

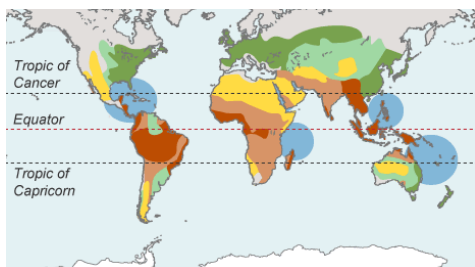
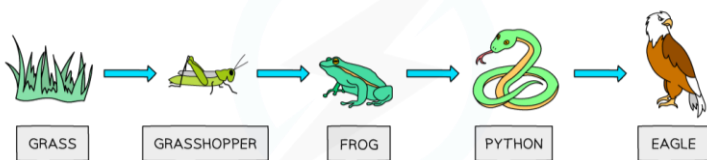
4.1 What are Ecosystems?

An **ecosystem** is a community of flora and fauna that interact with each other and their environment.

They consist of **interdependent** elements, relying upon one another:

- **Abiotic:** Non-living elements (air, water, heat, rock)
- **Biotic:** Living elements (plants, insects, animals)
- **Flora:** Vegetation or plant life
- **Fauna:** Animal life

Their interdependence is demonstrated through **food chains** and **food webs**. These show how flora and fauna are interlinked and the basic principle that energy is passed up a food chain, through the **trophic levels**.



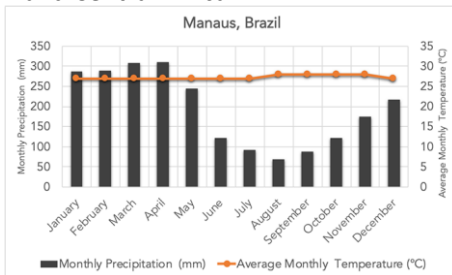
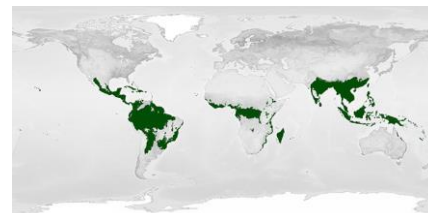
Large-scale ecosystems are called **biomes**. They have distinctive geography, flora, fauna, climate, and soils. These are location dependent.

Tropical Rainforest	Hot all year (25-30°C), over 200mm rainfall, tall canopy trees and great range of fauna.
Hot Deserts	Hot days (30°C+) and cold nights, very low rainfall, lack of flora, nocturnal fauna.
Temperate Forests	Warm summers and mild winters, variable rainfall, deciduous trees, adapting animals.
Polar / Tundra	Cold (-40°C to +5°C), very low rainfall, ice coverage, very few flora and fauna.
Coral Reefs	Warm equatorial waters, wet and dry seasons, plants such as algae, lots of fish.

4.2 What Biodiversity exists in Tropical Rainforests (TRFs)?

Distribution:

TRFs are distributed between the **Equator, Tropic of Cancer** and **Capricorn**. This includes South America (Amazon in Brazil and Peru), SE Asia (Indonesia) and Central Africa.

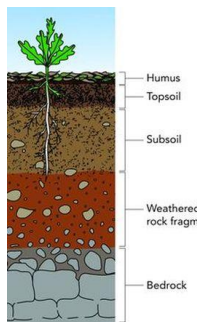


Climate:

Annual average temperatures range between 25 and 30°C, with rainfall above 200mm per year, with some places receiving 2000mm per year. Afternoons have heavy **convictional** rainfall.

Soils (Latosols):

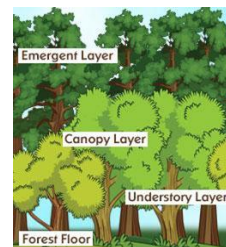
These are generally poor. They have a nutrient rich **humus** top layer from leaf litter. **Sub soils** are deep due to weathering. Soils are red.



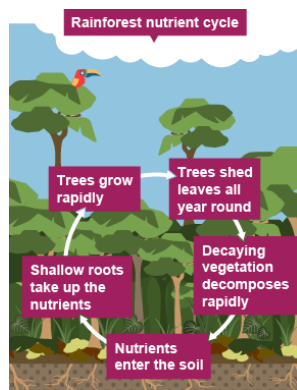
Sustaining Ecosystems Paper 1: Our Natural World

Tree Layers:

- **Emergents:** Tallest (>50m)
- **Canopy:** Bright, main trees
- **Undercanopy:** 20m high
- **Floor:** Darkness, shrubs

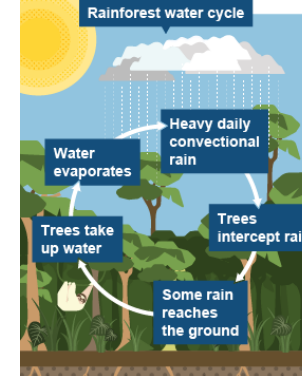


Sunlight cannot reach under the canopy in high amounts, and therefore **photosynthesis** takes place at a much slower rate, causing slow growth.



The Nutrient Cycle:

- Falling leaves and dead animals (**litter**) decompose on the forest floor.
- This creates a thin, nutrient rich layer of soil called **humus**.
- Tree roots are adapted and usually shallow (called **Buttress Roots**). They use these nutrients to grow rapidly.
- This cycle continues to repeat



The Water Cycle:

- Intense heat and water vapour in the atmosphere creates **convictional rainfall**.
- Trees **intercept** rain through their leaves and roots. Some rainwater reaches the forest floor.
- Trees absorb this water, and it eventually **evaporates** from the trees (**evapotranspiration**).
- This cycle continually repeats.

Adaptations:

Sloths	Camouflaged to rainforest tree bark and leaves, not easily detected.
Buttress Roots	Wide, shallow roots to stabilise trees and access humus.
Drip Tips	Pointy leaves allow heavy rain to run-off easily to root system.
Lianas & Vines	Climb trees to reach the top of the canopy for sunlight.

4.2 How do we Exploit and Manage TRFs?

Value of the Rainforest:

Climate	<ul style="list-style-type: none"> • Rainforests cool climate locally and globally. • They are carbon sinks (storing 15% of carbon dioxide emissions). • They therefore help to reduce the impact of climate change.
Food	<ul style="list-style-type: none"> • They provide food to indigenous people and the rest of the world. • Foods include bananas, pineapples, nuts and spices. • India is the world's largest banana producing nation, at 26 million tonnes.
Health	<ul style="list-style-type: none"> • 25% of modern medicine are made from rainforest ingredients. • Medicines and treatments such as aloe vera used widely. • Breakthrough drugs to treat cancers have been discovered.
Energy	<ul style="list-style-type: none"> • Indigenous people use wood for fire (heat, light and cooking). • Large dams are built on rainforest rivers to generate hydro-electric power (HEP). • 67% of Brazil's energy is generated by HEP.

Impacts of Human Activities

<p>Logging:</p> <ul style="list-style-type: none"> Activity used for harnessing wood from trees for materials globally. Destruction to biodiversity – reduction in species in the food web. Has led to conflict between indigenous people and commercial businesses. 	<p>Agriculture:</p> <ul style="list-style-type: none"> Both 'slash and burn' and shifting cultivation take place. Clearing land for palm oil trees and cattle ranching increases carbon emissions. River pollution and soil erosion increase due to land being exposed. Soil can become infertile.
<p>Mineral Extraction:</p> <ul style="list-style-type: none"> Metals such as gold and iron ore, as well as oil are found. Water contamination and river pollution in areas where mining happens. Indigenous can become displaced due to land being used to build roads. 	<p>Tourism:</p> <ul style="list-style-type: none"> Mass tourism means hotels and infrastructure being built in vulnerable areas. Negative relationship between tourists, government and indigenous tribes. Flora and fauna exposed to human disease.

CASE STUDY: Sustainable Management of the Costa Rica TRF



Location & Background:

Small Central American nation, mainly made up of tropical rainforest. 6% of the world's biodiversity. 6 million tourists per year

Threats to the Rainforest:

- Cattle ranching** and **slash and burn** methods deforest the area.
- Mineral mining** means large scale soil removal. Areas have been deforested and chemicals have entered the water cycle.
- In the 1990s, over 30,000 hectares of forest were cut down annually – devastating the fragile **ecosystem**.

Sustainable Management:

- Government established protected areas and passed laws to ban **deforestation**. Land owners were paid to protect the land.
- Government created 28 national parks and nature reserves, which protected 24% of the countries forest.
- Selective logging** is in place so that only selected trees are felled at a certain height, allowing younger trees to grow. But, this also leaves behind poorer quality trees affecting **biodiversity**.
- Afforestation** replaces trees that have been felled, but it takes a long time for these trees to establish.

Sustainable Ecotourism in Costa Rica: Samasati Nature Reserve

Ecotourism:

This is a form of tourism that is more **sustainable** – keeping the environment and local people in mind and reducing human impacts.

Ecotourist Activities:

Bird watching, canopy exploration, horseback riding, sea and river kayaking, walking and hiking.

Advantages:

- Only locally sourced produce is used.
- Employees are from local communities.
- No heavy machinery was used in construction.
- Rainwater is collected and reused for showers.
- Timber used came from **afforestation** project.
- Only biodegradable soap and shampoo used.

Disadvantages:

- Land prices have increased as a result of it's use.
- Projects such as this are expensive due to the sourcing of materials.



Sustaining Ecosystems Paper 1: Our Natural World

4.3 Arctic and Antarctica

Both regions are 60°N and 60°S of the **equator**, at the poles.



Arctic Features:

Cold, between -20°C to +5°C. Mostly sea, but tundra regions on land. Largely ice or **permafrost** cover. **Flora** include mosses and lichens.

Antarctic Features:

Cold, between -40°C to +5°C. Mostly land covered in **ice sheets**. Mountain ranges. Few species, but they include penguins and plankton.

Arctic Soil:

- Active Layer:** Thaws in summer, can sustain mosses and small shrub.
- Permafrost:** Permanently frozen ground.
- Bedrock:** Rock weathers slowly due to low temperatures.

Climate Change Impact:

Polar regions act in cooling our environment. As they have significant ice coverage, they are part of the **albedo effect**, which reflect sun ray's and **insolation** back to the atmosphere. With increasing climate change threatening the extent of ice coverage, this further contributes to the increase in sea and air temperatures globally.

Impact of Human Activity:

<p>Oil and Gas Exploration:</p> <ul style="list-style-type: none"> Arctic holds untapped resources of oil (13%) and gas (30%). Melting ice has allowed exploration companies such as Shell to search for future oil extraction areas. Threat of oil spills. 	<p>Whaling:</p> <ul style="list-style-type: none"> Historically whale hunting was a major industry, leading to decline in the species. International agreements in place to protect whales, limiting killing. There was an extinction threat.
<p>Fishing:</p> <ul style="list-style-type: none"> Significant ice melting has allowed for ships to fish commercially. This means fish stocks have been reduced but are also protected by quotas. Threat of web damage. 	<p>Tourism:</p> <ul style="list-style-type: none"> Cruise ships are growing in number. This activity increases carbon emissions, and wildlife can be disturbed by tourists interacting with the marine ecosystem.

4.3 CASE STUDY: Small-Scale Sustainable Management – Ice Hotel



Background

World's first hotel made of snow and ice, 100 years old. Tourist activities include ice sculpting, wilderness dining and visiting reindeer.

Successes:

Social & Economic: Local people involved in all stages (e.g. managing reception, tour guides etc – providing local **employment**).

Environmental: Solar panels are used in summer months to power the entire hotel. Building materials are obtained from the local River Torne, reducing overall **carbon footprint**.

Failures:

In winter, **non-renewable energy** sources are needed for power. Some activities, such as snow sled, burn **fossil fuels**.

4.3 CASE STUDY: Large-Scale Sustainable Management

Arctic Council:

1996. Environmental protection for the Arctic. 8 member states that all own land in Arctic (e.g. Canada).

Successes:

- Research's impacts of climate change, shipping and mineral extraction.
- Negotiating **legally binding** agreements between 8 countries.

Failures:

- Guidance in place on Arctic use is not legally binding.
- Illegal fishing** continues affecting food chain.

Paris Agreement, 2015

Global agreement of 197 nations to protect the world against climate change impacts, including the Arctic.

Successes:

- First time all government have agreed to take action.
- Some countries, such as France, took immediate action to ban petrol and diesel cars by 2040.

Failures:

- Non-binding**, no consequences for government not taking part.
- Pledges did not come into place until 2020 – no action from 2015.

5.1 Global Pattern of Urbanisation

Urbanisation is an increasing amount of people living in urban areas (towns and cities). 57% of the world's population live in urban areas.

Growth Rates in Urban Areas:

ACs	EDCs	LIDCs
<ul style="list-style-type: none"> Most urbanised countries Over 80% (e.g. UK) 	<ul style="list-style-type: none"> Urbanising rapidly Most between 60-80% (e.g. Brazil) 	<ul style="list-style-type: none"> Urbanising rapidly Most between 20-60% (e.g. Zambia)

Megacities:

These are cities with a population of 10 million or more.

- Growth caused by **natural population increase** (birth rates rising), **migration** and **economic development**.



World Cities:

The most important cities to global economic growth and influence. Hubs for international **trade** and **investment** (e.g. London).

5.1 Rapid Urbanisation in LIDCs

Urbanisation is caused by **rural-urban migration** and **internal growth**.

Push Factors <i>(pushing people away from the countryside)</i>	Pull Factors <i>(pulling people to the city)</i>
<ul style="list-style-type: none"> Few job opportunities with agriculture declining Lack of service access (e.g. schools) Poor transport networks 	<ul style="list-style-type: none"> More skilled job opportunities Higher income potential. Greater choice of educational opportunities.

Consequences of Rapid Urbanisation (e.g. Rio De Janeiro):

- Slum** communities develop with poorly built, unplanned homes.
- Overcrowding and unhygienic conditions, with lack of water access.
- Litter, pollution, and diseases spread quickly.

UK (AC) Urban Trends:

Suburbanisation	Counter-Urbanisation	Re-Urbanisation
People moving to city outskirts. Cause: <ul style="list-style-type: none"> Traffic congestion, pollution, cheaper land and more green space in suburbs. Consequence: <ul style="list-style-type: none"> Leads to urban sprawl. 	UK cities going into decline as people move to the countryside or small towns. Cause: <ul style="list-style-type: none"> Quieter, rural lifestyle. Consequence: <ul style="list-style-type: none"> Urban areas became neglected and under-developed. 	People moving back to city and town areas. Cause: <ul style="list-style-type: none"> Since the 1980s, Regeneration of derelict areas. Consequence: <ul style="list-style-type: none"> Increase in new homes, new job types.

5.2 CASE STUDY (AC): London Challenges & Opportunities



Location & Background: Northern Europe, SE of England. On the River Thames. 9 million population. Greenest city in the UK. 20 million international visitors annually. 40 universities and a world city.

Importance:

International	National
<ul style="list-style-type: none"> One of the most important financial centres in the world. Headquarters of international companies. 	<ul style="list-style-type: none"> UK's largest and wealthiest city. 22% of UK's GDP (wealth). Over 30% of UK's higher education centres.

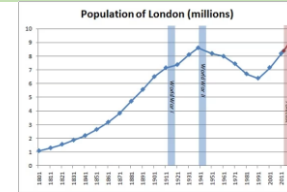
Migration:

International	National
<ul style="list-style-type: none"> London is very ethnically diverse (20% Asian, 14% Black) People move to London for employment, education and family. 350K people born in India. 	<ul style="list-style-type: none"> Internal migrants tend to be 20-30 years old – for employment and education, higher incomes. Over 30s and 60s move out to suburbs or coasts for quieter lifestyle.

Growth: Due to **migration**, **natural increase** and **urban sprawl**, London's population has grown from 6 million in 1941 to 9 million in 2024.

The **Green Belt** has shrunk due to **urban sprawl** and an increasing population. The UK government is looking at ways to protect the natural land.

Urban Futures Paper 2: People & Society



Character: London has Polish style shops to reflect a high Polish population. The largest religious groups are Christian (40%) and Muslim (15%), reflecting an increase in mosques. Notting Hill Carnival celebrates the British West Indian population. Chinatown is traditionally Chinese.

Contemporary Challenge: Deprivation

London is very unequal. 16% of Londoners are in the poorest tenth nationally, whilst 17% are the richest. Poorest suffer from lack of access to health and housing. House prices are highest in the UK, including rent. Schools in the poorest areas score lowest GCSEs – in Newham, 30% of 19 year olds are without a Level 3 Qualification.

Opportunity & Sustainability:

East Village Sustainable Housing	Congestion Charge and ULEZ
<ul style="list-style-type: none"> Filters rainwater to reduce consumption. Green roofs to encourage wildlife. Only one car parking space is provided to encourage use of public transport. 	<ul style="list-style-type: none"> Solving congestion and pollution problems started in 2003 with congestion charge – fee to pay. ULEZ expanded in 2023 at £12.50 per day to lower overall emissions.

5.2 CASE STUDY (EDC): Rio Challenges & Opportunities



Location & Background: South America. SE coast of Brazil. 13.8 million population. Former capital city. It is a world heritage site, hosted the 2016 Olympics and is a major port and industrial centre.

Importance:

International	National
<ul style="list-style-type: none"> Important tourist destination. Major global sporting events, such as Olympics 2016 and FIFA 2014 cup. Central international transport hub. 	<ul style="list-style-type: none"> Trading port, oil refinery and ship-building industries. 5% of Brazil's GDP (wealth). Many Brazilian company headquarters.

Migration:

International	National
<ul style="list-style-type: none"> Large immigrant group is Venezuelan due to refugee crisis in 2020. 190K Portuguese immigrants, with same Spanish language. Japanese and Chinese seeking jobs. 	<ul style="list-style-type: none"> Mechanisation has pushed people from rural areas to Rio. Poor living conditions and lack of diverse employment in rural areas. 65% of urban growth.

Growth: Due to **migration**, **natural increase** and **urban sprawl**, Rio's population has grown from 4 million in 1960 to 13.8 million in 2024.

Character:

Carnival: <ul style="list-style-type: none"> Held every year, celebrating Portuguese heritage since 1723. 6 million participants, 1.5 million tourists, £5 million revenue. 	Tourism: <ul style="list-style-type: none"> 2.8 million tourists annually, 3% of GDP. 170K jobs in Rio in tourism sector. Christ the Redeemer an attraction.
Daily Life: <ul style="list-style-type: none"> People in Rio are called Cariocas. High crime rates (2021 – 4,600 shootings). Legalised street art. 	Inequality (Informal Sector): <ul style="list-style-type: none"> 16 million in poverty in Brazil. 30% in Rio in the informal job sector. Squatter settlements (favelas) mainly built by migrants.

Contemporary Challenge: Squatter Settlements (Favelas)

Built informally on hills. Mainly due to migration. 25% of Rio's population. No public services, electricity or water. Run by drug and trafficking gangs. Death rate high.

Challenge: Traffic Congestion

80% own cars. Most congested city in S America. Commuters are frustrated. Loss of **productivity** due to lateness to work. Air pollution from **CO2** is high.

Opportunity & Sustainability: Bus Rapid Transit (BRT)

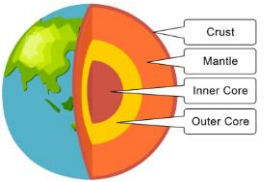
Four planned bus routes to reduce traffic congestion. Funded by the 2016 Olympic Games projects. 3.5 million passengers daily. Cost \$1.9 billion.

Advantages:	Disadvantages:
<ul style="list-style-type: none"> Reduced CO2 by 38% in the city. Efficient as it uses bus-only lanes and buses are of high capacity. Links all types of housing in the city. Pay off the bus system for ease. 	<ul style="list-style-type: none"> Slow progress – originally planned in 1970. Car numbers in city continue to rise – have doubled in the last 10 years. Not all can afford the fares.

1.2 Plate Tectonic Processes

Plate Tectonics is the theory that the world is divided up into tectonic plates (large areas of moving **oceanic** and **continental** crust).

Earth's Structure:



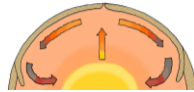
Inner Core: Hottest (6000°C), solid metal ball
Outer Core: 4,500°C, liquid layer of nickel
Mantle: Molten magma rock, 400°C to 4500°C
Crust: Thin, 70km deep. Ocean and continent.

Continental Drift Theory:

Alfred Wegener's theory states that the world was once one large continent, which has 'drifted' apart. Evidence for this is the 'jigsaw fit' of the world and fossil record across continents.

Convection Currents:

In the mantle, molten rock, called **magma**, is heated by the core. Pressure builds up and heat rises, forcing the plates above to move. When magma loses its heat, it sinks back down towards the core to heat up again.



Oceanic Crust	Continental Crust
<ul style="list-style-type: none"> Newer: under 200 million years old Dense and thin. Can sink, can be renewed or destroyed 	<ul style="list-style-type: none"> Older: over 1,500 million years old Less dense and thick. Cannot sink, cannot be renewed or destroyed.

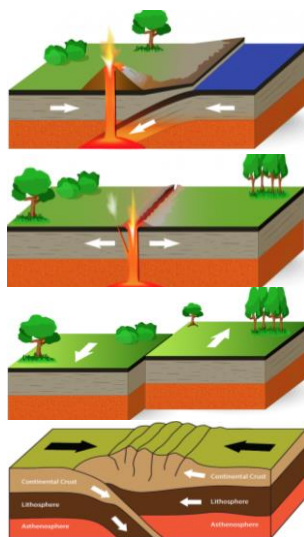
Plate Boundaries

Destructive: Oceanic and continental plates move towards each other. Oceanic **subducts**. Friction and pressure melts the plates. Magma comes out as lava. **Composite** volcano (e.g. Pacific/Eurasian).

Constructive: Two plates move apart. Magma rises from a fissure in the crust, which cools and forms new crust. **Shield** volcano (e.g. Eurasian/N American).

Conservative: Two plates move past each other, same or opposite directions. Crust is not created or destroyed. Earthquakes only occur. (E.g. Pacific/N American)

Collision: Both plates are continental and move towards each other. **Fold mountains** are formed (e.g. Eurasian/Indian).



Composite Volcanoes

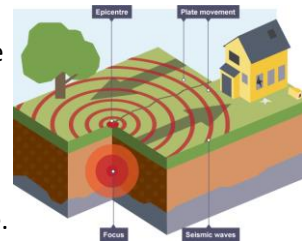
Tall and narrow. Erupt violently and infrequently. Produce **lava bombs** and ash. Can create **pyroclastic flow**.

Shield Volcanoes

Dome shaped – wide and gentle slopes. Eruptions are gentle and frequent. No ash.

Earthquakes:

Mainly found at destructive and conservative plate boundaries. **Focus** is where the energy is released. The **focus** can be shallow or deep. The **epicentre** is the point on land the earthquake first hits. It releases **seismic waves** across the landscape, causing damage.



Shallow Focus:

0-70km below surface. Common. 1.0-5.0 **magnitude**. Widespread damage caused. Usually on conservative plates and upper part of destructive plates.

Deep Focus:

70-700km below surface. Rare. 6.0-8.0 magnitude earthquakes, usually local damage only. Only occurs at destructive plate boundaries.



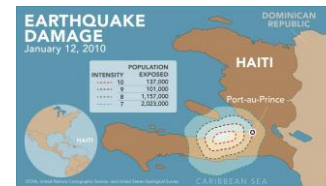
Global Hazards Paper 1: Our Natural World



1.2 CASE STUDY: Haiti Earthquake, 2010

Facts: January 2010, 7.0 magnitude earthquake in Caribbean Island of Haiti. **LIDC**, one of the poorest countries in the world.

Causes: N American and Caribbean plate moving towards each other. Third plate southward is conservative. **Shallow focus** on 10km deep, 25km away from capital city, Port-au-Prince.



Consequences:

Social: 220K fatalities, 300K injured, 1.3m homeless, roads irreparable.
Economic: 30K businesses closed, clothing industry damaged.
Environmental: Diseases due to poor **sanitation** (60K cases of **cholera**).
Political: Government accused of **corruption** due to land ownership issue

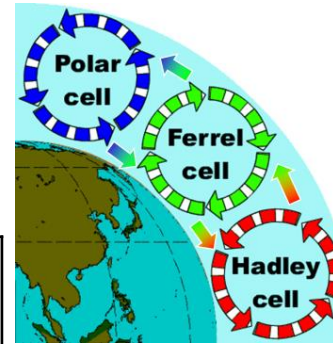
Responses:

Short Term: **Emergency aid** (food, water) from Dominican Republic, Red Cross set up temporary field hospitals, **UN** provided troops.
Long Term: '**Cash for work**' programmes to clear up rubble set up, 1,300 long-term living camps installed, **earthquake-proof** housing.

1.1 Extreme Weathers

Extreme weather is out of the ordinary or unusual for the normal patterns that a place experiences.

Global Circulation System:



Polar	60-90° North/South of equator . High pressure , cool air, little moisture. Polar fronts created.
Ferrel	30-60° North/South of equator. High and low pressure . Warm and cool air mixes, unsettled climate.
Hadley	Intense heat. Low pressure near equator. Unsettled climate. Air moves away from equator.

Extreme Temperatures:

These are affected by **insolation rates**, the **albedo effect**, cloud cover and altitude. Lut Desert in Iran is the hottest place on Earth (up to 70°C). Antarctica is cool (down to -89°C).

Extreme Precipitation:

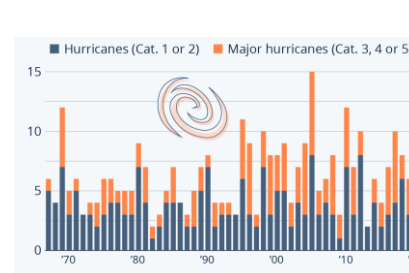
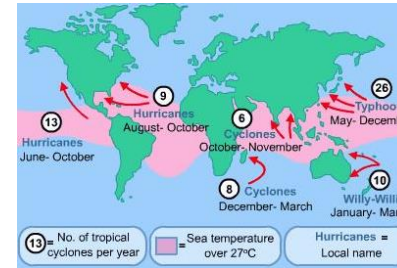
Frontal (warm and cool air meeting), **convective** (intense heat) and **relief rainfall** (mountainous). Northern India is very wet at up to 9,000mm in one month.

Extreme Wind:

Affected by **trade winds**, **katabatic wind**, **jet streams**, **tornadoes** and **tropical storms**. Some of the windiest places include Mt Everest in Nepal and Antarctica.

Tropical Storms Distribution:

Formed between the **Tropics of Cancer and Capricorn**, these are violent storms with heavy rainfall and strong winds. They are called **Hurricanes** in the Atlantic, **Typhoons** in the Pacific, and **Cyclones** in the Indian Ocean.



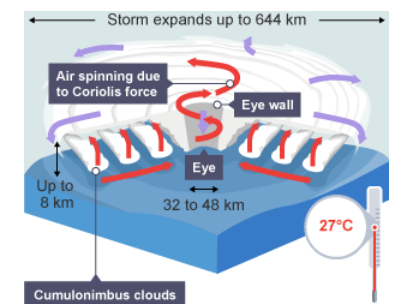
Tropical Storms Frequency:

Due to **climate change** and warming oceans, intensity of storms is increasingly slightly, but frequency is increasing more so. This is because there is more intense heat and moisture **evaporating** from the ocean, feeding the storm cycle. Atlantic storms have increased since 1995.

Tropical Storm Formation

Sea temperature needs to be 26.5°C or higher, and a sea depth of at least 50 metres to form.

- Warm air rises rapidly, drawing in more air from the ocean causing strong, swirling winds – linked to the **Coriolis Effect**.
- Rising air cools, **condenses**, forms clouds and energy released powers the storm.
- The **eye** (centre) of the storm is calm, but outside is strong.
- Once storms make landfall, they to lose their energy and dissipate.



Measuring Tropical Storms

The **Saffir-Simpson** scale is used to measure the intensity of tropical storms. The scale is 1-5, with category 5 storms being rare and most catastrophic.

CATEGORY	WINDS (MPH)	DAMAGE
1	74-95	SOME
2	96-110	EXTENSIVE
3	111-129	DEVASTATING
4	130-156	CATASTROPHIC
5	157+	CATASTROPHIC

1.1 CASE STUDY: Typhoon Haiyan, 2013



Facts:
SE Asia, November 2013. Most powerful and devastating on record. Tracked for 5 days in Pacific Ocean before hitting the Philippines at it's most powerful. Winds up to 300km/hour. Caused a major storm surge which hit the Philippines very hard, up to 10 metres high.

Causes:
30°C Pacific Ocean sea temperature, unusually high. Calm condition allowed for higher evaporation rates. Tracked East to West over 5 days, enough time to develop into a Category 5 **super-typhoon**, highest recorded in history.



Primary Impacts

- More than 6,300 people died, with many presumed dead.
- Drowning caused by storm surge.
- 600,000 people displaced.
- 40,000 homes damaged.
- Tacloban city was 90% destroyed.

Secondary Impacts

- 14 million were affected overall by shortages in food, water and aid.
- 6 million people lost their source of income.
- Mass burials had to take place.
- Flooding and heavy rain caused landslides and blocked roads.

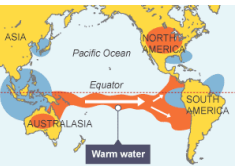
Responses:

Short Term:

- 'National Calamity' declared, which hurried the response of the Philippines Red Cross with basic supplies such as food and water.
- **Red Cross** supplied 1.1 million people with clean water.
- 1,200 evacuation centres set up to help homeless.

Long Term:

- **'Build Back Better'** programme aimed to build 200K homes.
- **Oxfam** replaced fishing boats, enabling employment to rise.
- **UNICEF** vaccinated thousands of children against **polio** and **measles**.

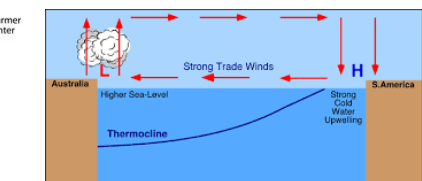
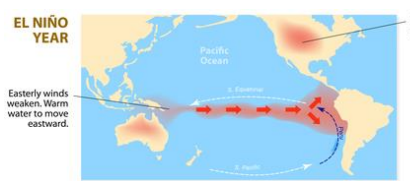


Global Hazards Paper 1: Our Natural World



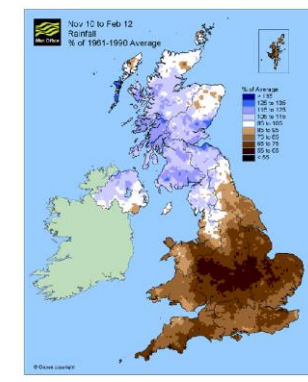
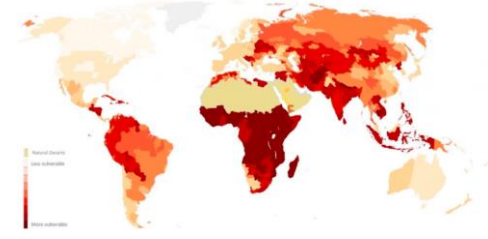
ENSO in the Pacific Ocean:

Normal Year	Light winds blow westward, towards Australia. Warm sea water is pushed near there, making it warmer. Low pressure occurs, high rainfall. Peru experiences high pressure and little rainfall.
El Nino	Winds are reversed, eastwards towards Peru. Warm water is pushed towards there, leading to low pressure and heavy rainfall (flooding). Australia can experience drought .
La Nina	Can follow El Nino event. This is like a normal year but stronger winds. Therefore, Australia can experience flooding and Peru can experience drought .



Drought Distribution & Frequency

Droughts are periods of dry weather (little precipitation) over a long period of time. This happened in the UK in 2012.



Droughts occur globally, and are becoming more regular. Western parts of S America, most of Southern Africa, and some parts of the Middle East are suffering from rising drought risk.

Heatwaves

In the UK, **heatwaves** are 5 consecutive days or more where the temperatures exceed the average by 5°C.

1.1 CASE STUDY: UK Heatwave, 2022



Facts:

Highest ever recorded UK temperature on 19th July 2022 of 40.3°C. Nine days where temperatures were above 27 °C.

Causes:

Jet stream moved northward, dragging African and S European air towards the UK. No large sea to cool and regulate temperatures.

Impacts:

Social:	Economic:	Environmental:
<ul style="list-style-type: none"> • 2,670 emergency services calls (9x normal amount) • 81 houses destroyed, 40 in London alone. • 18 firefighters injured. 	<ul style="list-style-type: none"> • Infrastructure melted – Luton Airport closed for 3 hours. Kings Cross rail track fire. • Tesco ice cream sales increase to 9 million. 	<ul style="list-style-type: none"> • Reservoir water levels dropped significantly. • Grassland fires destroyed acres of natural habitat in Wennington, London.

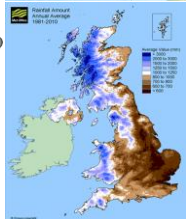
Responses:

- First ever Red Weather Warning – stay indoors, do not travel.
- UK Government declared a national emergency.
- Network Rail 'do not travel' saw drop of passengers by 40%.
- Gritters spread sand on roads in some parts of the UK to keep the tarmac cool.
- Hundreds of schools closed.

7.1 UK Physical & Human Characteristics

Landscape & Population:

- Most **uplands** are North and West, such as the Grampians in Scotland and Snowdon in Wales.
- These are mainly **rural** areas, **sparsely populated**.
- South and East is mainly flat, and **densely populated urban** areas such as London And Leeds.



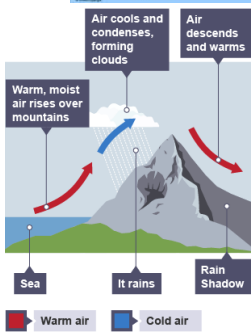
Precipitation Patterns:

- Highest rainfall totals are in the North and West – where uplands exist. Average rainfall here is 2,500mm per year.
- Lowest rainfall totals are in the South and East, with averages between 500 and 650mm per year.



Relief Rainfall:

- Most common type of rainfall in the UK.
- Prevailing wind** from the sea in the West blows toward the East.
- It carries moisture towards upland areas. The air is forced upwards to higher altitude.
- It cools, condenses and forms clouds for rainfall over the mountains.
- On the other side of the mountain, there is little rainfall, called a **rain shadow**.



UK Land Use:

- Urban areas cover 12% of landscape.
- Arable** land for crop growth is 20%.
- Grasslands** for cattle is 44%.
- Woodland** covers 13% of land.
- Mountain and moorland is 7%.
- Water covers 1% of the landscape.



This presents significant challenges in the UK for human use of the landscape.

Issues in the UK:

Water Stress:

- Water resources in higher demand than supply allows.
- South and East (linked to rainfall) have largest issue, along with a very dense population.
- Water demand is rising: 50% from homes and a growing population.

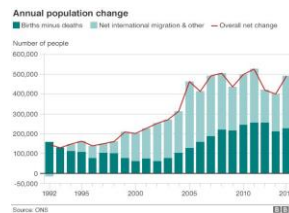
Housing Shortages:

- 68 million population, with population increasing.
- 200K homes being built per year, but 300K needed.
- Planning law, protected **green belt** land and rising land prices are causing a shortage.

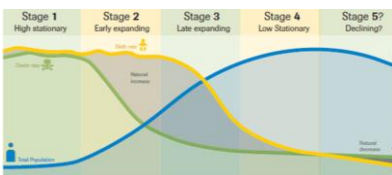
7.1 UK Population Change

Growth:

The UK population is now 68 million, expected to reach 70 million by 2030. Pre-21st Century, this was due to **natural increase** (difference between birth and death rate). Since 2001, **net migration** (difference between immigration and emigration) has driven population growth. Most of this was due to the expansion of the **European Union** in 2004 and 2007.



Life Expectancy is now 82 in the UK.



Demographic Transition Model:

Theory showing how populations go through 5 stages of growth and decline over time. UK is in Stage 4 of the DTM (**low birth** and **death rates**).

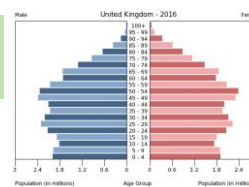
Stage 4 also has a slow rise in natural increase, like the UK. The population is still growing but more slowly than previously. This is due to **family planning**, good health and marriage later in life. There is also a reliable food supply.



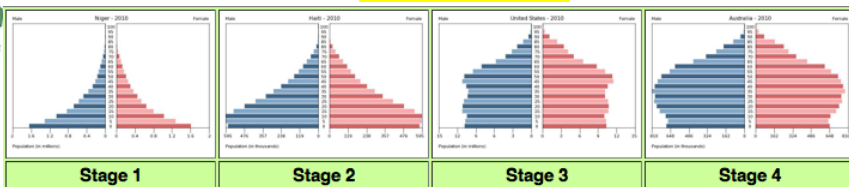
UK in the 21st Century Paper 2: People & Society

← Global Population Pyramid

UK Population Pyramid →



Population pyramids illustrate the number of people (% of population) in age categories. The wider the base, the higher the birth rate. The UK's population pyramid reflect a Stage 4 country as it has a consistently wide shape through the ages, and is also comparatively wide in the 65+ categories, demonstrating an **ageing population**.



UK Ageing Population:

The UK's population is increasingly older. In 1975, 14% of the population was over 65 years old. Today, just over 20% is over 65 years old. This is set to increase to 25% by 2050. Rural and coastal areas (e.g. Cornwall, Devon, Norfolk) have the highest rate of elderly population. Cities and towns tend to have lower elderly **population ratios**.

Causes	<ul style="list-style-type: none"> Baby boomers (large number of people born after WWII) Improved healthcare and treatments for long term illness Greater awareness of exercise and good diet importance
Impacts	<ul style="list-style-type: none"> High healthcare costs to fund treatment on NHS Shortage of places in care homes, increasingly expensive Boose to economy as older people volunteer in communities
Responses	<ul style="list-style-type: none"> Government increasing retirement age from 65 to 68 by 2046 Pensioners can get care, transport and heating allowances Higher immigration rates to boost the dependency ratio

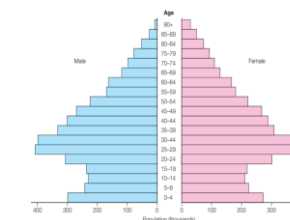
7.1 CASE STUDY: Ethnic Diversity in London

London's population has grown and changed due to a high birth rate (**natural increase**), and a low net migration over the long term.



Changes:

- 38% of London's population were born in another country. In Camden, 4.3% are Bangladeshi.
- London changed from majority White British in 2001 to a city with a majority of other ethnic groups in 2011.
- Largest ethnic groups: Irish, Nigerian, Jamaican.
- Camden's three largest religious groups are Christian (38%), Muslim (14%), Jewish (5%).



Causes of Change:

- EU Free Movement of People** since 2004, however this fell from 2016 after the EU referendum.
- Non-EU **migration** has continued to increase with **visa**'s being allocated to many (e.g. 23% of the increase is work visa's).
- International students coming to London to study (39% of the increase).

7.1 UK Economic Changes Since 2001

Primary: Gathering resources (e.g. mining, farming)	Secondary: Manufacturing goods (e.g. carpenter)	Tertiary: Providing a service (e.g. doctor, teacher)	Quaternary: High-tech, highly skilled (e.g. computing)
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Changing Employment Sectors (The Clarke-Fisher Model)

- Primary sector jobs are down to 10% today.
- Secondary sector jobs have risen slightly to 30%.
- Tertiary sector jobs have grown from 10% to 55%.
- Quaternary sector jobs exist since 1950 and are at 5%.

Causes of Economic Changes

Deindustrialisation: <ul style="list-style-type: none"> Decline in manufacturing (secondary sector) Machinery and technology LIDC Manufacturers for less (e.g. China) Lack of investment. 	Globalisation: <ul style="list-style-type: none"> Global connectedness (culture, ideas, money, people and information) Decline in Western manufacturing, increase in UK imports. 	Government Policy: <ul style="list-style-type: none"> 1970s/80s saw increase in privatisation policy. This cost jobs in steel and coal industries. Increase in unemployment for these people.
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Changing Work Patterns

Part-Time	Allows workers to fit around family, study or other jobs.
Flexi-Time	Choosing start and finish times within limits.
Job Sharing	Two people share the load of a full-time job
Zero-Hour Contract	Available to work, but without fixed hours or fixed pay.
Working From Home	Away from a workplace, at home on a device.

Core Economic Hubs:

These are areas in the UK where economic growth is strongest. They can be split into two categories:

- High growth:** Economic, population and place growth taking place.
- Dynamic growth:** Knowledge-intensive businesses, high-skilled workforce, new business formation and good transport connections are the main features.

Pattern of UK Economic Hubs

There are more economic hubs in the South of the England than in the North. This is because there are more cities and a dense population. However, there are clusters of economic hubs, joined together growth corridors, such as Liverpool, Manchester and Leeds in the North. London is connected to economic hubs North, South, East and West.

Growth Corridors:

High and dynamic growth areas create nine growth corridors in England which link together and are important for future economic growth. These exist in all directions, spreading growth. They are strongly influenced by major transport infrastructure such as the M4 between London and Bristol.



7.1 CASE STUDY: Core Economic Hub (Cambridge)

One of the UK's leading core economic hubs. East Anglia, in the London – Cambridge growth corridor. Top location for Education.

Advantages of Cambridge	Disadvantages of Cambridge
<ul style="list-style-type: none"> Good transport – M11 to London. Highly educated university graduates. City has good quality of life. 	<ul style="list-style-type: none"> Overcrowding and congestion. High house prices, which continue to rise. Rail routes require improvement.
Regional & National Importance	Changes in Cambridge
Regional: <ul style="list-style-type: none"> 4,500 knowledge-intensive companies within 25 miles. Unemployment is less than 2% - less than half that of the UK. National: <ul style="list-style-type: none"> World leading Cambridge University. Income 34% higher than UK average. Net contribution to UK economy. 	Opportunities: <ul style="list-style-type: none"> Guided bus routes have made commuting easier. A14 has been upgraded to ease congestion around the city centre. Challenges: <ul style="list-style-type: none"> Growth slowed recently due to transport and housing issues. 33K new homes needed across Greater Cambridge.



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7.2 Is the UK losing it's global significance?

UK's Political Role:

In history, the **British Empire** spanned one third of the world's landscape. This benefitted Britain as it had access to global resources and held control of nations.

After the Empire disbanded in the 20th Century, the **Commonwealth** was formed which is today a voluntary group of 52 countries co-operating on **trade** and **democracy**.

UK's Role in International Organisations:

United Nations (UN): <ul style="list-style-type: none"> International co-operation post 1945. Aims to protect peace, promote rights and economic development. UK is a member of the Security Council. 	North Atlantic Treaty Organisation (NATO): <ul style="list-style-type: none"> 28 country military alliance who defend each other against threats. UK in top 5 military spending nations, along with the USA, China and France. 	European Union (EU): <ul style="list-style-type: none"> 28 countries as an economic union for trade. Single market allows freedom of movement. UK left the EU in 2021 following the 2016 referendum.
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7.2 CASE STUDY: UK's Role in the Ukraine Conflict (2022)

Longstanding historical conflict between Russia and Ukraine. February 2022 saw Russia's attempt to invade Ukraine, still ongoing.

As part of NATO, the UK helped to respond by:

- Providing £2.3 billion as part of military training and funding.
- 10K Ukrainian troops trained by the Ministry of Defence.
- Spent \$1.5 billion on **humanitarian aid**.
- Targeting Russia with 16K **sanctions** on it's economic growth.
- Calling for large **transnational companies**, such as McDonalds, to boycott Russia.

However, the UK's spending on Ukraine is significantly less than the USA (which is \$40 billion). There are also questions about whether this aid will be enough to aid Ukraine in defending it's **territory**.

Influence of UK Media

The UK hold significant power in terms of global media. The industry is worth £70 billion and creates 1.7 million jobs.

Film Success: <ul style="list-style-type: none"> Films such as James Bond series and Skyfall have become globally successful. Skyfall generated over £100 million for the UK economy. 	TV Success: <ul style="list-style-type: none"> UK TV programmes have been exported, such as Peppa Pig. As English is widely spoken, this has been successful in 170 countries.
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Contribution of Ethnic Diversity to UK Food

Ethnic Diversity has changed UK food habits. The average household spends £450 annually on takeaways, which has doubled in ten years.

- Chinese is the most popular takeaway at 25%.
- It arrived in the 19th Century, and during the 1960s, more people from Hong Kong arrived to the UK, opening restaurants.
- Some UK cities have '**Chinatown**', where the ethnic group have grouped together the restaurants to offer Chinese cuisine.
- Other dishes, such as Chicken Tikka Masala, is said to be founded in Britain and is an adaptation to make curry mild, suiting the British.

Is the UK losing its global significance?	
YES: Loss of the British Empire, left the European Union, economy being overtaken by EDCs such as China, is losing it's food culture to other world foods.	NO: Member of the powerful NATO and UN, forefront of providing Ukraine weaponry, fifth largest contributor to UN budget, Film and TV box office successes.

3.1 What are Landscapes?

A **landscape** is a physical form created by the interaction of human and physical features.

Specific elements of a landscape include physical features (mountains, rivers, lakes and trees) and human features (buildings, railways).

Upland and Lowland Areas (Relief):

- Most **uplands** are North and West, such as the Grampians in Scotland and Snowdon in Wales.
- South and East is mainly flat, **lowland** areas, such as The Fens in East Anglia.
- Both landscapes have been formed by physical processes, such as **glaciation** and **weathering**.



Glaciation:

This is the process by which ice forms on land, or ice coverage is vast. The last ice age was 25,000 years ago, where most of the UK was covered in an ice sheet which extended southward from the Arctic (called **glacial** areas). Only the South-East was not affected by this (called **periglacial** areas).



Geology:

There are three main rock types:

Igneous: cooled magma from volcanic eruptions.

Sedimentary: Fragments of multiple rocks layered together.

Metamorphic: High heat and pressure from tectonic movement.

Igneous: Granite	Sedimentary: Chalk
<ul style="list-style-type: none"> • Hard rock, weathers slowly and erodes slowly. • Impermeable, so water cannot pass through it. • Acidic in nature. 	<ul style="list-style-type: none"> • Soft rock, so is easily eroded. • Permeable, meaning that water can flow through the rock. • Alkali in nature, therefore fertile and good for growing.

Human Activity:

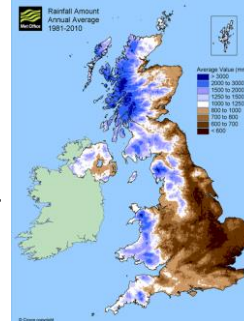
Human's use the landscape for a variety of purposes across the UK.

These uses include:

- 40% of England's land for **arable** (crop) farming.
- 15% of England's land being **urban** (towns and cities).
- Scotland only has 15% arable land, much more natural as mountainous terrain.
- Tourism is popular in upland areas.
- Energy creation, such as **wind farms** and **hydro-electric dams**.
- Traditional uses, such as hunting for deer and grouse.

Climate:

- Highest rainfall totals are in the North and West – where uplands exist. Average rainfall here is 2,500mm per year (**relief rainfall**).
- Lowest rainfall totals are in the South and East, with averages between 500 and 650mm yearly.
- This means that upland areas experience more **weathering, erosion** and **mass movement (geomorphic processes)**.



3.2 Geomorphic Processes (Weathering):

Mechanical	Caused by the physical action of rain, frost and wind.
Chemical	Caused by chemical reaction between rain and rock.
Biological	Caused by living organisms, such as burrowing or tree roots.

Freeze-Thaw Action (Mechanical/Physical):

Water becomes trapped in a crack. When it freezes, it expands by 9%. This pressurises the rock structure. This cycle continues, the crack expands and becomes deep enough that the rock splits.

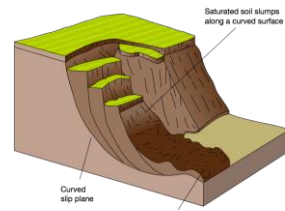
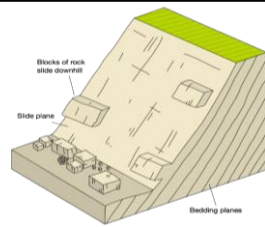


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Geomorphic Processes (Mass Movement):

Mass movement takes place on sloped or cliffed areas (e.g. mountainous areas or coastal areas) and requires rainfall, weathering, erosion and downward gravity.

<p>Landslides:</p> <ul style="list-style-type: none"> • Heavy rainfall over a long period may infiltrate permeable rock and soil, meaning its heavy. • Weathering weakens the rock structure, resulting in cracks. • Hydraulic action at the base of a coastal cliff leaves it unstable. 	<p>Slumping:</p> <ul style="list-style-type: none"> • Heavy rainfall saturates top layer of permeable rock and the underlying impermeable rock becomes unstable. • Weathering and sea or river water weakens it further. • Chunks of rock and soil break apart and slide down the slope.
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Geomorphic Processes (Erosion):

Erosion is the break down of rock due to movement –where they become smooth and round.

Attrition	Rocks that bash together to become smooth/smaller.
Solution	A chemical reaction that dissolves rocks.
Abrasion	The force of rock hitting cliffs/river banks and wearing it down.
Hydraulic Action	Water enters cracks, pressure causes it to expand further.

Geomorphic Processes (Transportation):

Transportation is the natural process of river and sea water physically moving eroded rocks or sediment.

Traction	Boulders rolling along the river/sea bed from water's force.
Saltation	Smaller pebbles that bounce along the river/sea bed.
Suspension	Fine sediments carried along in the water's flow.
Solution	Dissolved minerals from rock that is carried in the water.

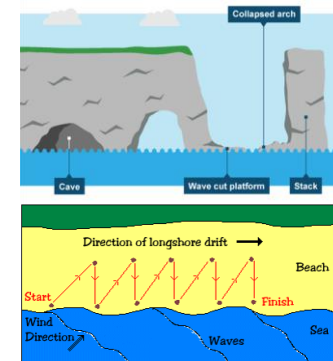
Geomorphic Processes (Deposition):

Deposition is the depositing of material, such as sand or pebbles, by the sea or a river when it loses it's energy.

3.2 Formation of Coastal Landforms

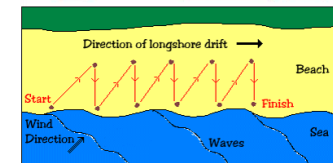
Coastal Stack (Erosion):

1. Hydraulic action widens cliff crack
2. Abrasion forms a **wave-cut notch**
3. Further abrasion widens the notch to form a **cave**.
4. The cave eventually breaks through the cliff, forming an **arch**.
5. Weathering and further erosion causes the arch to collapse, leaving a tall **stack**.

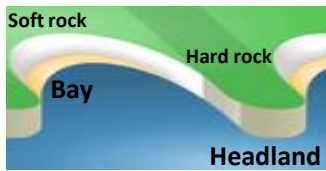


Longshore Drift (LSD) (Transportation):

Prevailing winds at sea are not often in a straight direction onto the beach, and often are at an angle. This drags the sea water onto the beach at an angle. The **swash** of the sea (water moving up the beach) carries and pushes sediment onto the beach. With **gravity**, the waves naturally come back down the beach (**backwash**) and out to sea at a 90° angle. This process continues up the beach, forming a **zig-zag** shape. This process continues along a coastline, transporting sediment with it and extending the length of the beach along the coastline. This can often lead to a **coastal spit** being formed if the beach is not managed appropriately.



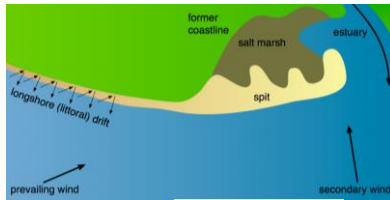
Headlands, Bays & Beaches (Erosion & Deposition):



These are formed along **discordant** coastlines, where there are alternating hard and soft rock bands, as opposed to **concordant**, where there is a single rock type. Waves attack the coast, where softer rock (e.g. chalk) is eroded by the sea, forming an inward **bay**. In bays, a **beach** can be formed when eroded material from the rock and sea is transported and deposited in these **sheltered areas**, which can become a beach with sediment. More resistant or harder rock, such as granite, erodes much slower and therefore is left jutting out of the landscape. This is known as a **headland** becomes more vulnerable to erosion due to its exposure to the waves.

Spit (Transportation & Deposition):

- Longshore drift transports sediment down a beach. At the end of a headland, the sediment is deposited and continues to build up, **lengthening** the beach.
- At the end of the beach, there can be a change in **wind direction**, forcing the sand inward. This forms a '**hook**' shape as the sand builds up, known as a coastal spit.
- Behind it, sea water is cut-off and dries up, known as a **salt marsh**.



3.2 COASTAL CASE STUDY: Walton on the Naze, Essex

Background:

Coastal town in East of England, on Europe's fastest eroding coast. 12K population. Northern beach unmanaged, Southern heavily managed.

Geology:

- Red Crag**: Soft rock, quickly eroding and consisting of marine shells and red sands.
- London Clay**: Heavy, grey rock. Somewhat permeable but also soft and crumbles easily.



Both of these rock types suffer from exposure to changeable weather conditions, including winter storms, and also weather and erode.

Processes and Landforms:

As Walton is an exposed coastline, on the East Coast of the North Sea, it experiences conditions that cause erosion, transportation and deposition to take place, forming distinct landforms.

Processes AT WOTN:

- High rate of erosion (2 metres per year lost).
- Longshore Drift occurs northward.
- High rate of deposition along the South Beach.
- Weathering on the soft northern cliffs.

Landforms at WOTN:

- Headland and bay (which contains the main Southern and Northern beaches).
- Wave cut-notches in the cliffs at the unmanaged Northern Beach.
- Formation of a coastal spit (this is managed by the groyne).

Human Activity / Management of Geomorphic Processes:

Hard Engineering is an intrusive and expensive strategy which aims to stop or block natural processes from occurring.

- Groynes**: Wooden and steel barriers installed in 1860 to stop LSD. This means the beach is still accessible for visitors, but lower deposition rates means higher erosion rates in places.
- Sea Walls**: Concrete walls to break wave energy along the promenade to protect housing from flooding. Built in 1977, and drainage was added later. It is an eyesore for the local community.
- Rock Armour**: Large boulders of hard rock in front of the soft rock cliffs to slow wave energy. Cheap to install. In 1998, 300 tonnes were installed costing £167K. However, needs replacing every 20 years.

Distinctive Landscapes

Paper 1: Our Natural World

Soft Engineering is a more environmentally friendly strategy which aims to work with natural processes.

- Beach Nourishment**: Human intervention to build up sand on parts of the beach to protect cliffs. This happened in the Northern Beach in 1999, but had already been removed by LSD in 2003 (needs repeating).
- Managed Retreat**: Allows natural processes to take place and accepts loss of low-value land. Northern Beach cliffs are low in value, with no housing, so this strategy has been a long-term one here.

Effectiveness:

Overall, this management has been **effective**. In the 12th to 15th Century, 16 metres of land on average was lost per year. With the management above, this has reduced to 2 metres per year.

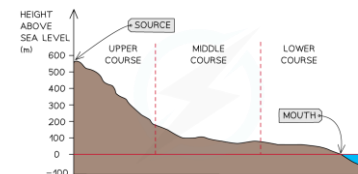
3.2 Formation of River Landforms:

Profile of a River:

- Upper Course**: Mountainous, erosion.
- Middle Course**: Hilly, transportation.
- Lower Course**: Flat, deposition.

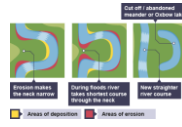
Waterfall (Upper Course - Erosion):

Rivers flow over alternate rock types, eroding soft rock faster than hard rock. Hydraulic action & abrasion form a plunge pool beneath the hard rock. The hard rock is undercut, collapsing. Waterfalls retreat forming **gorges**.



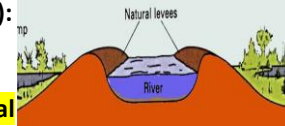
Meanders & Ox-Bow Lakes (Middle Course – Erosion & Deposition):

- Outer bank of a **winding** river erodes. Inner bank sees slower flow - deposition.
- Hydraulic action and abrasion on outer banks causes meander **neck** to become smaller.
- Erosion breaks through the neck, the river takes this straight route.
- Deposition **cuts off** the previous main channel, leaving an ox-bow lake.



Floodplains & Levees (Lower Course – Deposition):

When a river floods, sediment called **alluvium** is deposited on the valley floor. On the river banks, this material builds up, eventually forming a **natural barrier** to floodwater. A floodplain is an area surrounding the river whereby river water can naturally and regularly flood. Often **nutrient rich** and flat.



3.2 RIVER CASE STUDY: The River Tees, North East England

Background:

85 mile long river in North East, source in the Pennines (900 metres above sea level) to the North Sea. Within the Tees Valley.

Geology:

The Tees consists of two main rock types in the Upper Course:

- Whin Sill**: Hard, impermeable rock on surface.
- Limestone**: Soft, permeable and erodes quickly.

These help to create the High Force waterfall which has a steep gorge retreating up the Pennines.

Processes & Landforms:

This river is an excellent example of all of the geomorphic processes above taking place in each stage. It also has High Force waterfall, a gorge, meanders and ox-bow lakes, and large floodplains and levees in the lower course urban areas such as Middlesbrough.

Human Activity / Management of Geomorphic Processes:

As part of a £2.1 million management project at Yarm after 1995 flooding:

- Hard Engineering strategies such as **rock armour** to protect walls and embankments from erosion
- Soft Engineering such as improved **flood warning systems** in working with the **Met Office**.

As part of the Lower Tees Valley industrial economic area:

- Hard Engineering such as the Tees Barrage, a £54 million manmade barrier to stop flooding and reduce **tidal impact** across the river.
- Soft Engineering such as **dredging**, which removed accumulated material from the river bed to make room for more water. This has maintained deep water channels but is a process that needs repeating annually.

Effectiveness:

Overall, this management has been **effective**, because since 1995 there has been no major flooding event, and it has brought **economic stability**.

6.1 What is Development?

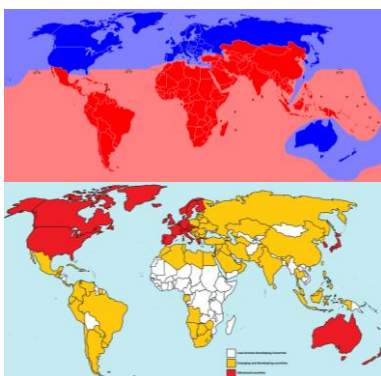
Development is an improvement in **standard of living** through better use of a country's resources. It is more than just wealth, as we can consider **social**, **economic**, and **environmental** development. When looking at global development, countries can be classified into three categories:

Advanced Countries (ACs)	Wealthy countries with a wide range of jobs and services.
Emerging Developing Countries (EDCs)	Countries rapidly developing, transitioning from low income.
Low Income Developing Countries (LIDCs)	Poorest nations which have a narrow range of jobs and services.

Global Distribution of Development:

The **Brandt Line** (North-South Divide) shows that the Northern Hemisphere benefits from being highly developed, including Australia in the South, whilst the Southern Hemisphere is underdeveloped.

Therefore, most AC countries are found in the Northern Hemisphere, with Australia and New Zealand in the Southern Hemisphere.



BRICs: Brazil, Russia, India and China are countries which have been identified as growing rapidly in terms of GDP.

MINTs: Mexico, Indonesia, Nigeria and Turkey are following the BRICs and have potential to be major world economies in future.

Measuring Development:

Social	Economic
<ul style="list-style-type: none"> Gross National Income (GNI): Measures sum of all wealth in a country. Can be divided per capita (per person). Purchasing Power Parity (PPP): Measures wealth compared to cost of living. <p><u>Criticism:</u> GNI per capita is only an average measure – may not recognise poverty.</p>	<ul style="list-style-type: none"> Life Expectancy (LE): The average age a person is expected to live until, measured in years. Literacy Rate (LR): The percentage of the population (adults) who can read and write effectively. <p><u>Criticisms:</u> Only infer wealth and do not directly take it into account. Education not necessarily related to development.</p>

Human Development Index (HDI):

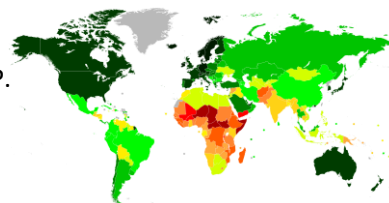
Composite index which scores nations between 0-1. A combination of three social and economic measures of development which creates an overall score.

Health: Using life expectancy.

Wealth: Using GDP per capita and PPP.

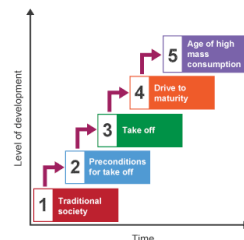
Education: Using adult literacy rate.

- Advantages:** Composite, therefore comparable. Social and Economic measures improve accuracy.
- Disadvantages:** Does not take important issues such as political freedom, democracy or environmental sustainability into account.



Rostow's Model of Development:

Five stage model showing countries pathway through development over time. LIDCs are **traditional societies** and create **preconditions for take off**, such as stable government. EDCs **take off** economically. ACs are on a **drive to maturity** and go through an **age of mass consumption**.



Dynamic Development Paper 2: People & Society

Uneven Development:

The world has not developed evenly – as seen above, there are a mixture of AC, EDC and LIDC countries. The causes of uneven development include physical factors such as location, climate, and natural resource availability, and human causes include infrastructure, political instability and colonialism. Some of these causes of uneven development are detailed below.

Population (Human):	People are needed for development – the higher the population, the easier it is to develop it.
Climate (Physical):	A warm, moist climate is good for growing crops and for people to live in.
Land (Physical):	Flat, fertile land is suitable for growing crops or urbanisation to take place.
Natural Resources (Physical):	Abundant materials and minerals, like oil or coal, are good for development as they can be used for manufacturing and trading .

Colonialism as a Cause of Uneven Development:

A major historical human factor causing uneven development is Colonialism, which is the power and rule of one country over another.

- Countries could not trade as equal powers.
- Europe and North America benefitted from colony countries resources.
- Colonies such as Nigeria and Jamaica still see the impact of colonialism today, whereby their GNI, life expectancy and literacy rates are much lower than European averages.

Barriers / Obstacles to Development:

Unlike uneven development which has resulted in the global pattern we see today, obstacles or barriers to development are current national issues which stop countries from developing.

<p>Trade Issues</p>	<ul style="list-style-type: none"> Buying and selling good and services between nations. AC countries are powerful and exert their power over LIDCs in terms of trade structure. LIDCs generally export low-value goods and raw materials, whereas ACs buy these products, manufacture them, and sell them at a much higher price. Additionally, investment from Transnational Companies (TNCs) is controlled by ACs mainly, so profits go back to the AC country. Africa has a total of 3% world imports and 3% world exports, versus Europe with 37% and 37%.
<p>Debt Issues</p>	<ul style="list-style-type: none"> The impact of debt on LIDCs is much worse than AC countries. This is because LIDCs have much lower GNI's and therefore paying the debt whilst funding all other services is difficult. The International Monetary Fund (IMF) lends money to countries on strict conditions. Since 2000, 30 of the world's poorest countries have benefitted from international debt relief, reducing the amount they need to repay, and allow them to spend more on development and their public services.
<p>Political Unrest (Conflict)</p>	<ul style="list-style-type: none"> Widespread dissatisfaction with a nation's government causes unrest. The underlying factors can include inequality, corruption, high taxes or war over resources. Civil war can break out which displaces people, disrupts food and water supply, and can destroy infrastructure. Countries such as Zambia have seen civil war in the past: during the 1980s, the Zambezi War which was a fight for liberation.

6.2 CASE STUDY: Zambia

- Southern Central Africa.
- Landlocked** country with no coast, surrounded by eight other LIDCs.
- 20 million population. Capital city is Lusaka in the South with 3 million population.



History:

Former **colony** of the **British Empire** who benefitted from mining for resources.

1964	Zambia gains independence . Unskilled and untrained workforce, power still in European hands.
1970	Global copper price declines, remaining lower for over 30 years, meaning Zambia needs to borrow money.
1980	HIV/AIDS spreads across Africa – life expectancy decreases and death rate rises in Zambia.
1990	Zambia's debt now very high. Food is expensive, and the government cannot afford to invest in development.
2006	IMF cancels some of Zambia's debt, allowing it to begin investing in infrastructure , and services such as health and education.

Current level of Economic Development:

- Human Development Index** score: 0.565 (154th place globally)
- GNI per capita**: \$4,000
- Birth Rate**: 35 per 1,000
- Death Rate**: 7 per 1,000
- Literacy Rate**: 87%
- Life Expectancy**: 61 years

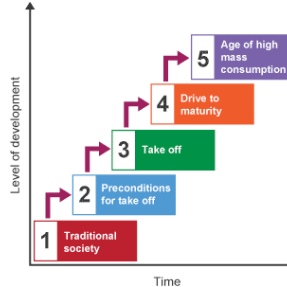


Factors Influencing Zambia's Development:

Social Factors: <ul style="list-style-type: none"> HIV/AIDS spread causes 1.2 million people suffering, death rate rises and life expectancy lowers. Malnutrition and starvation due to severe 1980s drought and high food prices. 	Economic Factors: <ul style="list-style-type: none"> Copper industry is 70% of all exports. Other markets: cobalt and tobacco Growth in other markets such as tourism, agriculture and hydro-electric power.
Environmental Factors: <ul style="list-style-type: none"> Abundance of national parks. 50% of land and soil suitable for agricultural growth. Tropical climate. Suffers from droughts, like 1980s. 	Political Factors: <ul style="list-style-type: none"> Former colonial country – 1888 to 1964. Peaceful democracy. Holds democratic elections every 5 years.

Zambia on the Rostow Model:

Zambia has improved its education and healthcare services more recently. **Investments** from TNCs is rising. Trade links across Africa are improving. There is more **tourism**, and **HEP** for energy creation as well as technology is improving slow, leading to better quality of life. Zambia is therefore in the **take off** stage.



Millennium Development Goals (MDGs):

Zambia had mixed success towards the global goals.

- Achieved **equality in primary school education** – now at 95%.
- Obtained Chinese partnership in mining, and **international debt relief** from the IMF.
- Good progress on **HIV/AIDS** – stopped the spread.
- However, **extreme poverty** only fell from 55% to 40%, and child mortality remains high 65 per 1,000.
- Overall, mixed success. Some social and economic gains but environmentally, little success.

Dynamic Development Paper 2: People & Society

Zambia's Global Connections:

Encouraging Investment in Zambia

In order for Zambia to develop, it's Government has encourage **foreign direct investment (FDI)**. It wants large, **transnational companies (TNCs)** to invest in it's industries. Zambia has lots to offer, including it's stable political system, abundant resources such as copper and natural parks, **tax incentives** and also positive economic growth since 2000.

China and Zambia Partnership:

In creating global connections, Zambia has benefitted from large-scale infrastructure improvement with Chinese investment.

- 1998, China bought **Chambishi** mine. This started a trend to today, where there are now over 500 Chinese companies in Zambia.
- These companies range from **telecommunications** to farming.
- China also improved the **TAZARA** railway line: 1,850km long, from the copperbelt to Tanzania's ports, improving export chances.



TNC Investment: Associated British Foods (ABF):

A British TNC benefitting from Zambian sugar plantations. This has provided the main employment for small towns south of Lusaka. It also supports free healthcare and schools for workers families.



However, criticism of ABF have come from the charity Action Aid, who claimed that it had paid no tax at all between 2008 and 2013. It was partly able to do this because of Zambian Government policy.

Aid and Debt Relief:

Aid: <ul style="list-style-type: none"> Lots of types: for example, international bi-lateral (one country to another) and voluntary (individuals and charities). UK donated emergency food aid following 2002 drought. China's tied aid for help with the Kariba Dam, in return for cheap energy. 	Debt Relief: <ul style="list-style-type: none"> In 2006, the IMF provided debt relief to Zambia of \$6.5 billion. Allowed for higher spending on public services such as education and healthcare – which helped Zambia to make progress towards it's MDGs. As a result, today Zambia is receiving less aid as a whole.
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Bottom-Up Development Approach: Water Aid

Voluntary aid was needed because 5 million did not have access to safe water, 8 million without adequate **sanitation**, and 5,000 children dying every year due to unsafe water or diarrhoea.



Advantages:

- Social:** Low-cost water pumps easily maintained by community.
- Economic:** Training and skills improved in local people.
- Social:** In one year, 54K people had safe water, and 42K people had improved sanitation.

Disadvantages:

- Social:** Small-scale, so only contributes to few overall communities.
- Economic:** Does not do much to improve national development.
- Environmental:** Pumps rely on regular rainfall.

Top-Down Development Approach: The Kariba Dam

Joint project between Zambia and Zimbabwe Governments, with Chinese aid. Built to produce hydro-electric power improving **energy security** & industry like copper mining.



Advantages:

- Economic:** Hydro-electric energy powers the copper industry.
- Economic:** New industry has developed, such as lake fishing.
- Environmental:** **Renewable** energy, low **carbon emissions**.

Disadvantages:

- Social:** 57K Tonga people **displaced**, resettled far away from home. Infertile land meant they suffered hunger and **famine**.
- Social:** Many communities still have no electricity.

Comparison / Evaluation: Top-Down or Bottom-Up?

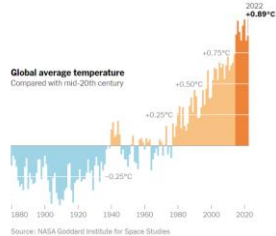
Top-Down strategies provide higher overall impact in aiding development, especially economically. Bottom-Up strategies have more social positive impacts than top-down strategies overall.

2.1 Evidence for Climate Change

Climate Change is a large-scale, long-term shift in the planet's weather system.

Quaternary Period:

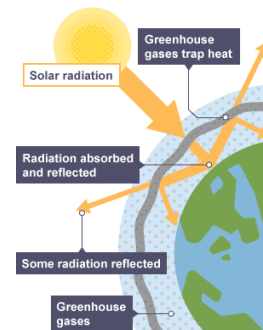
- Last 2.6 million years. Temperature always fluctuated, with cold periods called 'glacial' and warmer periods called 'interglacial'.
- Today, temperatures are high. The current trend is called global warming.



Natural and Enhanced Greenhouse Effect:

Natural: **Solar radiation** hits Earth from the sun, and is reflected back into space. GHGs help to trap some of this radiation, heating Earth. This maintains a balance.

Enhanced: Human activities, such as burning fossil fuels, produce further gases such as CO₂. This adds to the GHGs in the atmosphere, trapping additional heat, and leading to further warming over what naturally occurs.



2.1 Global Impacts of Climate Change

Food Supply (Social)	<ul style="list-style-type: none"> Northern Hemisphere benefitting from being able to produce more foods (e.g. UK and grapes) Overall yield falling, such as rice and wheat (22% less yield by 2050 in sub-Saharan Africa).
Plants & Animals (Environmental)	<ul style="list-style-type: none"> 25% of all species could be extinct by 2050. Species refugees will migrate to other parts of the world to survive (e.g. butterflies).



Changing Climate Paper 1: Our Natural World



Rising Sea Levels (Environmental)	<ul style="list-style-type: none"> 20cm rise since 1800, due to thermal expansion, melting glaciers and ice caps. Further rises will see loss of some low-lying island nations, such as Tuvalu in the Pacific Ocean.
Water Supply (Economic)	<ul style="list-style-type: none"> Many dry areas already suffer from extreme water stress. Reduced water supply impacts the fishing industry, agriculture and food supply.

2.1 CASE STUDY: Rising Sea Level in Tuvalu:

Tuvalu is a small group of low-lying islands in the South Pacific Ocean, North-East of New Zealand and Australia.

Facts:

- Highest point above sea level is just 5 metres.
- Population of 11,000 people.
- Economy relies upon fishing and the island mainly exports copra.
- It is suffering from many effects of global climate change, the most notable impact being **sea level rise** threatening its very existence.



Impacts:

Social	Economic	Environmental
<ul style="list-style-type: none"> Increased drought causing water supply issues. Water wells becoming contaminated. High tides threatening homes and roads. 	<ul style="list-style-type: none"> Salinisation of soil affecting agriculture. Coastal erosion destroying farmland. Main airport runway threatened by flooding. 	<ul style="list-style-type: none"> Ocean acidification is reducing fish stocks. Warmer sea temperatures threatening coral reefs. Salinisation of soil affecting nutrients.

Responses / Management:

- Environmental refugees to migrate to New Zealand in future.
- Sea walls constructed to protect against flooding, but these are now eroding.
- Japan supporting a **coral reef** restoration programme.

2.1 UK Impacts of Climate Change



The UK is experiencing changes to temperature and precipitation averages. Temperature has already risen by 1°C since 1990, and is predicted to rise by between 1.5°C and 2.5°C. Wetter winters and drier summers are leading to drought and flooding. The South-East is particularly at risk from these events increasing.

Rising Sea Levels:

30% of the UK's population live in coastal areas. Rising sea levels are threatening these areas, including: flooding in the East of England, £120 billion of infrastructure is at risk, and more needing to be spent on defences.

Positive Impacts of Climate Change in the UK	
Tourism: <ul style="list-style-type: none"> Warmer climate (+1°C) means more people will holiday in UK. Economically positive because of higher spending on ice cream, BBQs and days out. 	Agriculture: <ul style="list-style-type: none"> Longer growing seasons, new food types and more jobs. Sunflowers, olives and grapes can now be grown in the South-East due to this.
Negative Impacts of Climate Change in the UK	
Flooding: <ul style="list-style-type: none"> Coasts will suffer from coastal flooding and a potential loss of £120 billion in infrastructure. Extreme rainfall causing flash floods: £12 billion yearly by 2080. 	Death and Illness: <ul style="list-style-type: none"> Extreme heat affects young and elderly people most (e.g. 2,000 died in 2003 in the UK). Increasing air pollution as well as causing breathing difficulties.

Evidence for Climate Change:

Historical Evidence	
Ice Cores: Range: Long term, up to 800K years. Reliability: Comparable to previous ice and recent ice, but is only based on limited samples in Arctic/Antarctic.	Paintings & Diaries: Range: Long term, 10K to 40K years. Reliability: Visual and qualitative evidence such as Ice Age, but can't be dated accurately (is subjective).
Recent Evidence	
Sea Ice Position: Range: Recent, since 1979. Reliability: Accurate, quantifiable and dramatic data, but doesn't give evidence for long-term processes.	Temperature Data: Range: Recent, since 1880s. Reliability: Improving with continued addition of temperature stations, but early measurement are not consistent.

Natural Climate Change:

Climate Change has occurred without human existence. There are three natural reasons for the climate changing.

Milankovitch Cycles	Earth orbits, tilts and wobbles. It's proximity to the sun is therefore thought to affect global temperature: Eccentricity: Changes in the shape of the Earth's orbit. Obliquity: Changes in the Earth's tilt on its axis. Precession: The Earth's wobble on its axis.
Sunspots	Dark spots on the sun are called sunspots. They increase insolation , and the amount of energy Earth receives.
Volcanic Eruptions	Release large amounts of gases, such as CO ₂ . These can block sunlight, resulting in cooler temperatures short-term, and warmer temperatures long-term.

Greenhouse Gases (GHGs):

Carbon Dioxide: 60% of all GHGs. Burning fossil fuels.




Methane: 15% of all GHGs. Landfill, rice production and agriculture.

Halocarbons: Human made, from air conditioning and refrigerators.

Nitrous Oxide: 6% of all GHGs, from fertilisers and car exhausts.


8.1 Running out of Resources?

A **resource** is any object or material that has a purpose or use to humans. The three main resources are as follows:

Food 	Water 	Energy 
Without enough nutritious food, people can become malnourished , causing illness, halting progress.	People need a supply of clean and safe water for drinking, cooking and washing.	A good supply of energy is needed for a basic standard of living. People need light and heat for cooking.

Demand Outstripping Supply:

Resource demand continues to rise globally, and supply struggles to keep up with this demand. The **distribution** of global resources is not even, and therefore some areas have **surplus** and some have **deficit**. The reasons for **demand outstripping supply** are below:

<p><u>Population Growth:</u></p> <ul style="list-style-type: none"> Global population is now 8.1 billion, which has risen exponentially in the last 50 years. Population of 9 billion by 2050. More people means higher demand for food, water and energy. 	<p><u>Economic Development:</u></p> <ul style="list-style-type: none"> As LIDCs / EDCs develop, they need more resources (energy). These nations will continue to consume more energy. Economic development also requires water to produce food through agriculture.
 <p>A graph to show population and resource use increasing over time.</p>	<p><u>Uneven Distribution:</u></p> <ul style="list-style-type: none"> Due to climate patterns, not all areas of the world can grow crops and produce food to meet its local population. Similarly, water availability is linked to climate.

Impacts of Resource Use on Sustainability: Food

Mechanisation & Commercial Farming:

Mechanisation is the increasing trend towards replacing human labour in agriculture with machinery – which is more efficient, and includes GPS and tractor use. This leads to **commercial farming** on a large-scale, and a move away from traditional, simpler methods of **subsistence farming**. Whilst commercial farming helps to increase food production and reduce a food deficit, it has negative environmental impacts:

Biodiversity	Single-type crop growth reduces ecosystem variety.
Soil Erosion	Increases land exposed to rain and wind.
Soil Nutrients	Lost through over-farming, lost through leaching (irrigation)

Commercial Fishing:

Commercial Fishing is the large scale practice of catching fish for human **consumption**, which increases food supply and security. Fish consumption has doubled in the last 60 years to 20kg per person annually. **Fish farms** have been created to breed fish on-mass, however these suffer from disease spread. Below are the negative environmental impacts of commercial fishing.

Over-Fishing	More fish being caught than replaced, such as bluefin tuna. This disrupts the food chain and natural marine ecosystem.
Bottom-Trawling	Large nets drag along ocean floor, destroying the important sea bed, eventually causing ecosystem decay.
By-Catch	Accidentally catching species of fish which were not intended. Often thrown back to sea, but die.

Impacts of Resource Use on Sustainability: Energy

Deforestation & Mining:

Deforestation is when natural vegetation such as trees are removed, devastating local ecosystems. This is a method used for gathering wood as over 2 billion people globally depend on it for cooking and heat.



Resource Reliance
Paper 2: People & Society



Mining is also another activity to harness energy resources. Open-cast mining strips the landscape which allows for coal and minerals to be extracted below. This also requires infrastructure (e.g. roads). The impacts are:

Soil Pollution	Toxic chemicals released from rock, reducing vegetation.
River Pollution	Toxic chemicals kill fish and plant species.
Air Pollution	Dust, sulphur, acids and CO2 into the atmosphere.

Impacts of Resource Use on Sustainability: Water

Reservoirs and Water Transfer Schemes:

Less than 2% of all global water is **freshwater**, accessible and useful to humans. **Reservoirs** are large storage facilities for water, often built by damming a river, such as the Three Gorges Dam in China. From this water storage, we can create **water transfer schemes** to move the water to where it is most needed in a particular country or region. All of this human activity impacts ecosystem sustainability and also can have significant impacts on humans, such as being displaced or flooding. The specific environmental impacts are as follows:

Upstream on a River	Downstream on a River
<ul style="list-style-type: none"> Land flooded, destroying habitats. Water temperature rises, threatening species extinction. Dams block fish migration routes, such as salmon who breed here. 	<ul style="list-style-type: none"> Dams de-oxygenate water – killing fish downstream. Diversity of fish and reduced. Floodplains have reduced sediment and nutrients.

8.2 How can we create Food Security?

Food Security is the conditions where food is **accessible, available and utilised** well. It is difficult to create global food security due to rising population, economic development and uneven distribution. However, there are specific human and physical factors which influence of food security:

Physical Factors	Human Factors
<ul style="list-style-type: none"> Poverty prevents affordability and farmers from buying equipment. Conflict in regions disrupts farming and supply transportation. Food waste due to poor transport and storage techniques. 	<ul style="list-style-type: none"> Climate (rainfall and temperature averages) needs to be ideal for certain crops to succeed. Soil quality in producing crops. Extreme weather events such as flooding or drought.

Theories on Food Supply:

There are different views on whether or not the world is heading towards a food supply crisis. Theorists, **Malthus** and **Boserup**, have argued two different outcomes:

Malthus' Negative View	Boserup's Positive View
Argued population growth will always be higher than food supply, leading to famine and starvation . Believed population increases at a geometric rate, and food supply only increases at an arithmetic rate.	Argued that when population and food supply reached crisis point, new invention and innovations in technology and farming techniques would help to create more food supply.
Beliefs and Evidence	Beliefs and Evidence
<ul style="list-style-type: none"> 'Positive checks' such as famine would reduce population. Believed in a 'point of crisis' between supply and demand. World population would grow indefinitely. <p><u>Evidence:</u> 850 million suffer from hunger, LIDCs such as Nigeria have 25 million hungry, Ukraine conflict.</p>	<ul style="list-style-type: none"> Positive on population growth. Avoiding crisis is possible – large-scale contraception, later marriage. Human's intelligently create new ways of producing food. <p><u>Evidence:</u> GM crop science is reducing hunger, mechanisation in farming, AC nations continue to invest.</p>

Measuring Food Security:

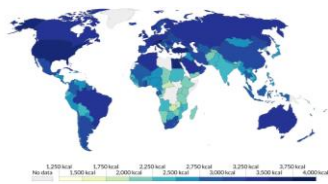
The **Global Hunger Index (GHI)**:

Composite measurement (0-100) of average people suffering hunger or illness in each country. Includes malnutrition and child stunting.



Daily Calorie Intake:

Average number of calories per person each per day. This can indicate the availability of food as well as food inequality globally.



Wealth & Health Measurements:

Health: **Life Expectancy** indicates average age of life.

Wealth: **GNI per capita** (per person) indicates ability to afford food.

8.2 CASE STUDY: Tanzania's Attempt to Achieve Food Security

Tanzania's Food Security:

Population of 65 million. Ranked as suffering serious hunger on the GHI (89th out of 116 countries). However, GHI and child mortality is decreasing. Food distribution is improving generally. Average daily calorie intake has increased from 1,960 to 2,137. This is due to less people in poverty and large and small-scale food security projects.



LOCAL-SCALE Food Security Project: Goat Aid

Background:

Babati District in Northern Tanzania. 90% rural and agricultural.

UK Charity Farm Africa ran goat aid programme to improve **nutrition**.

Toggenburg goats provide 3 litres of milk, cheese and meat at a cost of £400 each **on credit**.



Successes:

- Training for villagers on caring for goats and treating diseases.
- £200K invested in small District is a large investment.
- Profits by villagers spent on quality of life improvements, such as 25% on school fees, 20% on consumer goods and 11% on food.
- Crop production doubled by farmers as a result of better quality of life and profit compared to non-Goat Aid farmers tripled.

Criticisms:

- Goats require a lot of water to maintain their health, which is a scarce resource.
- Goats grazing on land can damage soil quality and lead to **desertification**.

PAST Food Security Project: Canada-Tanzania Wheat Project



Background:

1963 to 1993. **Hanang** District in Northern Tanzania. Aim for Tanzania to grow all of it's own wheat, reducing 80% import reliance. Severe droughts in 1970s had reduced Tanzania's own food security. Canada who had expertise provided \$95 million of aid. This included machinery, training, and chemicals.

Successes:

- It provided 60% of Canada's total wheat supply.
- 120 farmers received wheat growing training.
- 150 mechanics were trained.
- During the 1992 drought, Tanzania was the only African country not to rely on food aid.

Failures:

- **Yields** were low, **imports** would have been cheaper overall.
- Only wheat was grown, reducing biodiversity and soil quality long-term.
- Not many jobs were created.
- **Barbaig** people (indigenous) were displaced.

Evaluation of Effectiveness: Overall, it was **effective**. Long-term skills and knowledge was gained by farmers to increase food security. Tanzania no longer nationally reliant on imports only.

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PRESENT Food Security Project: Southern Agricultural Growth Corridor

Background:

The **Southern Agricultural Growth Corridor of Tanzania** (SAGCOT) started in 2010 in the central-southern belt. Government aims to develop a modern agricultural industry, creating cluster areas using the '**hub and out-grower model**'. Aims to improve **global connections** and produce more food by 2030.

Successes:

- **Kilombero** Plantation: 7,300 rice growers now connected, producing eight times more.
- 450K jobs created.
- 2 million lifted out of poverty.
- **TAZARA** railway improved by \$39 million Chinese investment.

Failures:

- Investments mainly benefit large **commercial farms** only.
- Indigenous people have lost access to water sources.
- Small landowners locked out of decision making.
- Lots promised, little complete.

Evaluation of Effectiveness: Overall, it is so far **effective**. National food security is improving. Infrastructure and TNC benefits for the long-term. Poverty reducing and diversity in crops is growing.

Sustainability of Strategies to Achieve Food Security

Ethical Consumerism: Buying products that have positive social, economic, environmental impacts.

Fairtrade	<ul style="list-style-type: none"> • Farmers get a fairer price for their products. • The profits benefit the community with paying for essential services such as schools and medical facilities. • Involves using environmentally friendly farming methods.
Food Waste	<ul style="list-style-type: none"> • One-third of all food gets lost or wasted. • Aim to eat locally sourced food to reduce waste transport. • Eating 'ugly' food can prevent waste and save money. • Prevents wasted energy for producing food and therefore reduces CO2 emissions.
Food Production:	Creating as much food as possible in the smallest possible space and time.
Intensive Farming	<ul style="list-style-type: none"> • Makes the most of the land and allows for higher yields. This can make growing food more productive and therefore cheaper to produce. • Chemical fertilisers, pesticides and herbicides can pollute the environment and harm people, animals and insects.
Organic Methods	<ul style="list-style-type: none"> • This involves the banned use of chemicals and ensuring animals are raised naturally. • This can lead to lower yields of 20% and higher prices.
Technological Developments:	Innovation and science improving methods.
Genetically Modified Crops (GM)	<ul style="list-style-type: none"> • Involves changing the DNA of foods to enhance their productivity and properties. • Crops can be better protected from disease and drought, but also made larger or include more health benefits.
Hydroponics	<ul style="list-style-type: none"> • This is a method of growing plants without soil. Instead they use nutrient solution. • Less water is needed and a reduced need for pesticides. • However, this method is very expensive so only used for high value crops.
Small-Scale Approaches:	Individual and local 'bottom-up- approaches.
Urban Gardens	<ul style="list-style-type: none"> • 15% of world's food grown in urban areas. • Small community gardens providing healthy food – too expensive to buy in LIDCs/EDCs. • Can also include livestock (chickens etc). • 'Green roofs' on apartment buildings are space saving.
Permaculture	<ul style="list-style-type: none"> • This involves people growing their own food and changing their eating habits. • This can create more natural ecosystems.