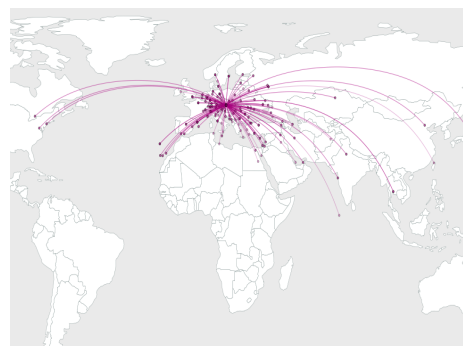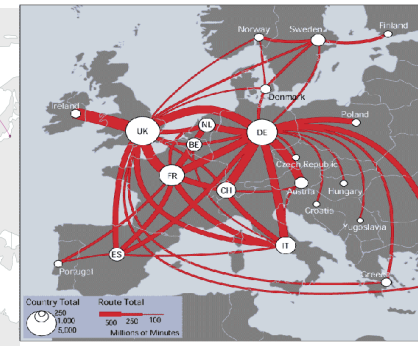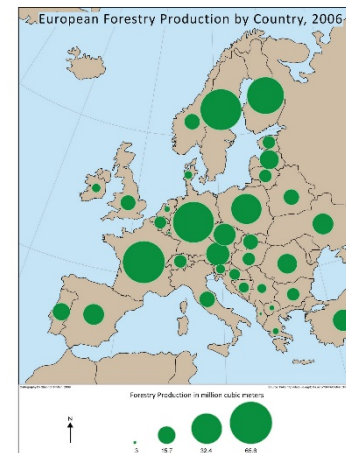

Population Pyramid

Scatter graph

Desire line

Flow line map

Proportional symbols

Physical Fieldwork

Geographical Enquiry:

To evaluate the success of coastal management strategies in Walton on the Naze

Hypothesis: Coastal management at Walton on the Naze is effective at reducing erosion

Sub Hypothesis 1: The beach profile will be steeper in the managed zone than the unmanaged zone

Sub-Hypothesis 2: Infiltration rates will be greater in the managed zone than the unmanaged zone

Location: Where did you go and why?

WotN is a suitable location to study coastal management because:
- There are many different types of coastal management in use here
- We can find out how effective coastal management is by comparing the managed zone to the south, where coastal management is in use, to the unmanaged zone in the north, which has been left unprotected.
- Easily accessible from London

EQ) Explain the advantage(s) of the location(s) used for your fieldwork enquiry (2 marks)

Method: What data collection techniques did you use?
Describe what you did and explain how they help to answer your question.

Description-filtration rates were measured in the managed and unmanaged zones at 6m intervals (systematic sampling) along the five 20m-long transects that were set up using the tape measure. At each of these points, the mallet was used to secure the infiltration tube into the ground (2cm deep). Then, water from the sea was collected in a bucket and poured to the brim of the infiltration tube. A ruler was used to measure the amount of water that had emptied from the tube after one minute, as measured by a stopwatch.
Justification- Infiltration rates tell us how built-up the beach is and therefore if the groynes are working (preventing longshore drift)
- Infiltration rates were measured less frequently (every 6m) than the beach profile because of time constraints.

EQ) Justify one primary data collection method used in your human geography enquiry (3 marks)

Risks-.Describe the risks you experienced on your fieldwork trip and how these could be reduced

1 – Tides - consult tide timetables, particularly along cliff sections, headlands and wide beaches. Every year people get cut off in this way.
2 – Watch out for and avoid slippery rocks on the foreshore at low tide. Students advised to wear sensible footwear and warned of the risks.
3 – Weather - hot weather. Students advised to bring plenty of water and sun cream if the weather forecast is hot.

EQ) Suggest one reason why risk assessment was important when planning your enquiry. (2 marks)

Analysis and conclusion
Description of results: At all locations along the transect, managed zone infiltration rates are significantly higher than in the unmanaged zone. For example, at a distance of 18m from the sea, managed zone infiltration rates are 240mm per minute while unmanaged zone infiltration rates are just 5mm per minute.

Analysis of results: We can infer from the large difference in infiltration rates that coastal management is effective at Walton on the Naze. This is because infiltration rates are higher in areas where sediment is more built up on a beach. Water passes through the gaps between sediment particles more quickly in built-up areas. Therefore, the high infiltration rates in the managed zone tell us that the beach contains more sediment than the unmanaged zone, and as a result we can infer that coastal management has been effective at maintaining sediment on the beach in this area.

Data anomaly: In the unmanaged zone, infiltration rates decreased with distance from the sea at the last point along the transect. This is an anomaly because the rest of the data shows increasing infiltration rates with increasing distance from the sea. This might have happened because of human error (e.g. the infiltration tube was not driven deeply enough into the sediment so water spilled out at the bottom).

EQ) For one of your fieldwork enquiries, to what extent did the result(s) and the conclusion(s) meet the original aim(s)? (9 marks + 3 SPaG)
EQ) To what extent were the data collected useful in satisfying the original aim(s) of the enquiry? (6 marks)

Evaluation of data presentation:

Method: Grouped bar chart *(See below)*

Strengths:	Weaknesses:
• *Very visual. Easy to plot by hand.* • *Full range of data can be seen together with the patterns and groupings of the data.* • *Good for comparing sets of data.* • *Appropriate for discrete data.*	• Significant differences are hard to compare.

How could the graph/ presentation be improved
GIS - Proportional symbols could have been used to show changes in sediment size along the shore. These could be located on a digital map

EQ) Assess how effective your presentation technique(s) were in collected in this enquiry. (6 marks)

Evaluation of data collection:

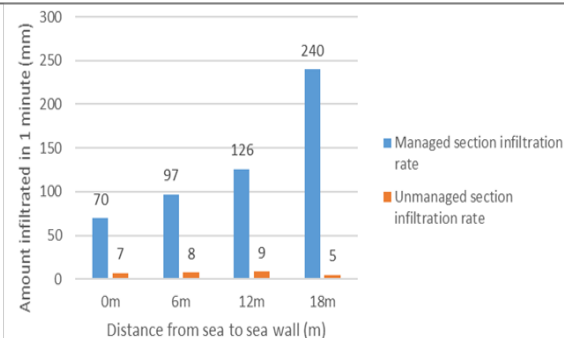| Strengths	Weaknesses	Next time/ improvements
• *The method of data collection is simple to carry out.* • *Systematic sampling is simple and has good coverage of the study area..* • *little equipment needed.* • *Equipment used to ensure accuracy*	• a larger sample would have given more accurate data. • There may be some user error when water spilled out of the tube • Tape measures need to be held parallel to the beach which was difficult	• *Measure more intervals on each transect* • *Compare different times of the year.*

Comparative Bar Chart Showing Infiltration Rates in Managed and Unmanaged Zones

Conclusion: What was the answer!?

The results of this investigation support the hypothesis that coastal management at Walton on the Naze is effective at reducing erosion. Both of the main methods of primary data collection – beach profiles and infiltration rates – provide evidence that the beach in the managed zone is significantly more built-up with sediment than the beach in the unmanaged zone. This is because the managed zone has a number of coastal management methods in place, including groynes, sea walls, and rip-rap, whereas the unmanaged zone has been left alone. The fact that the beach is more built-up in the managed zone shows that coastal management is effective because the management methods have retained sediment on the beach, instead of it being eroded away or transported by longshore drift. The unmanaged zone has a smaller beach with less sediment because there are no methods in place of preventing erosion.

Human Fieldwork

Geographical Enquiry:

To evaluate the success of regeneration of the Docklands

Hypothesis: Regeneration has not benefited Canary Wharf and Cubitt Town equally

Sub Hypothesis 1: The environmental improvements haven't benefited local residents in Cubitt Town.

Sub-Hypothesis 2: The economic opportunities haven't benefited Cubitt Town as much as Canary Wharf

Location: Where did you go and why?
The docklands was a good location to look at urban regeneration because:
- Recent regeneration so can conclude any difference are due to regeneration.
- Cubitt Town has quite a high deprivation index score so its an important area of the docklands to see how it has been affected by the redevelopment.
- Easily accessible from school

EQ) Explain the advantage(s) of the location(s) used for your fieldwork enquiry (2 marks)

Method: What data collection techniques did you use?
Describe what you did and explain how they help to answer your question.
Social and Environmental Quality survey
Description-1We used a survey form which took into account aspects of the environment and social quality of life in each area. We went towards the centre of our study sites in Canary wharf and Cubitt Town to complete the survey. When completing the survey we looked around us and gave a score to each of the environmental and social factors on the survey form.
Justification- This enabled us to quantify the quality of the environment in each location and the social aspects of each for example 'crime' or 'services'.

EQ) Justify one primary data collection method used in your human geography enquiry (3 marks)

Risks-.Describe the risks you experienced on your fieldwork trip and how these could be reduced

1 – Transport- staying in groups so we don't get separated.
2– Weather - hot weather. Students advised to bring plenty of water and sun cream if the weather forecast is hot.

EQ) Suggest one reason why risk assessment was important when planning your enquiry. (2 marks)

Analysis and conclusion
Description of results: For each area of the SEQS, Canary Wharf had a better score than Cubitt Town apart from traffic. For example the category of buldings had a score of 2.8 in Canary Wharf and 0.2 in Cubitt Town, a difference of 2.6.
Analysis of results:

EQ) For one of your fieldwork enquiries, to what extent did the result(s) and the conclusion(s) meet the original aim(s)? (9 marks + 3 SPaG)
EQ) To what extent were the data collected useful in satisfying the original aim(s) of the enquiry? (6 marks)

Evaluation of data presentation:

Method: Grouped bar chart *(See below)*	
Strengths: • *Very visual. Easy to plot by hand.* • *Full range of data can be seen together with the patterns and groupings of the data.* • *Good for comparing sets of data.* • *Appropriate for discrete data.*	**Weaknesses:** • Significant differences are hard to compare.
How could the graph/ presentation be improved Separate further into different categories	

EQ) Assess how effective your presentation technique(s) were in collected in this enquiry. (6 marks)

Evaluation of data collection:

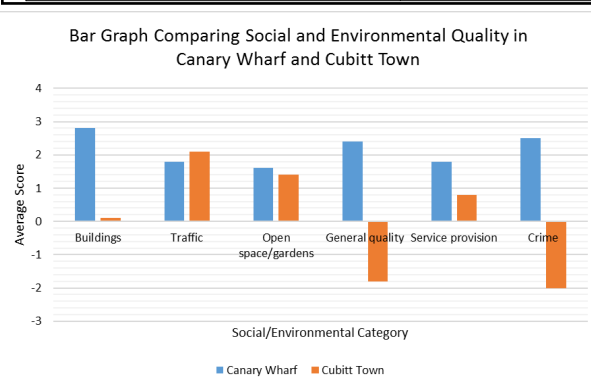| Strengths	Weaknesses	Next time/ improvements
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Bar Graph Comparing Social and Environmental Quality in Canary Wharf and Cubitt Town

Conclusion: What was the answer!?

The results of this investigation support the hypothesis that coastal management at Walton on the Naze is effective at reducing erosion. Both of the main methods of primary data collection – beach profiles and infiltration rates – provide evidence that the beach in the managed zone is significantly more built-up with sediment than the beach in the unmanaged zone. This is because the managed zone has a number of coastal management methods in place, including groynes, sea walls, and rip-rap, whereas the unmanaged zone has been left alone. The fact that the beach is more built-up in the managed zone shows that coastal management is effective because the management methods have retained sediment on the beach, instead of it being eroded away or transported by longshore drift. The unmanaged zone has a smaller beach with less sediment because there are no methods in place of preventing erosion.