

## How have geology and past processes influenced the physical landscape of the UK?

### What are the UK's main rock types?

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

**Igneous rocks** - these are a result of volcanic activity in the past, when Britain was close to a plate boundary. Some of the igneous rocks are due to lava reaching the surface, it cooled and solidified to form basalt rock. An example of this is the Giant's Causeway in Northern Ireland.

**Sedimentary rocks** - these are made up of small particles of sand and rock, which have been transported by the wind, rivers and ice and are usually deposited on lake or seabed. Over many millions of years the sediments accumulate which are compressed by the weight of the deposits above, into sedimentary rocks formed in layers, known as bedding planes. Compressed sand forms sandstone and compressed mud becomes clay. Limestone and chalk come from the remains of dead plants, animals and marine species and are rich in calcium carbonate and contain fossils.

**Metamorphic rocks** - existing rocks that are changed by intense heat and pressure at a plate boundary. These rocks start as either igneous or sedimentary rocks and are crystallised to form rocks such as slate and marble.

### How did glacial processes influence the physical landscape?

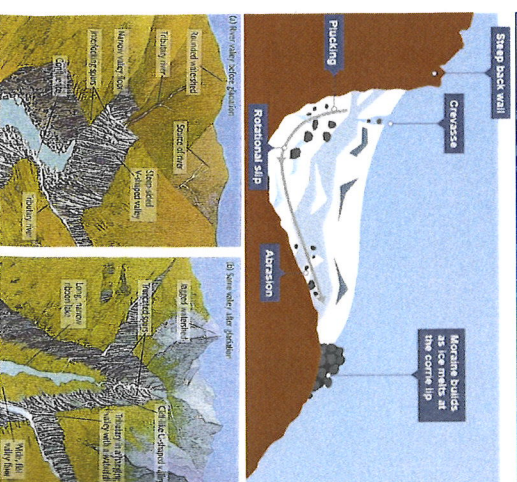
The last ice age in the UK took place around 18,000 years ago. During this time, temperatures remained low throughout the year and ice sheets and glaciers covered the north of the UK and other parts of Europe.

The two main types of glacial erosion are:

<b>Abrasion</b>	as the glacier moves downhill, rocks that have been frozen into the base and sides of the glacier scrape the rock beneath. The rocks scrape the bedrock like sandpaper, leaving scratches called <b>striations</b> behind.
<b>Plucking</b>	rocks become frozen into the bottom and sides of the glacier. As the glacier moves downhill it <b>plucks</b> the rocks frozen into the glacier from the ground.

The main type of glacial weathering is:

<b>Freeze-thaw weathering</b>	During the day when temperatures are higher, the snow melts and water enters the cracks in the rock. When the temperature drops below 0°C the water in the crack freezes and expands by about 9%. This makes the crack larger. As this process is repeated through continual thawing and freezing the crack gets larger over time. Eventually pieces of rock break off.
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## Unit 2: Topic 4 Overview—The UK's Evolving Physical Landscape

### What is Glacial transportation?

Glaciers move very slowly. As they move, they transport material from one place to another. As **freeze-thaw weathering** occurs along the edge of the glacier, pieces of rock which break off larger rocks, fall onto the glacier and are transported in this way. Rocks **plucked** from the bottom and sides of the glacier are moved downhill with the ice.

**bulldozing** is when rocks and debris, found in front of the glacier, are pushed downhill by the sheer force of the moving ice.

**Rotational slip** is the circular movement of the ice in the centre.

Any material carried or moved by a glacier is called **moraine**. The main types of moraine are:

**lateral moraine** - material deposited along both sides of the glacier. This moraine is usually made up of weathered material that has fallen from the valley sides above the glacier.

### Medial moraine

material deposited in the middle of the glacier. This is caused by the lateral moraines of two glaciers when they meet.

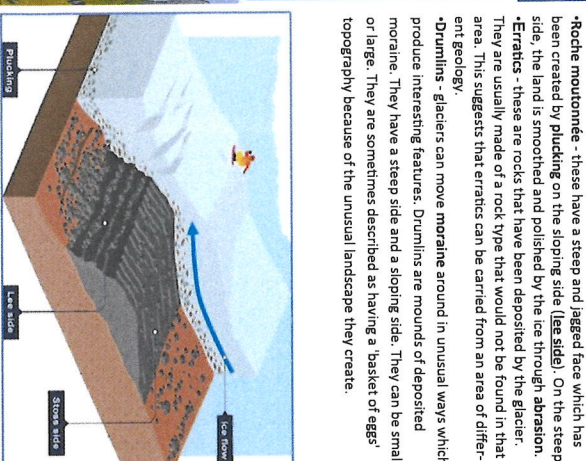
**terminal moraine** - material deposited at the end of the glacier.

**ground moraine** consists of an irregular blanket of till deposited under a glacier. Composed mainly of clay and sand, it is the most widespread deposit of continental glaciers.

### What Glacial landforms are created by deposition?

The name given to all material deposited by a glacier is called **glacial till** or **boulder clay**. Deposited material creates a range of features such as:

- Roche moutonnée** - these have a steep and jagged face which has been created by **plucking** on the sloping side (lee side). On the steep side, the land is smoothed and polished by the ice through **abrasion**.
- Erratics** - these are rocks that have been deposited by the glacier. They are usually made of a rock type that would not be found in that area. This suggests that erratics can be carried from an area of different geology.
- Drumlins** - glaciers can move **moraine** around in unusual ways which produce interesting features. Drumlins are mounds of deposited moraine. They have a steep side and a sloping side. They can be small or large. They are sometimes described as having a 'basket of eggs' topography because of the unusual landscape they create.

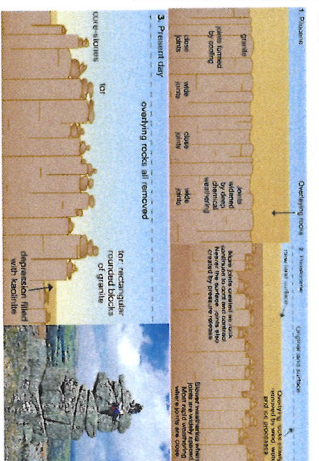


### What are Granite landforms?

The main granite landforms are **tors**, which can be found on moors such as **Dartmoor** and  **Bodmin Moor**. Tors are blocks of granite that have weathered slower than the granite around them, because they have less joints and faults.

### How are the Tors on Dartmoor formed?

The granite seen on Dartmoor originated as a granite **batolith**, under the surface of the earth. A batolith is an area of molten rock that has cooled very slowly within the crust, creating a rock with large crystals. Over time the material above the batolith was **weathered** and removed by rivers and glaciers. As this material was removed there was a reduction of pressure on the granite as there was less above it. This caused it to crack creating joints (vertical cracks) and bedding planes (horizontal cracks). Where the joints were close together the most rapid weathering occurred, and quickly broke down the rock. However, there were also areas where there were very few joints and so slower weathering occurred. The main form of weathering is **freeze-thaw**. As this process continued over millions of years, the overlying material was totally removed, leaving behind the tors and valleys seen on Dartmoor.

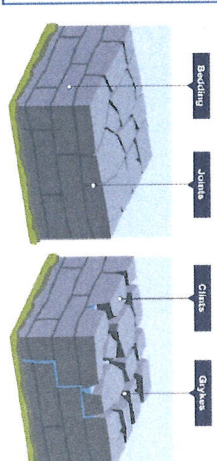


### What are Limestone Landforms?

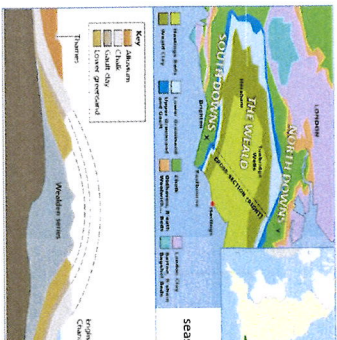
One of the largest areas of limestone in the UK is found in the Yorkshire Dales National Park, near Malham. The structure of limestone is like building blocks, with joints (vertical) and bedding planes (horizontal) separating the blocks. Most weathering takes place between the blocks where the acidic rainwater can penetrate; limestone is a porous rock.

### How is the Limestone pavement at Malham formed?

Where limestone has been exposed during periods of glaciation and the top soil has been scraped away to **expose the bare rock underneath**. Limestone is a sedimentary rock that is made up of **horizontal cracks called bedding planes** and **vertical cracks called joints**. Limestone is made of **Calcium Carbonate** which is **dissolved** by rainfall which is a weak acid. This process is called **chemical weathering**. A limestone pavement is formed when rain water seeps through the joints and dissolves the limestone on each side making the joint wider. The cracks are called **gyfkes** and the blocks are called **clints**.



### What is the landscape of the North and South Downs?





## Unit 2: Topic 4a Coastal Change and conflict

What are the two wave types?

The diagram illustrates the formation of two types of waves: a constructive wave and a destructive wave. The constructive wave is shown on the left, characterized by a long, low profile and a gentle slope. It is labeled 'Constructive Wave' and 'Long, low wave'. The water is moving towards the shore, and the beach is wide and sandy. The destructive wave is shown on the right, characterized by a steep, high profile and a sharp crest. It is labeled 'Destructive Wave' and 'Steep, high wave'. The water is moving away from the shore, and the beach is narrow and rocky. The diagram also shows various beach features like seaweed, shells, pebbles, crabs, starfish, molluscs, fish, birds, insects, plants, and animals. A scale bar at the bottom indicates distances from 0 to 100 meters.

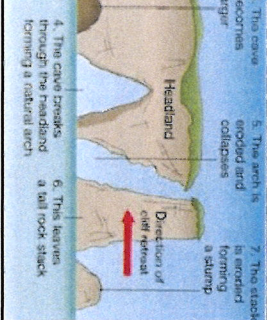
### What are the differences between concordant and discordant coasts?

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**irmed?**

By water wearing away the cliffs and sea level rising, the cliffs are eroding and the beach is being lost. The cliffs are eroding and the beach is being lost. The cliffs are eroding and the beach is being lost.

### What are the influences of transportation and stumps form?



s/platforms creat-

**Principles:**

The diagram illustrates the process of coastal erosion. It shows a cross-section of a cliff face. A dashed line represents the 'Original level'. The current cliff face has an 'Overhang' at the top. At the base of the cliff, there is a 'Wave-cut notch' and a 'Rock wave-cut platform'.

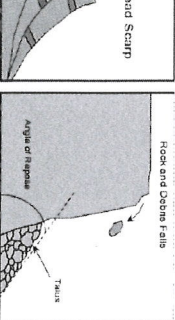
Every day when temperatures are higher, the snow or ice melts and water enters the cracks in the rock. When the temperature drops below 0°C the water in the crack freezes and expands. This process repeats itself over and over again as it is by about 9%. This makes the crack larger. As the crack gets larger over time. Eventually pieces of rock break off.

Plants grow in cracks and split the rock apart as they grow.

The movement of rocks and soil under gravity causes landslides.

When the weight of the rock and soil suddenly tumbles down the slope causing a landslide.

When the weight of the rock and soil becomes saturated. Where the rock (sandstone) meets impermeable rock (clay) and the rock slumps and slips.



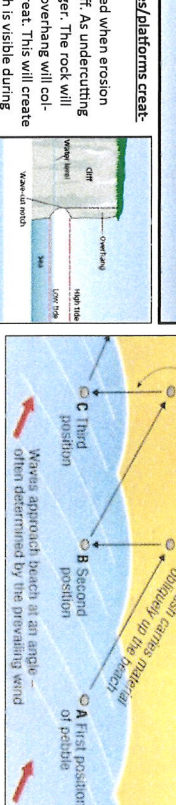
### What are the influences of transportation and stumps form?

Methods of transportation are similar to those in rivers



The transport of sand and pebbles along the coast is by longshore drift

Backwash carries material directly down the beach under gravity.



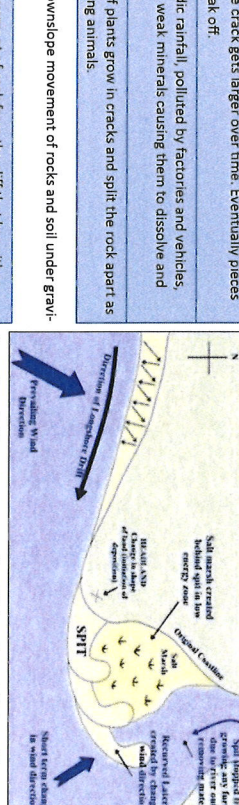
**What are the landforms created by transportation and deposition?**

When the sea loses energy, it drops the sand, rock particles and pebbles has been carrying. Deposition happens when the swash is stronger than backwash and is associated with constructive waves generally in sheltered areas such as bays, in calm conditions and with a gentle gradient.

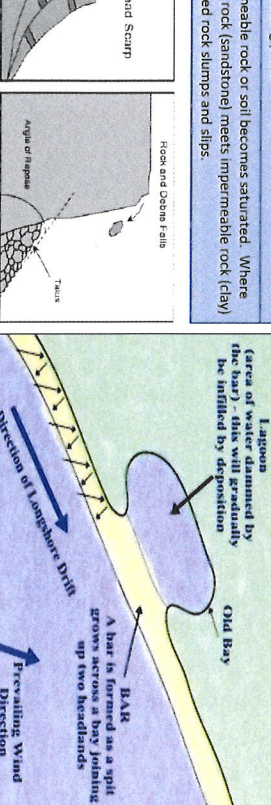
### Depositional landforms

mark. Weathering is the breakdown of rock: it is when feldspar (rock) are broken, the colour is darker. When feldspar (rock) are broken, the colour is darker. When feldspar (rock) are broken, the colour is darker.

By about 9%, this makes the crack larger. As it repeated through continual thawing and refreezing, the crack grew larger and larger. The ice drops below 0°C the water in the crack freezes by about 9%, this makes the crack larger. As it repeated through continual thawing and refreezing, the crack grew larger and larger.



rocks and soil suddenly tumble down the slope  
Government of rock from the cliff that has either  
or undercut causing the collapse



**Office of the Public Defender**

**What are the influences of transport methods of transportation are similar**

### How do human activities influence coastal landscapes?

**Headland**

Direction of

**TRACTION:** large boulders and rocks are rolled along the river bed

**SALTATION:** small pebbles and stones are bounced along the river bed

Whilst the UK's coast are affected by natural processes large areas are affected by human activities often increasing the risk of coastal erosion

4. The cave breaks through the headland forming a natural arch.

6. This leaves a rock stack.

As undercutting continues, the rock will overhang with col- lapsed rock visible during high tide.

**The transport of sand and pebbles along the coast is by longshore drift.**

Activity	Impacts
Settlements	20million people live in the coastal zone. 29 villages along the Holderness coast were lost from coastal erosion over 1000y.
Tourism	Groyne used to build and protect beaches. By trapping sand they remove sediment from the system, reducing trans- portation and deposition further along the coast.
Infrastructure	Roads, railways, oil refineries etc are located along the coast. Esso in Humber which handles 2000 ships per year trans- porting 22million tonnes of crude oil. Sea defences protect high value areas but the coastline doesn't change naturally.
Construction	Dredging removes sand and silt from the system. 1897 - 600,000 tonnes were dredged near Plymouth. 1917 the vil- lage of Hallsands disappeared with no beach for protection.
Agriculture	Farmland often has low value so isn't protected.

**When the sea loses energy, it drops the sand, rock particles and pebbles it**

...the UK with water enters the cracks in the rock. When the water freezes below 0°C the water in the crack freezes by about 9%. This makes the crack larger. As it is repeated through continual thawing and freezing the crack gets larger over time. Eventually pieces of rock break off.

...the sea level is rising. This will increase the height of the waves and when combined with high tides and rainfall will increase the risk of flooding and erosion. As sea temperatures increase the water expands at sea levels rise. Added to this ice melting on land adds to the amount of water in the oceans and seas, therefore increasing the risk of flooding. Rising sea levels: A warmer climate means that sea water will expand, ice will melt and sea levels will rise. Likely impacts are: increased erosion (especially in areas of soft rock e.g. clay), cliff retreat and the wave cut notch and platform changing position.

**Storms and Storm surges**—large scale increases in sea level (3m) due to storms. Gales drive water towards the coastline and along with low air pressure this allows the sea level to rise. E.g. 1955 a storm surge lasting 2 days breached the flood defences killing 307 people, damaging 14,000 properties and 65,000 hectares of land around Lincolnshire. East Anglia at Kent. A similar event in December 2013 was dealt with by early warnings and improved defences.

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**Can we protect our coastline?**

Planners have the challenge of identifying sustainable solutions that minimise conflicts between people and the environment through the Integrated Coastal Zone Management. The Environment Agency then publishes a Shoreline Management Plan with the following possibilities:

1. No intervention—no investment in defences against flooding or erosion

2. Hold the line—build defences to maintain the existing coastline

3. Managed realignment—allow the shoreline to change naturally

4. Advance the line—build new defences on the seaward side.

Planners use a **cost-benefit analysis** to compare the social, economic and environmental costs of 'do nothing' strategy with the costs of defences.

Advantages	Disadvantages
Defence	

	<p><b>Lagoon</b> (area of water damaged by the bar) - this will gradually be infilled by deposition</p>	<p>and buildings can prevent coastal flooding</p>	<p>to erode. The cost of maintenance is high.</p>
	<p><b>Groynes</b></p>	<p>Troughs material along the coast carried by longshore drift allowing the build up of a beach a natural defence against erosion and an attraction for tourists.</p>	<p>Can be seen as unattractive. Costly to build and maintain</p>
	<p><b>Beach replenishment</b></p>	<p>Natural defence against erosion and coastal flooding. Creates attractive tourist, inexpensive</p>	<p>Material is easily transported away, needs replacing</p>
	<p><b>Slope stabilization</b></p>	<p>Prevents mass movement</p>	<p>Difficult and costly to install</p>

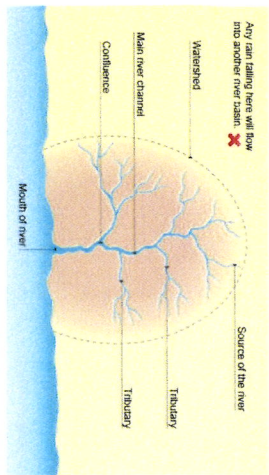


# Unit 2: Topic 4b River Processes and Pressures

## Why are there a variety of river landscapes in the UK?

### What is a drainage basin?

An area of land drained by a river or its tributaries.



### What are the features of drainage basins?

**Watershed:** Highland or hill that separates one drainage basin from another

**Confluence:** the point where two rivers/streams meet/join

**Tributary:** a smaller stream or river that joins a bigger stream or river

**Source:** the starting point of a river or stream

**Mouth:** the point where a river leaves the drainage basin and enters the sea

### How do weathering, Mass Movement, and River Erosion affect river land-scapes?

#### Weathering:

Weathering is the breakdown of rock by natural processes. There are three key weathering processes that affect river valleys:

<b>Physical (freeze-thaw)</b>	water enters cracks in rocks and freezes when temperatures drop below zero, the water expands, putting pressure on the rock. This process of expanding and contracting causes the rock to break into smaller pieces.
<b>Chemical (acid rain)</b>	slightly acidic rainfall, polluted by factories and vehicles, reacts with weak minerals causing them to dissolve and decay.
<b>Biological weathering</b>	the roots of plants grow in cracks and split the rock apart.

#### Mass movement:

Mass movement is the transfer of material down the valley/slope due to gravity.

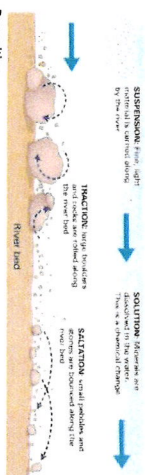
<b>Soil creep</b>	Individual particles of soil move slowly down a slope due to gravity.
<b>Slumping</b>	At the bottom of a valley slope the river erodes the valley side. Material above slides downwards rotating as it does, often after times of heavy rain saturating the rock and soil making it heavy.

#### River erosion:

The action of water wearing away rocks and soil at times of flood and on steep gradients. There are four key processes of erosion.

<b>Abrasion</b>	Load is dragged by water wearing away the banks and bed of the river and causes most erosion.
<b>Attrition</b>	Load collides with load and wears down/breaks up
<b>Solution</b>	Weak acid dissolves rocks such as limestone
<b>Hydraulic Action</b>	The shear force of the water trapping air in cracks fracturing the rock on the banks and bed of the river

### How do rivers transport load?

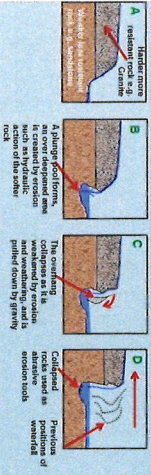


**Deposition:** When a river loses its energy deposition occurs. Heaviest material is deposited first.

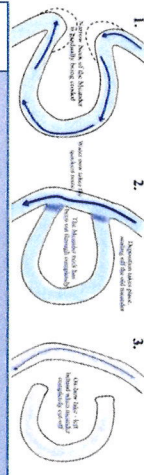
## How do river processes form distinctive landforms?

<b>Interlocking spurs</b>	At the source rivers have less power and flow around valley slopes (spurs) instead of eroding them. The spurs then interlock from one side to the other.
<b>Waterfalls</b>	Occur where water flows over bands of rock with differing resistance. Weaker less resistant rock erodes quicker due to increased velocity and creates a step in the river bed gradually undercutting the more resistant rock. Continued abrasion and hydraulic action creates an overhang and a plunge pool is created at the base from abrasion and the force of falling water. Eventually the overhang will collapse and make the waterfall steeper. Repeated causes the waterfall to retreat upstream forming a steep-sided gorge.

### The formation of a waterfall



<b>Meander</b>	Large bends that swing from side to side (sinusity) on the floodplain. Faster flowing water erodes the outside of the bend through lateral erosion creating a steep bank (river cliff) whilst the inside of the bend due to slower shallower water deposition takes places creating a gently sloping bank (slip of slope).
<b>Oxbow Lake</b>	When a meander gets its neck narrower then at times of flood the river simply cuts straight through it leaving an old meander cut off (horseshoe-shaped lake). Deposition blocks up the old bend.



<b>Levees</b>	Levees are natural embankments formed by the deposition of sediment at times of flood. Large sediment is dropped first as the river floods onto the floodplain and loses velocity. Smaller sediment is deposited afterwards and when this process is repeated the banks get higher forming Levees.
<b>Flood-plains</b>	The area of land at the side of a river in the lower course. Lateral erosion on the outside bend cause meanders to migrate across the valley floor so the valley floor becomes wide and flat. During floods rivers deposit fine sediments called alluvium.

<b>How is a delta made?</b>	Water speed decreases near the sea. Material is deposited. Over time this builds up to create an area of new land - a delta. Because the river is now flowing slowly the channel fills up with sediment and the river splits into different streams, distributaries.
<b>How is a delta made?</b>	Deposition occurs at the river's exit when it enters the sea. Heaviest material is deposited near the river's exit. Over time, the river splits into distributaries. The delta is built up.

## How do climate, geology and slope processes affect different river landscapes?

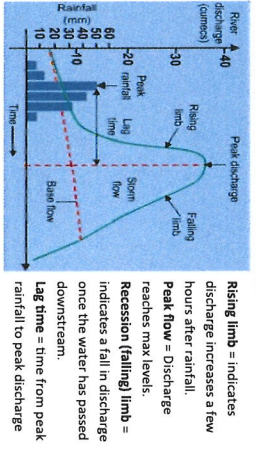
How does the long profile of a river change according to the Bradshaw model?

Upper course	Mid-course	Lower course
60m above SL, 2500mm rainfall, Hard impermeable geology e.g. shales	100m rainfall, Softer permeable rock e.g. sandstone	Soft geology e.g. mudstones, River 70m wide

Characteristic	Changes downstream
Gradient	Decreases: Steep source (hills) Gentle mouth due to a shift from vertical to lateral erosion.
Velocity and Discharge	Both increase due to tributaries feeding more water into main channel and reduced friction.
Channel width/depth/roughness	Becomes wider/deeper/smoother and more efficient with less friction.
Sediment/Load	Smaller: source - boulders/cobbles then pebbles/sand finally mouth - silt/clay due to abrasion and attrition. Capacity increases downstream.

### How do physical features and human activities affect storm hydrographs?

A hydrograph is a way of showing how a river responds to a rainfall event showing the relationship between rainfall (mm) and discharge (m³/seconds). The shape of a storm hydrograph varies due to a number of factors:



Physical Feature	Human Activity
Precipitation	Heavy, rapid snow melt
Geology	Impermeable rock
Drainage basin size	Small, rain reaches quickly
Soil, slopes, vegetation	Frozen, saturated, clay, steep, little vegetation, deforestation
Towns/cities	Urban areas, impermeable surfaces
Antecedent conditions	Heavy rainfall, saturated

### How do human and physical processes interact to cause of flooding?

**E.g. Yorkshire, UK 2007**  
2007 saw very heavy rainfall in June and July with rivers level at their highest for over 100yrs. Rainfall doubled the average for these months and reached 140mm on one day. 20th July in just a few hours caused by a series of depressions and a strong jet stream. Antecedent weather conditions led to immediate run-off over saturated soils into already swollen rivers. Flash flooding in urban areas e.g. Sheffield caused flash flooding. Areas at the confluence of two tributaries e.g. Tewkesbury along the Severn and Avon. It's Abbey flooded for the first time in 250yrs.

## Why is the flood risk in the UK increasing?

Flooding is a natural occurrence but since 1998 severe flooding has occurred somewhere in the UK every year sometimes twice - in a year. The main reasons for this are as follows:

- Increased population = more housing. Building on the 'cheaper' land of the flood plain has put 2.3 million houses at risk of flooding.
- Land use changes with urban developments = more impermeable surfaces which increase surface run-off.
- Changes in weather patterns linked to climate change making extreme weather more likely as a result of the changes in the behaviour of the jet stream. Storms that once occurred every 100yrs are now more likely to happen every 80yrs in southern UK.

### How does the Environment Agency manage flood risk?

The Environment Agency makes Catchment Management Plans, manages rivers and land use, controlling developments in flood plains, building flood defences as well as helping people to prepare and plan for warnings.

### How is flooding reduced through Catchment Management Plan?

The EA works out the chances of a flood happening for example: Mr. The river Severn has a 1% chance of flooding which would put 60,000 people and 29,000 business at risk as well as infrastructure including roads and power supplies. The plan would then include the following actions:

- reduce run-off by improving land use and restoring flood plains
- prevent unsuitable developments on the flood plain
- improve flood defence in urban areas and protect vulnerable buildings
- work with natural flood processes where few people live.

### How can flooding be reduced by hard and soft engineering?

Hard Engineering	Advantages	Disadvantages
<b>Embankments - high banks (levees)</b>	Stop overflowing, prevent erosion of banks and flood plain.	Can limit urban development, prevent water from flowing through.
<b>Flood walls</b>	Prevent water overflowing onto flood plain, protect buildings.	Expensive, cause flooding, prevent water from flowing.
<b>Demountable flood barriers</b>	Can be up and down, allow water to flow when not in use.	Not a long term solution, can be damaged, expensive to maintain.
<b>Flood barriers or storm surge barriers</b>	Prevent large waves, can be raised up, prevent water from flooding.	Not a long term solution, can be damaged, expensive to maintain.
<b>Soft Engineering</b>	<b>Advantages</b>	<b>Disadvantages</b>
<b>River restoration - rivers original course including meanders</b>	More effective for rivers original course, natural meanders.	Some flood plains are lost, expensive.
<b>Floodplain retention- land use according to flood risk</b>	Low risk areas are used for building, high risk areas are used for parks.	Not a long term solution, can be damaged, expensive to maintain.

### What decisions are made before building flood defences?

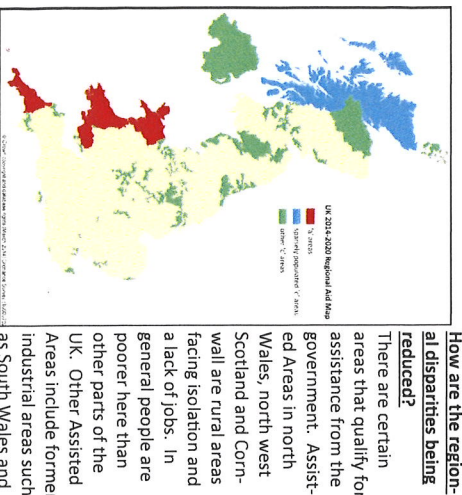
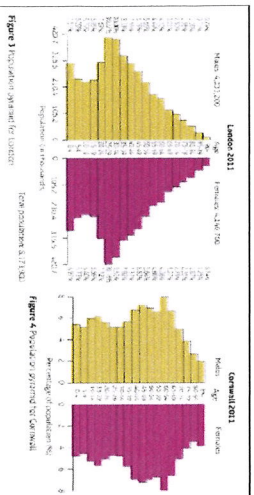
Because flood defences are so expensive the EA works out which would be most effective with limited environmental damage by conducting an impact assessment (residents, business, transport, wildlife and habitats) and a cost-benefit analysis (value for money). In 2000, severe flooding of the river Severn affected 140 in Bewdley so local residents and businesses want to improve the flood defences. The EA worked a number of possible options including the costs and benefits:

Costs	Benefits
1. Do nothing therefore £0	1. Little benefit except £0 spent
2. Maintenance of banks £0.2m	2. Bank collapse prevented
3. Storage dams 1km upstream £15m	3. Volume of water reduced wouldn't prevent a 100yr event £0.5m
4. Demountable aluminium flood defences, 2.7m high costing £6.9m	4. 150 properties protected, 24hr warning required £7.5million



**Why are population, economic activity and settlements key elements of the human landscape?**  
**How do the urban core and rural periphery compare?**

	Urban core E.g. London	Rural periphery E.g. Cornwall
<b>Population density</b>	High, over 200 people per km <sup>2</sup>	Low, 1-100 people per km <sup>2</sup>
<b>Age structure</b>	Young adults, single people	Older people, some single
<b>Economic Activities</b>	Retailing, large shops, offices, HQ's, many jobs	Farming, fishing, forestry, mining, working from home, tourism,
<b>Settlement</b>	Conurbation, large town, high and low rise buildings, expensive	Market towns, villages, farms, low rise generally cheaper



**How are the regional disparities being reduced?**

There are certain areas that qualify for assistance from the government. Assisted Areas in north Wales, north west Scotland and Cornwall are rural areas facing isolation and a lack of jobs. In general people are poorer here than other parts of the UK. Other Assisted Areas include former industrial areas such as South Wales and North-East England where a decline in coal, steel and ship building left unemployment and poverty.

**What is regional development and transport infrastructure?**

The EU's Regional Development Fund supports UK regions by economic regeneration for example projects connecting businesses to fast broadband enabling people to live in Cornwall and work from home. Investment in transport for example rail routes linking Manchester with Sheffield.

## Unit 2: Topic 5a The UK's Evolving Human Landscape

**How does migration shape the UK economy and society?**

**Retirement migration**

Older people moving within a country when they retire. The SW attracts many retirement migrants because of beautiful scenery, slower pace of life, lower crime rates and a sense of community.

**Rural to urban migration**

Advantages	Disadvantages
Creates demand for services, shops and social activities creating jobs locally	Healthcare pressures, house price rise, young people move out

In rural areas, apart from a few jobs in farming, fishing or mining/quarrying jobs opportunities are scarce so young people leave to find better jobs in the city leaving a concentration of older people.

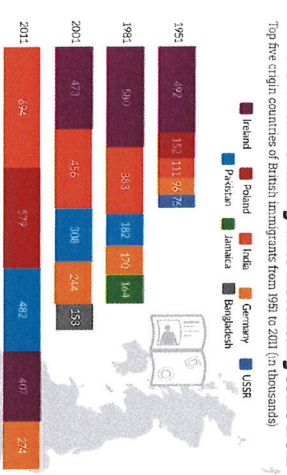
**International migration**

The UK government encouraged immigration from former British colonies in the Caribbean, India and Bangladesh during the 1950's in response to shortage of workers reaching 1million by 1971. During the 1970's there was no longer a shortage of workers and immigration was controlled by the government. Around 2004 and the enlargement of the EU saw young immigrants, 80% aged 18-34, from Eastern Europe especially Poland to cities such as London and Birmingham for jobs in industries or fruit farming. In 2014 560,000 immigrants arrived in the UK and during the period 2012-15 people fled from fighting in Syria and Afghanistan arrived in cities like Birmingham.

**What are the impacts of international migration?**

Advantages	Disadvantages
Source of cheap unskilled (construction) and skilled labour (doctors/nurses). Benefit of a youthful population. Introduced to new cultures	Puts pressure on services e.g. housing, healthcare, education, social unrest

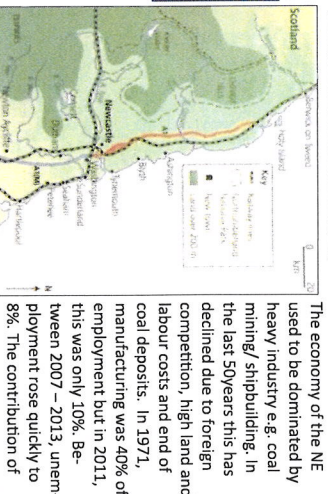
**Where Britain's immigrants historically come from**



**How is the UK economy changing?**

There have been many changes in the UK economy in the last 50 years in the primary, secondary, tertiary and quaternary sectors. These changes are best seen in two contrasting regions on the country, the NE and SE of England.

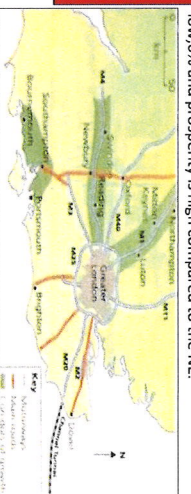
**How has the North East changed?**



The economy of the NE used to be dominated by heavy industry e.g. coal mining/shipbuilding. In the last 50 years this has declined due to foreign competition, high land and labour costs and end of coal deposits. In 1971, manufacturing was 40% of employment but in 2011, this was only 10%. Between 2007 – 2013, unemployment rose quickly to 8%. The contribution of the area to national GDP is only 2%. Between 2011-12, child poverty rates in Middlesbrough and Newcastle rose 39% on average. In rural areas, economy still relies heavily on agriculture. Mining, fishing and quarrying are very small scale. Manufacturing is based in urban areas but employs fewer people due to increase in machines and new technology. Manufacturing, especially chemicals, are still important but employ fewer people with improved technology and Nissan employ 4000. Tertiary activities have increased (257,000) which has reduced unemployment slightly, 22% of all employment.

**How has the South East changed?**

Primary industries are mainly centred on farming in rural areas with some of the most prosperous farms in Britain. Manufacturing industry is growing rapidly, mainly in urban areas and along the M4 corridor, a centre for light industries in electronics and engineering. The region is very important for tertiary and quaternary industries in financial and business service firms. Unemployment is low, 6% and prosperity is high compared to the NE.



**Why is the South East so attractive to industries?**

**Transport**—M25 motorway network and railways. 72% of UK freight was carried on roads in the south-east. It has 4 major airports e.g. Heathrow and Gatwick. **Markets and labour**—a market of 19million people, skilled labour from Oxford and London Universities. **Political**—Close to national government. Previous governments encouraged movement from London to the South East. **Geographical**—transport routes radiate from London and its close to the channel tunnel giving access to Europe.

	% of UK pop	Median age	Unemployment %	Manufacturing employment 2011
NE	4	41.5	8.2	10.2
SE	14	40.8	6.0	7.2

**What are the effects of Globalisation, trade and investment?**

**Globalisation**

The growing importance of international operations for all economic sectors and for the culture and way of life of people around the world.

Manufacturing, tertiary and quaternary industries are being increasingly affected by decisions and events in other parts of the world. The three key elements of the global economy are:

**Networks**—linking countries together e.g. internet/trading blocs

**Flows**—goods and services that move through networks e.g. raw materials, manufactured goods or migrant workers

**Global players**—organisations that have a big impact on the working of the global economy e.g. TNCs, World Bank, IMF

**Privatisation**

Privatisation of many UK industries e.g. steel, railways, computers, airports, docks, petroleum, electricity, water, gas and postal services.

The Effects of privatisation include:

- Increased Foreign Direct Investment (FDI) from businesses wanting to invest in the UK.
- Increased awareness of markets and increased competition
- Increased foreign ownership of UK firms
- Dividends and profits from some UK based firms going abroad
- Loss of jobs in the UK due to increased efficiency

**Free trade**

Firms want to and need to take part in international trade to increase their profits. Global links can significantly increase the market for a firm. Not all trade is free trade which is trade without tariffs or import duties. Some countries have high import duties to protect their industries. The UK, as part of the EU, has pursued a policy of promoting free trade with the EU to allow the free movement of goods and services which should make them cheaper.

**Foreign Direct Investment (FDI)**

FDI is composed of the flows of money (capital) from businesses in one country to another. The flow of finance allows the companies to become involved in the business life and markets of the receiving country—for the UK, this is the EU markets. The companies can vary from giant TNCs e.g. GlaxoSmithKline. In 2014, the largest investor in the UK was the USA. 50% of investment into the UK came from European countries. Most of the investment was in energy projects e.g. wind and nuclear or infrastructure e.g. airports and hotels.

**Transnational Companies (TNCs)**

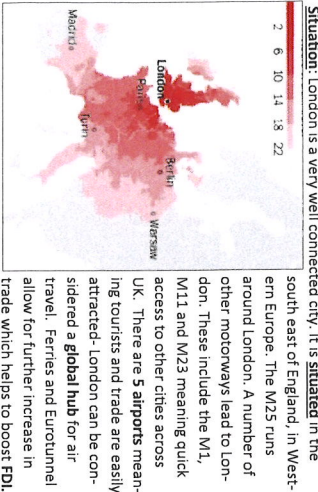
TNCs are large companies that operate in a range of other countries. They are powerful players in the global economy and link up national economies in many different parts of the world. The top TNCs are involved in 3 main industries—oil, electronics and motor vehicles. Some TNCs are specialised e.g. Nestle (food & drinks) or Rio Tinto (mining) where are others e.g. Mitsubishi have a range of interests e.g. vehicles, air transport and food processing.





What is the significance of site, situation and connectivity of London?

**Site:** Located on the Thames River, the land is flat as it is on the flood plain. Located on the Thames as this was a 'bridging point' during Roman times. Romans bridged the Thames after their arrival in Britain in 43AD. The site they chose was the last place the Thames was shallow enough to cross. Economically this meant that businesses started in the area and trade soon started. Market traders originally met there but the new bridge met. With the market came houses and within decades a significant town – 'Londinium'.



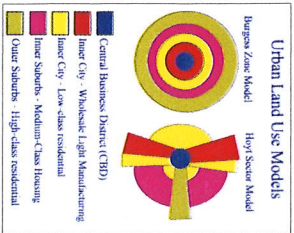
### What is the significance of London?

Regional Significance	National Significance	Global Significance
Inner London's GDP per head was 328% of the European Union average in 2010.	The UK's fastest rail services link London and major UK cities. Manchester and Birmingham each have 3 fast services an hour.	Being close to Europe, London can trade by sea or air quickly.

The capital generates 22% of UK GDP despite accounting for only 12.5% of the UK population. The UK population is concentrated in London like spokes of a wheel. Most major A roads and motorways lead to London, linking it with other major cities. It's a radial network: roads converge in London like spokes of a wheel.

### What is the structure of London?

London's structure is more complex than both the Burgess model and the Hoyt model. Its main economic function has shifted to the Docklands and now includes world famous building like Canary Wharf. In some ways you could say London has 2 CBDs, many businesses and tourists are attracted to Central London and as with the Burgess model the city becomes more suburban in its function as you get further out. Housing age decreases and in many areas we are seeing new development in residential areas. With the internet and transport businesses are starting to move out of town for cheaper rent, they are 'footloose'. Environmental quality improves as you get further out, there is less traffic and pollution and population density decreases.



## Unit 2: Topic 5b The UK's Evolving Human Landscape – London case study

### Central Business District (CBD)

The CBD is the oldest part of the city and is where most of the offices are found. London's radial roads mean that it's very accessible from all parts of London. This leads to higher land values which make it high density, therefore buildings are built high to maximise value. London's CBD has expanded recently to include Oxford Street in West London and Canary Wharf in East London. Central London benefits from large parks e.g. Hyde Park but also has the UK's worst air quality due to traffic.

### Inner city/inner suburbs

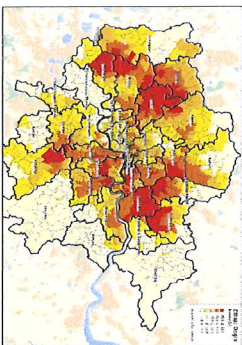
In the Industrial Revolution, factories and densely packed terraced housing were built close to central London. A few high-income suburbs also developed whose population (rich upper-class) wanted to be close to the city. The inner suburbs have a very varied – Kensington is one of the world's most expensive suburbs. Hackney is an area of old factories and new flats. Large houses are now being divided into flats for rent. The environmental quality varies between run-down areas (Hackney) and Kensington.

### London's urban-rural fringe

Where the city meets the countryside is the urban-rural fringe. Almost every house has a garden, so building density is lower. Most houses were built in the late 20<sup>th</sup> century and there is some industry, near underground, but the area is mainly residential. Environmental quality is much higher.

### How is migration affecting London?

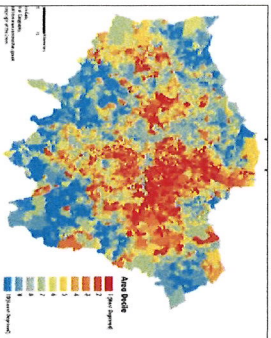
Most migrants are adults aged between 18-35. Migrants from within the UK tend to be graduates from UK universities seeking work and a London lifestyle. International migration consists of skilled and unskilled workers.



**Skilled workers** – take up well-paid jobs in the knowledge economy in London. Migrants with particular skills get jobs when there are not enough skilled people in the UK. Most migrants tend to be white, high-qualified professionals from the EU, USA, South Africa and Australia. **Unskilled workers** – do jobs unvalued by UK workers (refuse collection), unskilled hours (pizza delivery). Construction, hotel and restaurant companies would not have enough workers without them. Any come from the EU, but also India, Pakistan, Bangladesh and West Africa. Most recent migrants seek cheap rented accommodation. They aren't eligible for social housing so take private rented property in inner city areas. Clusters of particular ethnic communities develop which help defend migrants from discrimination, support ethnic shops and services and help to preserve cultural distinctiveness. **Blitz Lane** is an example of immigration playing a role in changing culture, restaurants, shops selling saris and a mosque are all evidence of this.

### What are the patterns of inequality in London?

The Index of multiple deprivation (IMD) measures inequalities across cities. In London inequality is highest in East London. Traditionally the London docks were in this area, **transport links** were poor to reduce potential for robbery as a result few businesses were located here. This means a **negative multiplier effect** where people don't have jobs, there is less tax paid, councils have less to invest in education and services so people get worse jobs. In 2012, over 2 million people lived in poverty (28% of the population). Incomes in London are more unequal than any other part of the UK.



### How do Newham and Richmond upon Thames compare?

Newham is one of London's most deprived areas while Richmond is one of the wealthiest. Incomes were low in Newham, so more students are on free school meals. Incomes in Richmond are twice as much on average than Newham. The percentage of those with degree qualifications is much higher which allows people to get better paid employment. Health of those in Newham is worse with more people having a limiting long-term illness which limits people's ability to learn and work. In both areas, percentage of 19-year olds without qualifications is high, meaning they are limited to unskilled jobs.

	Newham	Richmond
People with long-term illness	12.3	7.6
Premature deaths (before 65/100 000)	210	121
% with 5 GCSEs A*-C	38	37
% adults with degree	26	64

### Why is there inequality in London?

**Deindustrialisation** London's dock closed in 1981, due to the use of containers to transport goods by sea. The new container ships were larger so ports moved downstream where the water was deeper. Industries that relied on the port moved too. Industries in London's biggest manufacturing area closed down. In 2001, only 7.5% people worked in manufacturing, from 30% in 1971.

**Depopulation** - Closures had a massive impact on communities. East London had an unemployment rate of 50% in some areas. 'People left in search of work' – over 16% of the population left inner London suburbs between 1971-1981 (500 000 people!)

### What challenges have been created by the changes in London?

**Suburbanisation** – depopulation speeded up a process whereby outer London suburb gained people that left inner London suburbs. Flats were replaced by houses with a garden. Over 1.5 million left London between 1951 – 1981. Reasons for suburbanisation include: Underground was established by 1930 so workers could be in the inner city in 30 minutes. Electrification of surface rail made it easier to travel to London from further away e.g. Guildford which is 50km away

**Decentralisation** - Shift to the suburbs meant people spent their money there. People began to shop by car, not train and this shifted the shopping activity and employment from the CBD towards: **Out of town shopping centres** – developed undercover shopping to attract customers e.g. 'Treaty Centre, Hounslow

**Retail parks** – built away from suburban shopping centres but close to major circular roads

**Business parks** – areas for employment e.g. Stockley Park near Heathrow

**E-commerce** – buying online has further decreased the shopping e.g. Amazon

How has urban living in London been made more sustainable and improved quality of life?		
	Aim	Outcome
Transport	Reduce greenhouse gas emissions	Congestion charge introduced in 2003 to encourage more people to use public transport. All London buses are hybrid which reduces CO2 emissions 4500 electric vehicle charging points to be in place by 2018
Employment	People encouraged to work from home 1/2 days a week	Number of people who work from home increased from 4.3% to 8.6% in 2011
Affordable housing	To increase the amount of affordable housing	East Village in Stratford has 50% affordable housing but still need to earn £63 000! Shared ownership is becoming more common – own part of a property and rent the rest
Energy efficiency	To promote sustainability	BeZED has 100 apartments and offices – it uses 81% less energy for heating, 45% less electricity, recycles 60% of waste and 58% less water. It is London's only project though!
Green Spaces	Increases quality of life	Can lead to loss of farmland and loss of rural scenery. The Green Belt around London could be in trouble – it is close to London and ideal to build houses
Waste	Reduce household waste by 10% by 2010	Re-using waste and providing accessible recycling (bin: everywhere) Developing waste-burning power stations to create heat and power

### How have parts of London experienced economic and population growth?

More recently (during the 1980s) the Docklands and East London have experienced regeneration. Government investment in attracting business (Special economic zones – low taxes) and more transport links (Jubilee line, East London line, DLR). This has had a positive multiplier effect. More job opportunities attract more people which means more income and facilities are created. Gentrification (the movement of wealthier people into the area) and studentification (arrival of students in increasing numbers) means that the culture of the area changes, there are more cafes, restaurants and shops which at times can be unaffordable for the 'locals'. As the area becomes more popular house prices increase and 'locals' are 'forced out'. Stratford has also undergone regeneration through the Olympics. This has changed people's perception of the area 'rebranding' and is attracting people into the area.

### How have regeneration and rebranding of the city had positive and negative impacts on people?

Positive impacts	Negative impacts
Transport links were improved – the new DLR and Jubilee Line. Transport links are running expanded hours (buses 24 hours). Eurostar, city airport, cycle lanes	Many local people were forced out. 36% of the local people were unskilled workers living in social housing – they weren't qualified for the jobs available (Borough of Newham)
The environment has been improved and quality green space created e.g. Olympic village - Biggest urban park in Europe	Traditional businesses closed and were replaced with services for the wealthier population (expensive restaurants)
Businesses have been attracted back, creating jobs and investment	Existing communities were destroyed, local people were moved to new towns and estates on the edge of London (Chigwell, Essex)

### How is London interdependent with its rural surroundings?

Chelmsford's population has increased from 55 000 in 1971 to 168 000 in 2011. It's population growth is due to people migrating from London. This works well for people as high London salaries mean that rail tickets are affordable and house prices are much cheaper. London relies on the rural-urban fringe as there are not enough people living in London to work. 650 000 people commute to central London. Rural-urban fringe areas benefit from higher salaries paid in London but residents have to deal with crowded commuter trains and congested roads. Housing estates are built on the edges of London, so the fringes shift outwards so Greater London changes from outer suburbs, to green belt to dormitory towns (during the day empty, commuters return to sleep and eat) to villages to rural landscape. London relied on the surrounding rural areas for food – many farmers sell their produce to supermarkets and wholesalers who transport it into the city. Also, many rural people travel into London to do some of their shopping as there is a greater selection of shops.





Unit 2: Topic 5c The UK's Evolving Human Landscape—Devon/Cornwall case study

What are the challenges and opportunities of rural change?

The challenges of availability and affordability of housing, decline in primary employment, provision of healthcare and education and how they affect quality of life (IMD) for some rural groups. New income and economic opportunities are created by rural diversification and tourism projects may have environmental impacts.

Affordable housing

Property prices are rising in rural areas because they are attractive places for different groups of people. Older people who want to retire to the countryside are attracted by the peaceful, slower pace of life in a pleasant environment. People who work in urban areas also want to live in the countryside and commute to work. Properties are larger with outdoor space suitable for young families in a pleasant, safer rural environment. These two groups buying homes push up prices beyond the reach of local people so the challenge is to provide affordable housing for locals in rural areas



Services

Bus services in rural areas have declined as have schools, doctors surgeries and shops. 35% of rural villages had no food shop, 76% no doctors and 85% had no chemist. Schools are expensive to run but villages campaign that schools are at the centre of a community. Services for teenagers are also lacking with long distances needing to be travelled for their education, entertainment and recreation and as such many complain about their quality of life.



Transport

On average 65% of households in Britain have regular use of a car and is higher in rural areas. Increased car ownership reduces the need for bus services so fares increase and frequency is reduced resulting in fewer passengers in a vicious circle.



How do we measure the quality of life using the IMD?

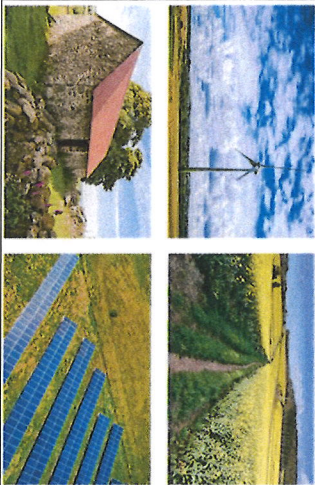
The IMD covers seven main types of deprivation which are weighted based on the governments levels of importance:

- 1. Income deprivation (23%)
- 2. employment deprivation (23%)
- 3. health deprivation and disability (13%)
- 4. Education, skills and training (13%)
- 5. barriers to housing and services (9%)
- 6. crime (9%)
- 7. living environment (9%)

What is rural diversification?

Many farmers are finding it hard to make a living from traditional food production alone so develop methods of income generation from their farm whilst still farming or by transforming their farms into a range of completely different businesses for example:

Products	Outlets	Tourism	Leisure	Development	Energy
Organic crops	PYO	B&B	Shooting	Barn conversions	Wind turbines
Different animals	Farm shop	Caravan camp	Off road driving	Industrial units	biomass solar farms
Ice cream	Farmers market	site café	Paint-balling		



What are the challenges and opportunities of rural change in Cornwall?

What is Cornwall like?

540 000 people live in Cornwall with 4 million tourists visiting it each year. It has a 700km coastline with sandy beaches. It has one of the UK's fastest growing populations.

What are the issues in Cornwall?

Length of county – 140km from one end to another. Transport is very slow – no motorway and trains take 2 hours.

No large population centres – largest only has 23 000 people. No knowledge economy to raise incomes so Cornwall has the UK's lowest weekly wage (£340 compared to £660 in London).

What are Healthcare and services like in Cornwall?

West Cornwall is one of the UK's most deprived areas. It has a high percentage of elderly people, few services and lowest average wage.

Only 38% of villages have a doctor's surgery & most are only open once a week. 70% of villages have buses but they only run 3-4 times a day

Main hospital in Truro but for many people it is over 30 miles away – difference between life & death

Young people have to travel 30 miles for 6<sup>th</sup> form education/training & travel costs are high

What are the Index of Multiple Deprivation measures in Cornwall?

- Income – Low
- Employment – medium
- Health & disability – low
- Education, skills & training – low
- Housing & services – very high
- Crime – very low
- Living environment – very high

What Primary industry exists in Cornwall?

Decline of primary economy had left the county with few permanent, full-time jobs

Farming – number of cattle farms has fallen by 60% since 2000 due to falling milk prices

Fishing – stocks in decline due to overfishing by UK/ EU fishing boats

China clay quarrying – one employed 10 000 people in 1960s but TNCs have moved overseas for cheaper clay

Tin mining – collapse of tin prices has meant closure of Cornwall's last tin mine in 1998

What was the Biggest IT move in history?

In 2003, the Metrological Office (responsible for the weather) moved 1200 people from its office in London to the Exeter in East Devon. It meant new jobs for the rural region as not all staff moved. The local council estimates that the move has brought an extra £74million annually to East Devon through the multiplier effect. This is due to:

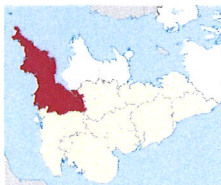
- Money spent moving house e.g. grants towards moving costs
- Regular weekly spending e.g. shopping, leisure, supermarkets

Why choose East Devon?

Land rental is much cheaper £9 per sq ft (£90 per sq ft in London)

Daily flights from Exeter Airport to London, UK & Europe

Good train links & road links (M5)



What problems were created by the movement of people?

Population change – in 2015, 5000 migrants moved there from other parts of the UK. It is also sunny and accessible. Part of the increase is due to retirement migration and some is family migrants. Pressure on housing – 2/3 of Devon is classed as an area of natural beauty (AONB) which makes planning permission hard to get which pushes up house prices. Average incomes are 10% below natural average but housing is only 3% cheaper here so more affordable housing is needed. Pressure or leisure and recreation – many attractions are located close by – Jurassic Coastline (Swanage) and Dartmoor national park. 15 million-day trips are made every year. This puts pressure on the roads and environmentally sensitive areas.

How has farming changed in Cornwall?

Diversification

With farm incomes falling, farmers make a income in alternative ways. This is called diversification whereby they do a wider range of activities to enable a farm to survive:

**Farm shops** (e.g. Trevilley) – 3 families developed a farm shop using a £200 000 grant from the UK/EU government. Shops sell meat and vegetables which has created 12 full-time jobs and 8 part-time jobs. They have increased from £30 000 income per year to £700 000 per year. Every £10 spent in farm shops becomes worth £23 in the local economy through the multiplier effect.

**Tourist accommodation** – barn conversions and camp sites can give farms additional money. A few farms have also invested in log cabins, health spas (e.g. Merlin Farm Cottages) and swimming pools. While this has increased tourism, it has led to a reduction in nesting places for birds such as swallows and owls

What are some of the opportunities in rural areas?

What are their costs and benefits?

Project	Benefits	Costs
Eden Pro-tourist attraction in Cornwall	Visitors spending on accommodation and meals generated £1 billion to the Cornish economy. It employed 700 people and generated 3000 jobs elsewhere	Sustainability aims have taken short, it promotes use of cycle paths and reduce entry costs to anyone who comes by transport but 97% of visitors arrive by car. Visitor numbers are also falling.
Diversification – Farm shops	It has created 12 full time jobs and 8 part time jobs. The turn over is now £700,000 per year. The shop also educates people about sustainable farming. Local businesses that are supported creates the multiplier effect.	If more farms take this route of diversification, it could mean less farmers focus on farming food for the UK, threatening our food security.
Diversification – Tourist Accommodation	They have invested in leisure complexes such as spas, cabins, play areas and swimming pools could attract families.	Increasing number of barn conversions lead to less habitats for nesting birds such as owls and swallows.



**What global factors affect biome distribution and characteristics?**  
A biome is a global scale ecosystem, where all the plants and animals interact perfectly together with their living and non-living environment e.g. Tropical rainforest.

**Where are the biomes of the world?**  
To describe the distribution of a place is to state where something is found and any patterns in it's location and point out areas that don't fit with the general pattern. For example: **Tropical rainforest** found on either side of the equator, about 15 N or 15 S where the climate is wet and not condition perfect for all year round growing plants. There is no tropical rainforest in East Africa even though it is on the equator.

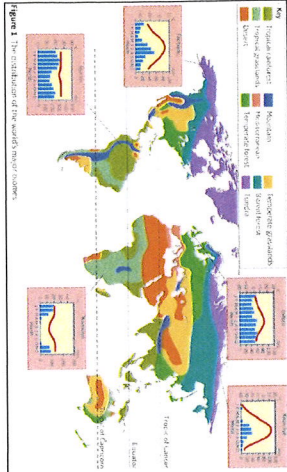


Figure 1: The distribution of the world's major biomes.

**What are the characteristics of the world's major biomes?**  
Characteristics are specific features that allow us to identify how one biome differs from another.

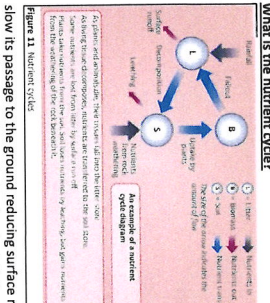
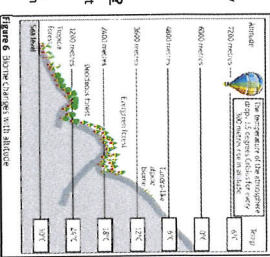
Biome	Climate	Vegetation
Tropical rainforests	Hot all year, 25-30C, rainfall 200-3000mm	Dense forest, layers of trees competing for light
Tropical grasslands	Hot all year, 25-35C, rainfall 500-1000mm, dry season	Tall grasses, shrubs, trees e.g. baobab
Deserts	Very hot all year 30C, cool nights, less than 250mm rain	Scare plants, water storing succulents, spines not leaves e.g. cacti
Temperate grassland	Hot summer 25C, very cold winter -40C, 500-900mm rain	Short grasses with very few trees and bushes
Temperate forest	Warm summers 18C, cool winter 5C, 1000mm rainfall	Deciduous trees such as oak
Boreal forest	Mild summers, 10-20C cold winters below 0C, less than 500mm rainfall	Coniferous trees such as pines
Tundra	Below 0C most of the year, 10C in summer, less than 250mm rainfall	Very few plants mostly lichens and mosses. Trees are

**How can we explain the distribution of and characteristics of biomes?**

Biome	Reasons for distribution
Tropical rainforest	High temps, high rainfall, on equator, sun overhead all year, inter tropical convergence zone.
Tropical grasslands	Further from equator, high temps, dry season, sparse tree growth, moist summer, dry winter
Deserts	On the tropics, sinking air, high day temps, cool night temps, low rainfall
Temperate forest/grassland	High latitudes e.g. UK, low pressure, year round rain, lower sun angle, reduced sunshine hours.
Boreal forest	Northern hemisphere, cold temps, higher pressure, sinking air, low rainfall
Tundra	Low temperatures, short sunlight hours, sinking air, low

**What local factors affect biomes?**

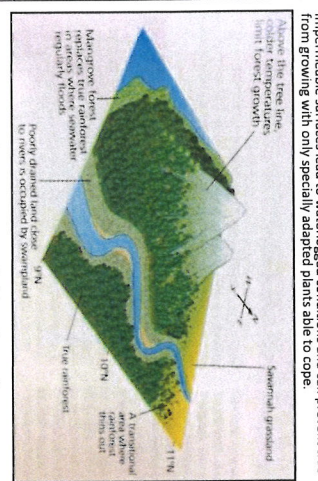
**How does altitude affect biomes?**  
Temperatures fall between 0.5C and 1C every 100m in height. Hills/ mountains are also exposed to wind. Slopes become steeper and biomes decrease with altitude and are replaced by grasses then mosses and lichens at the highest altitudes.



**How do soil types affect biomes?**

Soil type	Characteristics
Sandy soil	Small air gaps, drains well, quite dry, plants need tolerance to
Clay soil	Sticky, few air gaps, poor drainage, puddles from rain, holds
Chalky soils	Well drained, grass and barley
Peat	No rock/mineral particles, decayed plants, rich in nutrients, acidic,

**How does drainage affect biomes?**

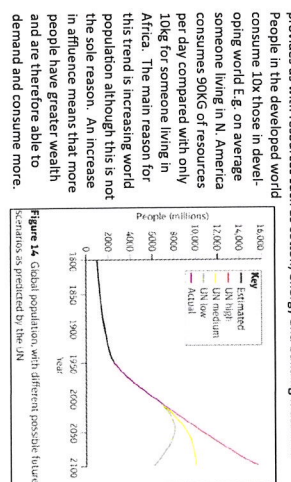


**How do biotic and abiotic components of a biome interact?**

**Biotic components** of a biome or ecosystem are the living parts: the flora and fauna, all fungi, bacteria and any other form of life.  
**Abiotic components** are the non-living elements of a biome or ecosystem such as rocks, soil, air and water. These components interact to keep ecosystems in equilibrium for example the nutrient cycle.

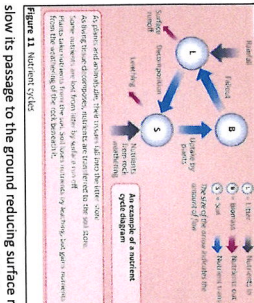
**Examples of biotic and abiotic interactions:**

When rocks get broken down by living things *in situ* for example tree roots growing in the joints of a rock and breaking the rock apart. Some flora and fauna also secrete acids which dissolve rock. Seabirds produce guano which contains uric acid which can dissolve rocks like limestone.  
**What are photosynthesis and respiration?**  
Living organisms interact with the atmosphere. The process of photosynthesis extracts carbon dioxide from the atmosphere and produces oxygen whereas respiration uses oxygen and produces carbon dioxide. These processes naturally regulate the atmosphere keeping these gases balanced.

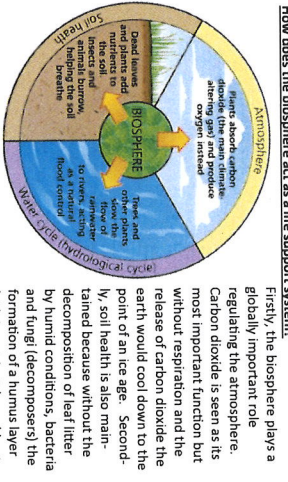


## Unit 3: Topic 7 People and the Biosphere

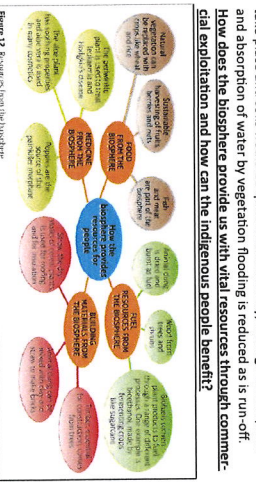
**What is the nutrient cycle?**



**How does the biosphere act as a life support system?**



**How does the biosphere provide us with vital resources through climate?**



**How can the increasing use of resources lead to over exploitation?**

The amount of food, energy and water we consume has risen over time. We currently extract 50% more resources to obtain water, food, and energy: 600n tonnes of raw materials per year. Our natural environment provides us with resources such as cotton, energy and building materials. People in the developed world consume 10x those in developing world e.g. on average someone living in N. America consumes 300kg of resources per day compared with only 10kg for someone living in Africa. The main reason for this trend is increasing world population although this is not the sole reason. An increase in affluence means that more people have greater wealth and are therefore able to demand and consume more.

**What are the regional trends?**  
Some developing countries are progressing towards emerging economies for example Brazil, Russia, India and China (BRIC) have grown rapidly. Collectively their GDP surpassed that of the USA in 2006 but since then Brazil and Russia have slowed. The MINT countries of Mexico, Indonesia, Nigeria and Turkey are expected to develop strongly next. As people gain more wealth their consumption of food, energy and water increases. In 2015, 10 of the world's 20 fastest growing economies were in Africa so over the next 30 years, rapid urbanisation, industrialisation and growing wealth (affluence) is going to be significant in Africa.

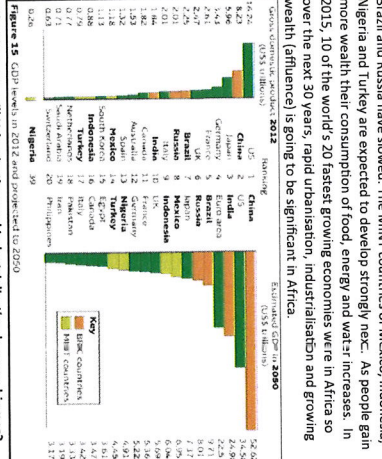


Figure 15: GDP levels in 2012 and projected to 2050

**What impacts will Urbanisation and industrialisation have on biomes?**  
The growth of cities and an increase in manufacturing over the last 50 years has had a direct impact on biomes. A city's population requires resources to support it and often these come from remote areas away from the city. China and India are the main culprits, second and ninth largest economies respectively in 2014 and a combined population of over 2.5 billion. Over the next 35 years it is expected that global energy consumption will increase by 56% with China and India being leading contributors due to the increase in living standards.  
**Is the biosphere being exploited?**  
Increased demand for resources is leading to damage of the biosphere. Demand for beef and soy, to feed the cattle, has led to widespread deforestation in the Amazon rainforest with 80% of it attributed to this. Demand for palm oil which is used in ice cream, pizza, soap, shampoo and biofuels has led to massive deforestation in Cameroon. HEF projects have led to flooding of 400km<sup>2</sup> tropical rainforest in Brazil for the Santo Antonio Dam and the three gorges dam in China led to the extinction of the Yangtze river dolphin. Finally, open cast mining for tar sands in Alberta, Canada, has destroyed huge areas of Boreal forest.

**Malthus or Boserup, whose theory of population and resources is most convincing?**

**What was the Malthusian theory?**



Thomas R Malthus believed that the human population would grow faster than resource supply. When food, energy and water resources began to run out there would be social unrest, famine and epidemics (natural checks). He argued that population grew geometrically while food resources grew arithmetically. 2.4, 6.8, 10.1 etc leading to a shortage of resources with resulting deaths particularly amongst the poor. Repeated cycles of population increase and crash would eventually bring the population closer to a balance with resource supply. Evidence for and against this theory: Wars and civil wars, bird flu and Ebola epidemics as well as droughts and famine - are all evident today. However, improved technology in food and resource production and discovery as well as improvements in development have seen birth rates fall reducing pressure on resource consumption.  
**What was the Boserupian theory?**  
Esther Boserup suggested that as population increased and reached a point of crisis beyond the country or world's 'carrying capacity', human ingenuity and innovation would find ways to increase production to meet the demand. The saying, 'necessity is the mother of invention' has been applied to her theory. Evidence for and against this theory: World population has risen from 1.5bn to over 7bn but there has been no worldwide crash. This is due to improvements in farming and global distribution of food and aid as well as the Green revolution, HYV's e.g. IR6, GM crops, solar power and improved birth control. However, others will evidence the AIDS pandemic, the growing number of refugees fleeing fighting and natural disaster such as drought.



### How does the tropical rainforest reflect the equatorial climate?

Most tropical rainforests (TRF's) are located in a zone 20N or south of the equator, called the equatorial climate. (See world map on Unit 3 Topic 7 People and the Biosphere). The climate is hot and wet all year round with average temps of 25C-30C never falling below 20C and 2000-3000mm of precipitation ideal for plant growth all year round. Abiotic components of the TRF such as the atmosphere, soil and water interact closely with all of the biotic characteristics including plants, animals and humans.

### What is the nutrient cycle like in the TRF?

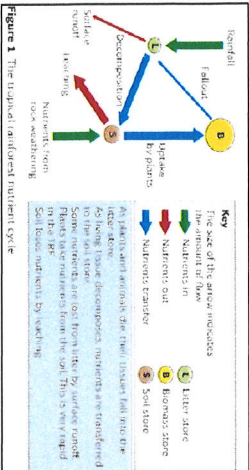


Figure 1 The nutrient cycle in a tropical rainforest

All ecosystems have three compartments: soil, litter and biomass. Nutrients are transferred between the stores which differ in size depending on the ecosystem. The biggest store in the TR is biomass which is made up of all living things. When leaves and branches fall into the litter store they decompose quickly releasing nutrients in to the soil for the plants to quickly absorb them. Rain water takes nutrients and minerals with it as it soaks through the soil, this is called leaching. Biodiversity in the TRF is high supporting thousands of species that have evolved over thousands of years.

### How have plants in the TRF adapted?

Although climatic conditions are ideal for plants they face major challenges in the TRF, the main challenge is light. The emergents are the tallest trees (50m+) that 'emerge' through the canopy (30-40m) made up by the other trees. When a tree dies and falls and a gap appears and the light reaches the forest floor enabling tree saplings to race upwards to the light. The gap will soon fill with broad leaves to maximise the sunlight it receives. Two other adaptations are drip-tip leaves and buttress roots.

### How have animals in the TRF adapted?

A huge number of animal species are supported by the TRF. The forests of Madagascar are estimated to have 14,000 species of plant that support 250,000 animal species, 75% of which are not found anywhere else in the world. Trees and plants produce flowers, leaves and fruit which the animals travel across the canopy to eat. Monkeys for example, have evolved gripping hands and prehensile tails for balance and colour visions to identify ripe fruit. Eagles have adapted strong legs and clawed talons to grab monkeys from the canopy whilst other animals are camouflaged to avoid being eaten e.g. stick insects mimicking sticks and leaves.

### How does the taiga reflect the subarctic climate?

The taiga is the largest biome on the earth's surface stretching about 50 to 70N across the north of Asia and America in a zone called the subarctic climate. (See world map on Unit 3 Topic 7 People and the Biosphere). Very long and cold winters dominate this climate with average temps -40C compared to summers which are short and mild rarely above 18C. Precipitation is low, less than 500mm. There are significant differences in biodiversity and productivity between TRF and the taiga due to the climate. Taiga plant growth is limited to short summers and with limited biomass productivity is low. Soil is low on nutrients due to slow decomposition of litter which even stops during the deep freeze of the winter. With only a few plant and animal species able to survive it's winters biodiversity is low overall.

## Unit 3: Topic 8 Forests Under Threat

### What is the nutrient cycle like in the taiga?

The litter store is the biggest store. Biomass and soils stores are small and transfers between stores are low. Litter is mainly made up of pine needles which are slow to decompose so the litter layer builds up and provides limited nutrients to the soil and as a result the soil is unable to support a large biomass. The needles make the soil slightly acidic so along with frozen winters, low precipitation and short growing seasons they produce extreme conditions that only a small number of species can survive e.g. coniferous trees, mosses and lichens. As a low nutrient, low productivity ecosystem, there are fewer permanent animal species although in summer insects attract large numbers of migrating birds.

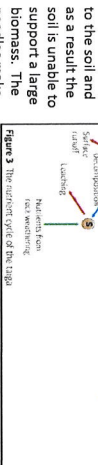


Figure 3 The nutrient cycle in the taiga

### How have plants in the taiga adapted?

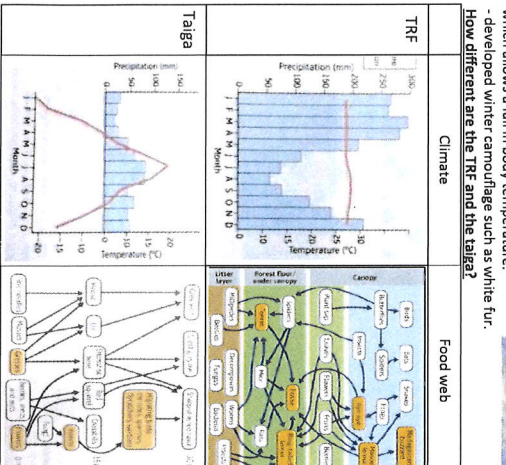
Almost entirely conifer trees, they don't drop leaves in autumn because leaves take energy to grow and there's a shortage of energy in the taiga. When it begins to warm up again in spring the tree need to be able to photosynthesise straight away. The pine needles have the following characteristics: small surface area and a wax coating so they lose less water, dark green colour to absorb the maximum amount of sunlight, they don't freeze due to limited sap content. It has a simple structure compared to the TRF with a few species of conifer that grow close together to prevent wind damage. Most are conical shape to shed heavy snow rather than accumulating.



### How have animals in the taiga adapted?

Summer sees large populations of birds, 300 species, which migrate to take advantage of the lakes that produce billions of insects but in winter this drops to just 30 species. Permanent residents have adapted the following ways: - Thick fur coats, smaller ears and tails to avoid frost bite - the ability to hibernate e.g. bears build up fat in summer then enter a sleep like state in winter which allows a fall in body temperature. - developed winter camouflage such as white fur.

How different are the TRF and the taiga?



### How do their climates compare?

Climate in the TRF has little variation as it is hot and wet all year round 25C+, precipitation from 50mm in August to almost 3000mm in March. The temperature range in the taiga is 40C from -20C in January to 20C in July. Precipitation in the taiga is always below 75mm with a low in March of approx. 20mm and a high of 75mm in July.

### How do their food webs compare?

TRF webs are highly complex due to very high biodiversity. The forest structure has different layers from the dark, damp forest floor right up to the emergent layer 50m+. Each layer is like a mini ecosystem in itself with adaptations adding to the complexity of the food web. Food webs in the taiga are much simpler because the climate produces much less biodiversity. Slow growing conifers produce a single consistent layer of trees at a similar height. The dark forest floor has little undergrowth with pine needles cover the low-nutrient floor. There are few amphibians and reptiles in the taiga because of the climatic challenges for, cold blooded animals however there are large mammals that eat as much as possible in summer in order to survive winter.

### What are the threats to the TRF? (Deforestation)

Commercial agriculture e.g. cattle farming in Brazil accounts for 75% of deforestation. Recent clearance for sugarcane and palm oil as a biofuel 'deforestation diesel'. Subsistence agriculture clears 1/3 of the forest through slash and burn for people to farm to feed their families. Due to rapid population more forest is cleared and isn't given time to recover so the soil loses nutrients. Commercial logging was commonly used to pay off international debt but now there are strict logging controls although illegal logging still takes place in the TRF. Open cast Mining for minerals and road building account for approx 15% of deforestation. Fuelwood and charcoal are increasingly becoming a cause of deforestation due to population increases.

### Why is climate change a threat to the TRF?

Logging and farming are direct threats to the TRF whereas climate change is an indirect threat. Rising global temperatures can affect the weather systems that bring the wet season to equatorial regions as they are likely to shift polewards. Conditions are likely to be hotter and drier more like a seasonal tropical forest with a dry season lasting several months. Animal species are unable to cope with heatwaves and plants are unable to survive forest fires or drought. Plant species that have adapted to hotter drier conditions e.g. baobab tree would spread out and compete with TRF species causing ecosystem stress with TRF species exposed to new pests and diseases.

### What are the threats to the taiga?

Commercial developments are the greatest threat to the taiga, some having a greater impact than others. Logging for softwood which is used for timber in construction or in paper mills is a direct threat removing trees which are a key biotic component to the nutrient cycle, no pine needles=lower soil nutrients. Cleared at a rate of 12million hectares per year, with as much as half of it illegal (in Siberia), is a huge threat as there is no effort to replant trees. Logging in Canada is much more sustainable with government policies for replanting. Mining minerals, oil and gas have indirect threats such as oil spills and forest fires. Russia has 20% of the world's oil and gas the mainly in the taiga. According to Greenpeace, Russia's oil industry spills 5million barrels of oil each year due to accidents or leaks in pipelines. In Canada the government have stricter controls although leaks can still happen (Alberta tar sands, 2011, 5million litres). Oil spills are damaging because drainage is poor so the oil doesn't get washed away and due to climatic conditions decomposition is very slow. Therefore it remains in the ecosystem for many years killing trees by entering their shallow root systems. Acid rain from sulphur dioxide released from burning fossil fuels affects the soil, lakes and ponds killing insects and their eggs. This reduces the food available for migrating birds in summer and weakens plant species. Forest fires from camp fires or gas flares in oil fields can produce nutrient rich ash benefiting plants although their occurrence is now too frequent burning young saplings before they can grow. Pests and diseases such as Tungus and mould damage conifers' needles etc. Silkworm spread through Siberia in the 2000's and spruce-bark beetles have affected over 6million acres of Alaskan forest.

### What global actions have been taken to protect tropical rainforests?

International organisations have been taken to establish agreements to protect the rainforest. By signing up to these agreements, member countries receive aid and assistance. Two examples are CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora) which has 35,000 different species under it's protection with countries monitoring trade across their borders. REDD (Reducing Emissions from Deforestation and forest Degradation) is a UN scheme that advises governments on how to reduce the rates of deforestation and replant forest areas. It uses remote sensing to monitor deforestation rates and uses money from the world bank to fund schemes for example a REDD scheme in Brazil has a US\$1bn fund behind it.

Advantages	Disadvantages
<p><b>CITES</b></p> <ul style="list-style-type: none"> <li>It has a very large international influence - 183 countries have signed up.</li> <li>CITES is supported by the UN and is a part of the UN's commitment to protect the environment and wildlife.</li> <li>CITES is a very effective way of protecting the environment and wildlife.</li> <li>CITES is a very effective way of protecting the environment and wildlife.</li> </ul>	<p><b>REDD</b></p> <ul style="list-style-type: none"> <li>Deforestation remains very rapid in South Asia, despite the commitment to stop it.</li> <li>It is difficult to check that all countries are doing all they should be doing to halt forest in protected areas.</li> <li>REDD is a very expensive way to protect the environment and wildlife.</li> <li>REDD is a very expensive way to protect the environment and wildlife.</li> </ul>

### What is been done to cut rates of deforestation?

Whilst forest are still commercially valuable this remain the biggest challenge for rainforests around the world. Although with enough political and financial backing it can be slowed e.g. Brazil from 2004. There are a range of reasons for the reduction experienced in soy: - The change in the demand for soy. Prices crashed in 2005 due to TNC's only sourcing soy from sustainable farmers - A REDD fund set up by Norway protected areas which were enforced by government officials and the police.

### What are the challenges of sustainable forest management?

Deforestation went up again in Brazil (2014-2015) mainly due to cattle ranching. Ecotourism however is an attempt to benefit local people economically. By creating jobs as forest guides, hospitality and catering services as well as tourists spending money on their handicrafted products. For these people they see that it makes economic sense for them to protect the forest from illegal poachers and loggers. Sustainable farming schemes that aim to keep the fields fertile for longer with crops that provide higher yields means that new plots do not need to be cleared and existing plots support more people.

### Why does the taiga wilderness area need to be protected?

The taiga is a very fragile ecosystem and takes a long time to recover from damage as pollution remains in the ecosystem for years. Plants grow slowly due to the climate and lack of nutrients from slow decomposition. It may take 50 years for a single tree to be replaced and with only a few highly specialised species, disease or climate change affecting one species would be a disaster.

### How can National Parks and protected wilderness help?

Designated areas where development is prevented with the aim to preserve wilderness areas need ecosystem management by park rangers including possible culls e.g. Elk that eat saplings. Big predators e.g. wolf/grizzly bear, need large areas but NP's are often not big enough but beyond their boundaries they are not protected from farmers or game hunters. License shooting kills predators numbers down. Canada's buliest NP Banff NP attract 3-4 million tourists per year for skiing and ice festivals which inevitable cause damage and risks known as 'human-wildlife conflict occurrences' (attacks).

### What challenges are national parks facing?

-Migration of species beyond the protection of the NP boundary -Income from resource exploitation puts governments under pressure -Damage from atmospheric pollution caused by tourists from the cities

### How can sustainable forestry help?

Trees that are cut down are replaced with native species. Corridors of forest are maintained to support species migration from area to area but this is expensive and needs international organisation funding.

### What are the conflicting views on protecting the taiga?

**Forestry** - use it sustainably e.g. Canada or unsustainably e.g. Russia **Mining** - countries are poorer without it, 380000 Can. dollars emp. in mining. **Indigenous people** - desire to maintain traditional activities e.g. hunting **Tourism** - tourists visit the taiga to relax bringing money into local economies **Taiga products** - paper, oil and gas for many countries comes from the taiga