

Geography – Rural Urban links

1.

Urbanisation

Urbanisation means an increase in the amount of people living in urban areas compared to rural areas.

Today the UK is a mostly urban society, with 90 per cent of the population living in towns or cities.

On a global scale, urbanisation is taking place rapidly, particularly in LIC's.

CASE STUDY: Kenyan Countryside to Kibera

Push Factors (reasons for the movement away from countryside)

- Jobs are physically demanding and low paid
- Poor sanitation
- Weather - This can make life difficult as crops fail/little water etc

Pull Factors (reasons for movements to the city)

- perceived better quality of life
- higher paid jobs
- access to education

2.

Counter Urbanisation

Counter Urbanisation means an increase in the amount of people living in rural areas compared to urban areas.

Counter urbanisation is a process that's more common in HIC's.

CASE STUDY: Cardiff to Cowbridge

Push Factors (reasons for the movement away from cities)

- higher rates of congestion and pollution
- high land values making it harder for people to find affordable housing
- higher crime rates

Pull Factors (reasons for movements to the countryside)

- perceived better quality of life
- believed to be a safer and more pleasant environment for children to grow up in
- less pollution and more open space

Improvements in transports and technology have led to the increase in counterurbanisation as it has become easier for people to commute to work or indeed work remotely from home, using the internet.

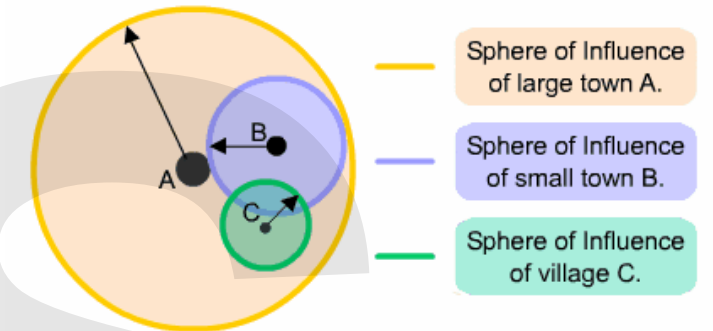
REMEMBER: An urban area is a built-up area such as a town or city. A rural area is an area of countryside.

3.

Sphere of Influence

"The sphere of influence is the area surrounding a settlement that is affected by the settlement's activities."

The sphere of influence of a shop is how far people will be prepared to go to make use of that shop. For example if people decide to travel a long distances for a shop that shop will have a big sphere of influence. But if a people didn't feel it was necessary to travel long distances to go there shop has a small sphere of influence.



4.

Egan's Wheel

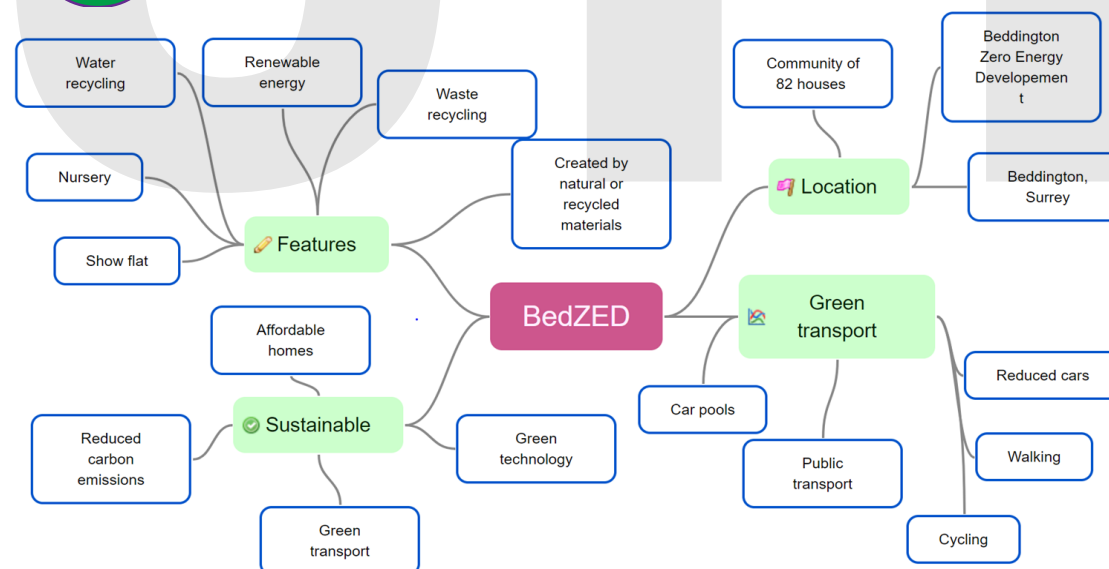
Sustainable communities are places that are able to support the needs of all residents, providing a decent quality of life in the present, as well as for future generations.



For something to be sustainable it should meet most, if not all of the criteria on Egan's Wheel.

5.

CASE STUDY - BEDZED



6.

Brownfield Sites

- Are often on disused or derelict land.
- Are valuable as existing buildings can be split up into more homes on any one site.
- Use unsightly areas for building developments, so improves the urban environment.
- Are found in urban areas, so building housing there reduces demand on car use.
- Are more expensive to build on as often the land needs to be cleared first (especially if land is contaminated from previous use).

Before



After



Before



After



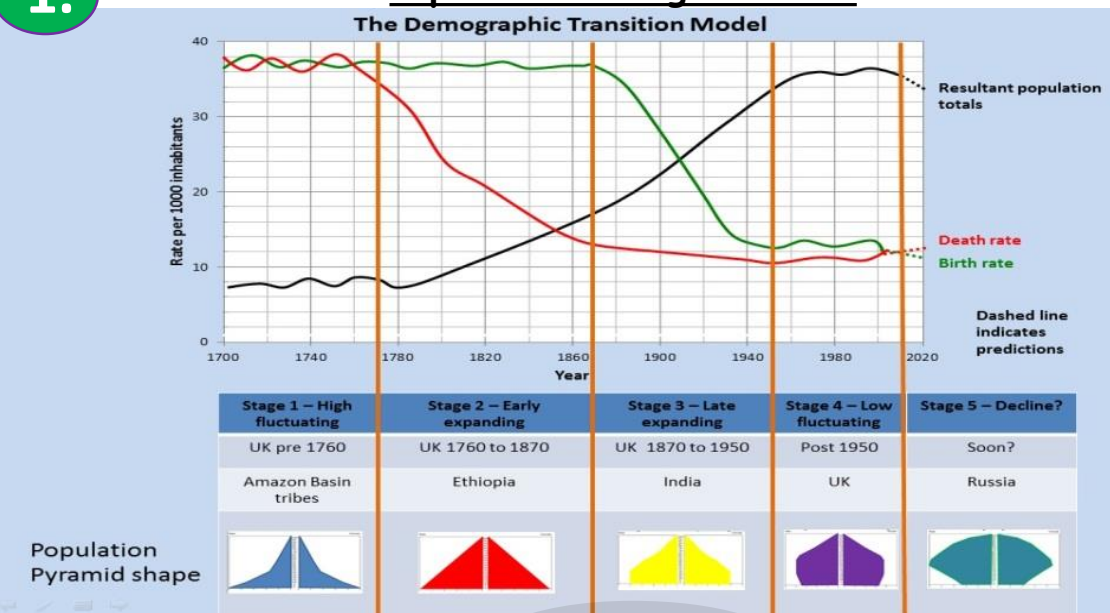
Greenfield Sites

- Are sites which have not previously been built on. This includes the greenbelt land around cities.
- Are cheaper to build on.
- Are not favoured by environmentalists, as it encourages urban sprawl.
- will mean that countryside is built on.

Geography – Rural Urban Links

1.

Population Change - Global



Sub Saharan Countries

- Botswana
- Ethiopia
- Kenya
- Malawi

South Asian Countries

- India
- Pakistan
- Bhutan

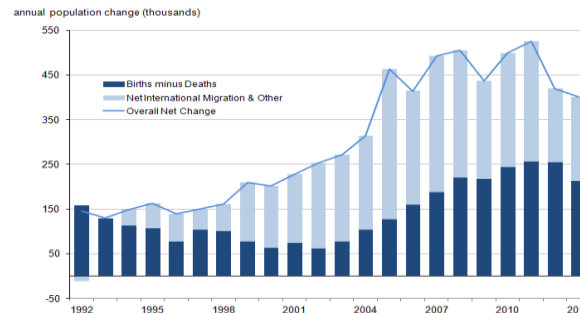
Western Europe

- UK
- Germany
- Italy

2.

Population Change -UK

The population of the UK is always changing. In 2014, the UK population was 64.8 million, while in Wales it was 3.12 million. Between 2004 and 2014 there was a period of growth, although this varied across different areas.



Ageing Population

Due to low birth rates and death rates in the UK, an increasing proportion of the population is aged over 65. This ageing population can cause a number of problems such as, a reduce number of economically active people so less contributions to tax, more money used on pensions, more pressure on NHS.

3.

Retail Change

The traditional shopping hierarchy of the central business district, with its large shopping centre, the local high street offering a smaller range of shops and the local convenience store, has for some time been under threat from the rise of out of town shopping and internet supply.

Factors Leading to Retail Change

Economic Factors	Cultural Factors	Technological Factors
Increase in the number of delivery firms, making delivery cheaper	Car-dependant society	Wide coverage of high speed broadband
Congestion in city centres and expensive parking	Habit of bulk buying and weekly or monthly shops	Online shopping
Wages been paid monthly rather than weekly		Internet banking

4.

Global Cities



As a result of **globalisation**, places around the world are now more connected than ever before in terms of economics, trade, society, culture, and politics. Global cities have become key places of connection with the following features:

- Finance and trade
- Governance - location on international organisations such as UN, EU and headquarters for **MNC's**.
- Diversity - attract large numbers of migrants
- Media
- Cultural centres
- Innovation - Top universities and research

The pattern of global cities is not static and open to change. To maintain their global city status, each city must continue to develop and strengthen its links with other places around the world.

5.

Example of City in HIC: Cardiff

Cardiff is located in south-east Wales and is Wales' it's capital. It has a population of 346000 and a large sphere of influence, with over 1.49 million people.

Reasons for Growth

- **Natural Population Change /Historic Change** - Increased life expectancy has lead to an increase in natural population change.
- **Migration** - The **pull factors** attracting people to Cardiff are the availability of jobs, good education, research facilities and a thriving tourism industry. The **push factors** from the surrounding region are mainly due to lack of jobs in south Wales valleys.
- **Connections** - Being the capital of Wales, Cardiff has a well developed connections to the local region and to the rest of the UK and Europe. It has an international airport and the links to London in just over 2 hours.

Current Urban Challenges

- Reducing poverty and deprivation
- Reducing traffic congestion
- Regeneration of the **CBD**

Urbanisation in Global Cities



6.

Example of City in NIC: Mumbai

Mumbai is located in northern India. It is India's largest city, with 21.04 million in 2015.

Reasons for Growth

- **Natural Population Change /Historic Change** - The city is still growing, but not as rapidly as it was between 1971 and 1991 because women as choosing to have less children now than they were then.
- **Migration** - The **pull factors** for Mumbai are cheap rail travel, jobs and better training opportunities. The **push factors** from the surrounding countryside are poor standard of living, healthcare and sanitation.
- **Connections** - Mumbai is the financial capital of India. It is also home to **MNC's** such as Tata Steel. It has an international airport and a major port.

Current Urban Challenges

- There are two main challenges that face Mumbai:
- Reducing poverty and deprivation
 - Housing

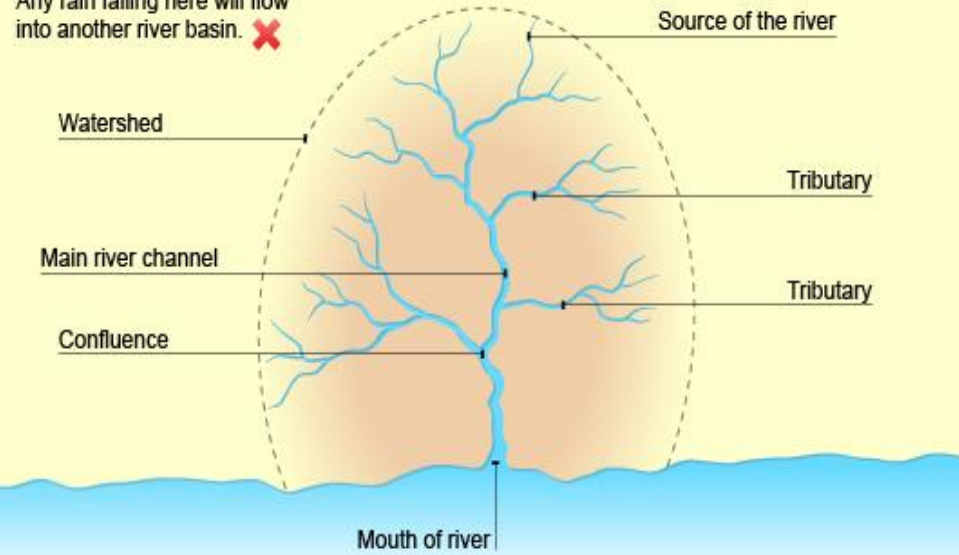


Geography

River Landforms and Processes

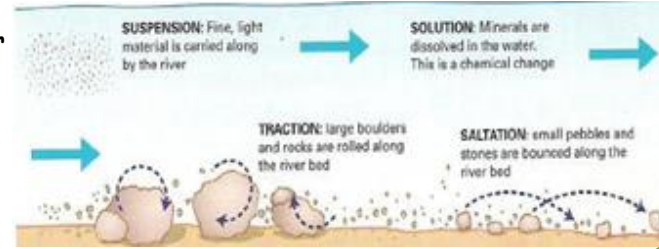
Drainage Basin

Any rain falling here will flow into another river basin. ❌



Transportation

This when the river carries sediment down the river.



Deposition



This when the river begins to lose energy so drops the sediment it is transporting.

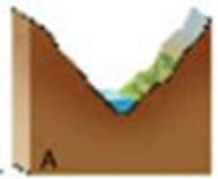
Erosion



Erosion involves the wearing away of rock and soil found along the river bed and banks. **The four main forms of river erosion**

- **Hydraulic action** - the force of the river against the banks can cause air to be trapped in cracks and crevices. The pressure weakens the banks and gradually wears it away.
- **Abrasion** - rocks carried along by the river wear down the river bed and banks.
- **Attrition** - rocks being carried by the river smash together and break into smaller, smoother and rounder particles.
- **Corrosion** - soluble particles are dissolved into the river.

The Upper Course



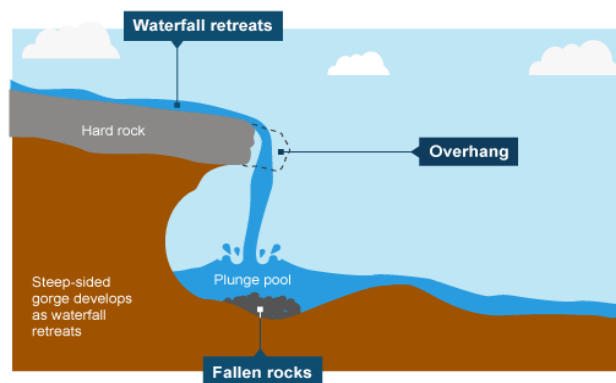
- Steep sides - V shape valley
- **Vertical erosion** is the main process - Meaning erosion downwards.

- Channel is at it's narrowest and shallowest
- Channel is rocky
- Discharge is low

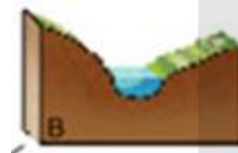
Main Landform = Waterfalls

Waterfalls often form in the upper stages of a river where it flows over different bands of rock.

- The soft rock erodes more quickly, **undercutting** the hard rock.
- The hard rock is left **overhanging** and because it isn't supported, it eventually collapses.
- The fallen rocks crash into the **plunge pool**. They swirl around, causing more erosion.
- Over time, this process is **repeated** and the waterfall moves upstream.
- A steep-sided **gorge** is formed as the waterfall **retreats**



The Middle Course



- Sides of the valley are less steep
- **Lateral erosion** is the main process - Meaning erosion sideward

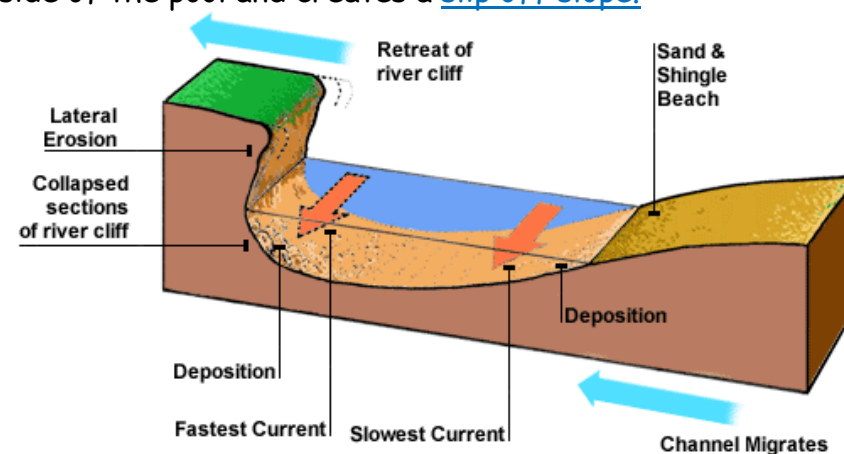
- Channel is now wider and smoother because of erosion

Main Landform = Meanders

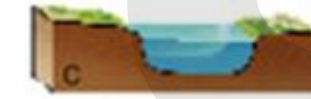
The river starts to flow from side to side in a winding course but still in a relatively straight channel. The pools tend to move to opposite sides of the channel over time and this is where a meander will develop.

Water moving faster has more energy to erode. This occurs on the outside of the pool and creates a **river cliff**.

Water moving slowly tends to deposit material as it has little energy left to erode or transport material. This occurs on the inside of the pool and creates a **slip off slope**.



The Lower Course



- Thanks to lateral erosion the valley sides may now be several kilometres away
- **Deposition** is main process

- Channel is at it's widest and deepest
- Discharge is high

Main Landform = Floodplains and Natural Levees

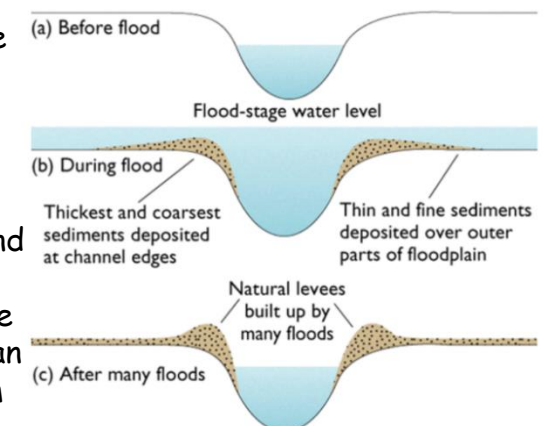
The river now has a wide **floodplain**. A floodplain is the area around a river that is covered in times of flood.

A floodplain is a very fertile area due to the rich alluvium deposited by floodwaters. This makes floodplains a good place for agriculture.



A build up of alluvium on the banks of a river can create levees, which raise the river bank.

Levees form where rocks and smaller sediments are deposited at the edge of the river during a flood. They can protect the flood plain from further floods as they build up.

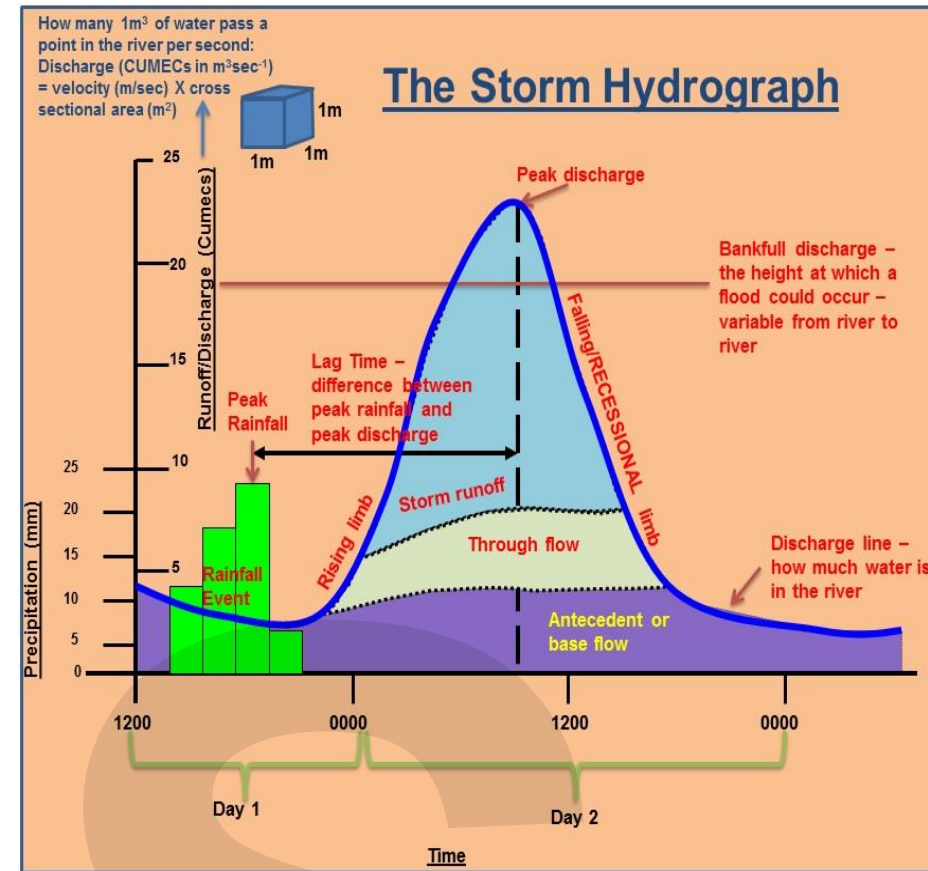
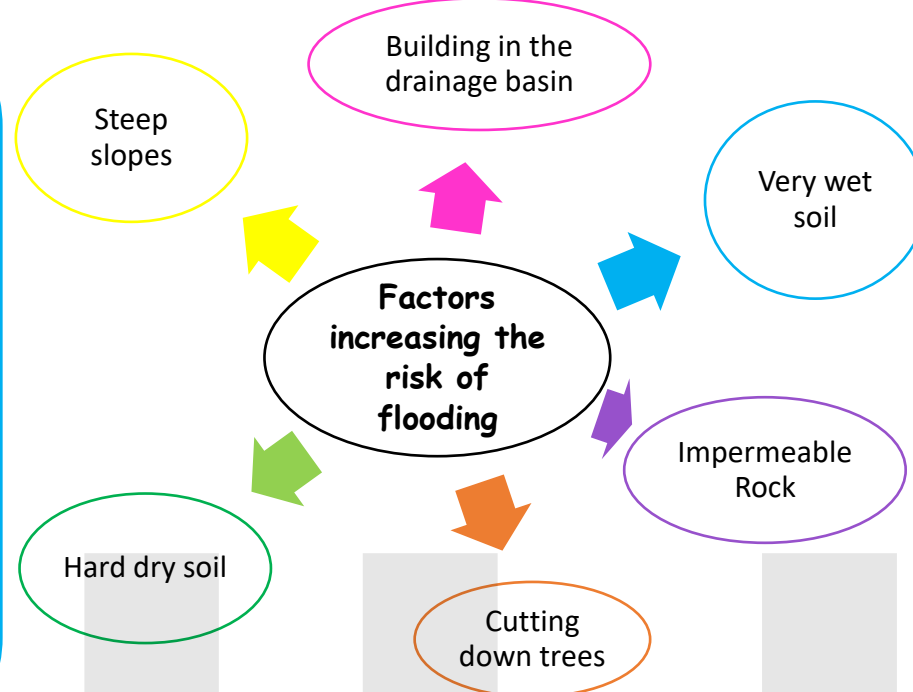


Geography

Rivers - Drainage Basin Management

Flow through a basin

- Overland flow - When water cant soak through or doesnt have enough time so travels across the top of the ground. Very quick.
- Infiltration - When water is soaked into the ground and enters underground system
- Through flow - Once water has infiltrated the soils it moves slowly back to the river
- Groundwater flow - This is the movement through the ground. Very slow.
- Interception - When plnts and trees interrupt the journey of water, either through their leaves or taking up water in their roots.



The Impacts of Flooding

Economic	Social	Environmental
<ul style="list-style-type: none"> Loss of jobs Cost to repair/rebuild homes Cost to drain and clean up 	<ul style="list-style-type: none"> Loss of jobs Loss of homes Injury/death Spread of disease Disruption to infrastructure (roads, rail etc.) 	<ul style="list-style-type: none"> Natural habitats lost Animals injured



Case Study

Bewdley is a small town in Worcestershire situated on the river Severn



What happened:

In November 2000 Bewdley suffered serious flooding:

- 140 properties were affected
- Transport was disrupted
- Business had to close - losing money

The flood was caused by:

- Long periods of heavy rain
- Saturated soils - Meaning impermeable and increasing surface runoff
- Building on natural floodplain

Flood management:

After the flood, the aim was to construct an effective flood defence for Bewdley, which would also enhance the Georgian town and its 18th Century quay.

They decided on an innovative demountable aluminum barrier system called 'the invisible defence'. The barrier works with a below-ground wall, which acts as a cut-off to underground flow during flood events. About 450m of demountable flood defence was built, with 150m of permanent flood defence wall.

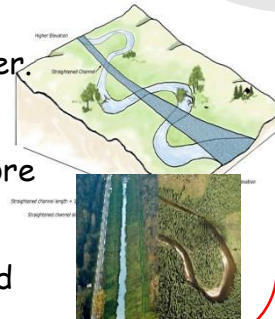
In the major flooding of July 2007, the barriers were put in place before river levels rose and the town was saved from serious damage.

Straightening (or channel realignment)

Meanders are removed from a river.

This means the water has less distance to travel and can therefore be removed quicker.

However, it increases erosion and flooding downstream.



Dams

Dams are often built along the course of a river in order to control the amount of discharge. Water is held back by the dam and released in a controlled way. This controls flooding.



Planning - Land Use Zoning

Local authorities and the national government introduce policies to control urban development close to or on the floodplain. This reduces the chance of flooding and the risk of damage to property.



Afforestation

Planting trees.

This soaks up water.

Less surface runoff.

Reduces flood risk.



Hard Engineering Strategies to reduce flooding

Soft Engineering Strategies to reduce flooding

Geography – Distinctive Landscapes

1

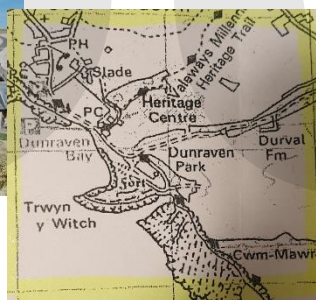
What is meant by distinctive?

'Distinct' refers to recognizable differences between things e.g. the following physical and human features should be considered:

- Location (inland or coastal) and relief (upland/low land or steep/gentle slopes)
- Settlements (village, cities, towns)
- Population (dense or sparse)
- Rural/urban
- Land use (farming, residential, commercial, industrial, etc.)
- Landforms/landmarks
- Type of vegetation, underlying geology/soil
- Climate (temperature, rainfall, etc.)

Place: used to describe what makes somewhere special, unique, and distinct

Example: Dunraven Bay (coastal landscape)



Human features – car park, settlements (sparse), roads/paths, campsite, farming (sheep/crops), fort, heritage centre, public convenience, public house

Physical features – shingle beach, cliffs/hills, trees, coast, woodland, headland, wave-cut platform

2

How are physical landscapes affected by human activity?

A honeypot site is one where tourists visit in large numbers due to attractive scenery and historic interest.

The point at which visitors become a problem to local people/environment is when geographers would say the carrying capacity has been reached/maximized.

Example of honeypot site: National Park, Lake District, Cumbria, North-West England

People visit here as it has many natural attractions such as beautiful scenery, mountains and lakes and human attractions like Zip wire, Wordsworth Dover cottage and Beatrix Potter's house.

Problems	Solutions
Traffic congestion	More car parks or park and ride in place, traffic wardens
Polluting water	Banning jet skis/motor boats. Allowing time and speed limits for jet skis.
Litter	Increasing the amount of bins, fines for people caught littering
Cars park on grass verges	Build more car parks, screen car parks
Second homes	Build affordable accommodation, time shares



3

How can landscapes be managed?

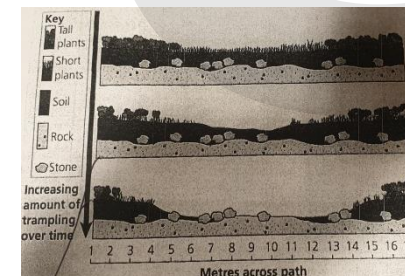
AONBs (Areas of Outstanding Natural Beauty) must produce a 5-year management plan and action points that need to be met.

Management of visitors in the Gower AONB:

- Footpaths for visitors to protect sensitive areas
- Information boards to highlight the unique features of the location
- Clearly marked car parks to reduce parking on grass verges
- Strict control over planning and building within the area so new buildings or extensions do not spoil the natural beauty.

Soil erosion as a problem in AONBs (Lake District):

- Plants are short and stunted where trampled
- Plants die and the soils becomes exposed to rainwater leading to erosion by rain splash and gully erosion
- Walkers avoid central sludgy region where everyone walks & instead walk on the edges causing the path to be wider and stones to be exposed as soil eroded further



Footpath maintenance solutions:

- Local environmental groups help wardens to repair footpaths and walls
- Footpaths replaced with hard-wearing materials such as stone
- Restore vegetation on either side of the path once restored to maintain flora and fauna.

Geography – Development and Resource Issues

1

The Development Gap

It exists between richer and poorer countries. There are different ways of showing this divide:

- 1980s Brandt Line - rich north, poor south



- Development continuum – a sliding scale from very poor to super-rich, countries can move up and down according to gross national income (GNI)
 - High, upper-middle, lower-middle and low income countries
- Limitations of both models – they focus on economic factors not social and do not recognize inequality within the country.

4

NICs

The biggest change in pattern of development has been the growth of newly industrialized countries.

Top 4 NICs – China, India, Indonesia & Brazil they have nearly 40% of the world's population combined

Reasons for India's rapid growth:




- Highly skilled and young, flexible workforce
- Investment by MNCs such as IKEA and Samsung
- Well-developed infrastructure
- Low wages costs compared to China & Mexico
- Stable and large democratic government
- Second largest population, market is large and attractive
- The World Trade Organization promote free trade between countries removes tariffs/quotas
- Development of own MNCs e.g. Tata Steel headquarters in Mumbai employs 80,000 worldwide.

2

Globalization

Free flow of goods, people, ideas & money which creates global interdependence (one country relies on another). Factors that drive this include:

- Trade – improved technology, cheap aviation fuel
- Culture – western styles of films, etc. released worldwide
- MNCs – open branches in several countries
- Communication – smart phones, internet, satellite TV

Case study: Nike - It is an MNC operating and selling in over 140 countries. Headquarters Oregon, USA 

- Undertake outsourcing, where companies work for Nike for a period of time under a signed contract. Gives them the advantage of negotiating on price.
- Vietnam is now Nike's biggest source of outsourced workers due to low labour cost, less expensive factories, low tax rates, low energy bills, fewer laws and restrictions.

5

Trade

The buying & selling of goods/services between countries:

- HICs export valuable manufactured goods, import cheaper primary products e.g. sugar, tea, coffee
- LICs are opposite, earn little and remain in poverty

Prices of primary products fluctuate they are set by HICs so LICs like Ghana in Africa lose out:

- If prices of cocoa beans from Ghana are too high then dealers shop around and buy from whichever country is cheapest, the pressure on prices is downwards.
- Price also depends on production, when production is low (due to weather, pests, diseases) then global prices rise because supply is short. Demand high = price high.

Reducing balance of trade deficit & increasing trade is key for LICs:

- Free trade allows countries to import & export without tariffs leading to increased exports, more jobs and greater choice
- Trade blocs are groups of countries e.g. EU who work together to promote free trade between member states.
- Ghana joins the WTO to promote free trade in 1995.

3

MNCs

Multi-national corporations are companies that operate in several countries but have headquarters in a 'global city' e.g. Nike in Vietnam – see box 2.

Advantages of Nike in Vietnam (a NIC):

- + 40,000 jobs and improves skills base
- + Higher wages than local companies
- + Helped to attract more MNC investment
- + Contributes to tax, can go towards education, etc.
- + Export of products brings money to the country

Disadvantages of Nike in Vietnam (a NIC):

- Company image may undermine national culture
- Concerns about political influence of Nike
- Investment can be quickly transferred to another country, leaving people without jobs
- Sweatshop conditions – abuse of workers
- Large demand for energy and water

6

Tourism

Mass tourism began in 1960s due to:

- Higher salaries, flying is easier/more affordable, growth of holiday companies, internet made people more aware and easier to book.

Recent tourist developments include:

- Enclave tourism: tourists pay one price and get travel, accommodation, food, drink all in one.
- Cruise holidays: 'all inclusive' packages
Less money spent by tourists goes into the local economy and leaked back to MNCs and many tourist related activities e.g. beach massages are part of the informal sector so government gets no income.

Case study: Enclave tourism in Cancun, Mexico

- + employs 52,000 direct jobs, 175,000 indirect jobs, wealth invested into services for locals
- Low-paid temporary contracts (seasonal), local culture destroyed, increased pollution, ecosystems destroyed

7

Inequalities in India (NIC)

Despite there being big growth in India's industry it still has millions of low-paid workers. Some reasons for inequalities are funding of education and health by the state government, climatic conditions and discrimination against women. See below:

Bihar (East)	Maharashtra (West)
80% live in rural areas	3 of the largest cities
Education poor, birth rate high	Centre for banking, insurance and call centers
Landless farm labourers	Manufacturing e.g. steel
Small farms	Centre for India's film industry
Government is corrupt	Government jobs are well-paid
	Fertile soil, good climate and water supply

8

Inequalities in the UK (MIC)

N/S divide – social & economic difference between South England and rest of the UK



People in London have higher incomes, longer life expectancy, and fewer health problems.

Regions decline when deindustrialization occurs e.g. Tata steel closures 2015-16 led to job losses in Scunthorpe, Port Talbot and Llanwern all of these regions that already have low pay and unemployment

One way to overcome this is investment in major infrastructure projects e.g. road and rail schemes such as the Newport Relief Road (a 23km, 3-lane motorway that bypasses the congested section of the M4 in order to create better access to land near the steelworks and extra land for development.

9

Responses to Global Inequalities

The United Nations (UN) set 17 sustainable development goals in 2015 to be achieved by 2030 e.g. Goal 1 – End poverty in all its forms everywhere.

To achieve these it will require long-term/ development aid from one country to another. **Case Study: Malawi, LIC**

- Most people are subsistence farmers, the Middle Shire area is affected by soil erosion during the rainy season as a rising population has led to deforestation for firewood and more intensive tobacco cultivation.
- COVAMS is a 10-year project funded by the Japanese government to prevent soil erosion through education, training farmers, building barriers to slow the flow of water, terraces to reduce run-off.

Fair trade is another way LICs can increase wealth in places like Ghana and The Kuapa Kokoo cooperative:

- Receive 10% than the usual price for cocoa
- Training for farmers, raises the status of women, etc.

10

Water use/demand

Increasing population and economic development has led global demand for water to increase.

Consumption varies between and within countries:

- HICs have a bigger water footprint than LICs
- People living in urban Sub-Saharan Africa are 2x as likely to have piped water than rural areas

Water footprint – total amount of water used in everyday life, tells us how much is being consumed individually, in a country or globally for drinking, cooking, washing, water to cook food/produce goods, etc. – 70% of our water is used to grow food, 20% industry, 10% in the household.

Water used to produce food and goods is known as **embedded water** e.g. 1kg of beef requires 15,000 litres of water.

11

Water Security in South Africa

Water security – safe and affordable water, sufficient for agriculture and industry, sustainable supply, ecosystems supplying water are conserved, protect from drought.

Case study –South Africa, Lesotho Highlands Water Project (LHWP):

- 4 million people have no access to fresh piped water, mainly in rural areas. One reason is rainfall is not evenly distributed; eastern parts such as Lesotho have a lot more rain than western parts.
- Lesotho earns money by selling excess water to places where population is high but rainfall is low.
- Dams collect water from mountains, 40% of water in Senqu river basin, Lesotho is diverted to Vaal river system, South Africa via 200km of tunnel systems to the Gauteng Province.

+ Provides 75% of Lesotho income, new roads, electricity generated, 20,000 jobs created.

- People in Lesotho do not have access to improved water sources, project expensive (\$31billion), displaced 20,000 farmers

12

Over abstraction of groundwater

Water stored in porous rock known as an aquifer recharged when rain or snow percolates into ground

Case Study: India

- 65% of all water used for agriculture and 85% domestic supply is groundwater
- Water is being taken from the ground faster than it is recharged (over-abstraction)
- Long dry seasons mean dry rivers and lakes so ground water is the only source
- Many rivers and lakes are polluted
- Green revolution has led to farmers growing crops that need more water
- Need alternative ways of supplying the growing demand such as building more dams (top-down) or encouraging farmers to adopt water conservation measures e.g. rain water harvesting (bottom-up)

Geography – Social Development

1

Measuring social development

Social development is a measure of how well a society is changing for the better or how living standards are improving.

Gender – indicators measure progress that a country makes towards equal rights for men and women e.g. fertility rate, male and female literacy rates, etc.

Health – measure the progress that a country is making towards a healthy life for all citizens e.g. average life expectancy, % of GDP spent on health, infant mortality rate.

Rather than taking one indicator as a single measure a continuum of social development is needed – a way of thinking about social development as a continuous process with no end point e.g. **Human Development Index (HDI)** which measures progress across length of schooling, literacy rates, GNI per capita and life expectancy.

2

Child labour

Sub-Saharan Africa has the highest proportion of child laborers causes include:

- Poverty – children expected to support family income
- Lack of access to affordable good education
- Unemployed parents
- AIDS lead to increase no. of orphans

Consequences of child labour:

- 22,000 die in work-related accidents per year
- Trapped in slavery, trafficking and prostitution
- Damaging effects on health e.g. growth deficiency

Tackling child labour by International Labour Organization:

- Improving access to education so that all children are in school
- Improving social security systems so poorest in society are supported rather than rely on children.

3

Primary Education in India

UN Millennium Development Goal 2: To halve no. of children missing from primary school this is hoped to help to reduce child labour.

In India more women are uneducated, consequences include:

- Child born with uneducated mother 2x as likely to die before age of one
- Well educated women marry later and have smaller families
- Education empowers women – high status

Strategies to improve access include:

- Educating parents to see the value of education for girls
- Building more accessible schools
- Creating girls' councils within school to give them a voice
- Criminalizing employing children in industries means there is less value of children in work.

4

Refugee Crisis

Lebanon borders to Mediterranean Sea, Israel and Syria and receives migrants fleeing Syrian civil war. The issues of this include:

- Population grown by 25%, highest per capita of refugees in the world putting pressure on health, labour, education, infrastructure, etc.
- Violent incidents and illegal businesses
- Tent cities and squatter settlements
- Lack of clean water and poor sanitation

Tackling the issue:

- Germany and Sweden welcome them and help them integrate, Austria is trying to limit the amount and the UK has agreed to accept 20,000 from Syria by 2020.
- Schengen agreement – Europe passport-free movement of people between countries who have signed. Led to increase in no. of illegal migrants trying to get into the country e.g. crossing English channel illegally by stowing away in lorries in Calais.

5

Health in Sub-Saharan Africa

Two of the most common killers in Sub-Saharan Africa are Malaria and HIV. Malawi has one of the highest infant mortality rates and a life expectancy of 50 years due to these

Malaria in Malawi (438,000 deaths in 2015 mainly in Africa):

- Varies seasonally, peaks in rainy season (Jan-April) and highest around Lake Malawi as the water is stagnant. Infection is highest in rural areas and children, pregnant women and people with HIV are high risk. It is a long walk to visit the doctor
- The government want to increase use of bed nets, improve access to fast and effective treatment, spraying insecticides in places where mosquitos come in contact

HIV in Malawi (1 million infected):

- Rates higher in urban areas, families in poverty as too ill to work, reduction in taxes as fewer working, children drop out of school to look after parents
- The government want to increase HIV testing and counseling services, preventing mother-to-child transmissions by offering pregnant women access to medication, free condoms, anti-retroviral treatment stops HIV leading to AIDS

6

Link between health and water

- 2.2 mil die each year as a result of infections of the gut caused by drinking/bathing
- Clean water essential to social/economic development – safe water maintains water supply, provide hygiene, grow food & supply industrial processes.

Case Study: Water insecurity and polio/health in Kano, Nigeria

- Suffers from hot, semi-arid conditions and a long dry season, below average rainfall, lack of piped water supply or sanitation in cities (Kano).
- Poverty and drought have led to political instability e.g. Boko Haram
- Kano is the 3rd largest city due to migration from rural areas but its lack of sewerage system or treatment plants means people area at risk of cholera and polio from contaminated water.
- The government have now approved the use of a vaccination of polio in children but some are violently opposed to it.

Theme 1&4: Coastal Hazards and Management Landforms and Processes

Why are some places more vulnerable to coastal hazards?

Physical factors	Social factors	Economic factors
Magnitude: stronger the hazard, more severe it is	Education: where populations are literate, messages used to spread warnings	Wealth: poor people less able to afford housing to withstand extreme events.
Duration: the longer it lasts the more severe it is	Age: children and elderly more vulnerable.	Governments: fund to support education and awareness and build defences.
Predictability: a lack of warning makes it more severe	Time of day or day of week: influences whether people are at home or work or are at the coast.	Emergency services: richer countries have well-trained and resourced rescue teams.
Regularity: if hazards happen often, for example storm a couple of days another hits, the severity is likely to be greater.	Population density: the more people, the more severe the impact	
	Health: healthy person more able to escape danger.	

Severe weather events and climate change create vulnerability to coastal flooding

- Sea levels likely to rise by 50 to 100cm by 2100 leading to more coastal flooding
- Warmer seas lead to increased frequency and strength of storms causing increased coastal erosion and storm surges
- More violent storms give heavier rainfall and increased risk of flash flooding

Example: Thames Gateway, East of London

- **Risks to severe weather include:** storm surges (sea pushed into the funnel shaped estuary); isostatic change (area sinking 2mm/yr.); and sea level change (rising 3mm/yr.)
- **Vulnerability due to:** 1.6 mil live and work there; 150,000 properties at risk; 75% of England and Wales property value; London City Airport at risk; UK's largest centre of economic activity
- **Storm surges are a particular threat because:**
 - Depressions over the N. Sea create low pressure leading to increased sea level
 - N. winds push surface waters of the sea forwards ('wind drift')
 - N. Sea is funnel shaped as water is forced south it cannot escape through narrow English Channel increasing the height of the sea
 - Funneling effect enhanced by the Thames Estuary
 - Devastating flood of 1953 led to the building of the Thames barrier

The capacity of a community to react to and recover from coastal hazards depends on how prepared that community is. It depends on monitoring (predicting extreme weather), hazard mapping (know which areas are affected by the hazard), and emergency services (resources and training to react).

Flood Forecasting Centre monitors in the UK, The Environmental Agency and Natural Resources Wales inform the public and created hazards maps.

Managing Coastal Hazards

Rates of coastal change can also depend on human activity either intended or unintended:

- Intended – management strategies to reduce impact of erosion
- Unintended - The management of beaches where parts of the coastline is left exposed to erosion as the process of longshore drift moves large amounts along the coast, human settlements are vulnerable to cliff collapse or flooding in these areas.

Hard engineering strategies – artificial structures to control coastal processes they are normally expensive, have high environmental impact and is unsustainable, these include:

- Sea walls – concrete, reflect wave energy and prevent flooding, recurved so waves reflect, often protect settlements
- Groynes – wooden barriers built down a beach, trap sand being transported, the wider beach left then absorbs wave energy reducing erosion
- Rip rap – large boulders of hard rock placed on base of a cliff to absorb wave energy
- Gabions – steel cages containing boulders to absorb the wave energy
- Revetments – wooden fence structures that allow seawater and sediment to pass through but structures absorb wave energy and a beach builds up behind them.

Soft engineering strategies – work with natural systems, using natural methods and processes often less expensive, low environmental impacts and more sustainable. Include:

- Beach nourishment – beaches made higher and wider by importing sand from along the coast or from the sea bed
- Sand dune stabilisation – sand dunes act as natural defence against flooding and erosion
- Managed retreat – areas of coast allowed to erode and flood naturally, creating a new intertidal zone acting as a natural barrier against storms and rising sea level.

Different viewpoints:

- Environmental groups e.g. Green Party member and Environmental government spokesman believe managed retreat and leaving the coastline to its natural ways is best.
- Residents and property developers believe it should be defended as they do not want to leave homes and coasts are desirable places to live.

Why is there increased vulnerability for coastal communities in the future?

- More than 200mil people live along coastlines <5m above sea level estimated to increase to 400-500mil
- Areas could be inundated by rising sea levels forecasted to rise by up to 1m
- Inhabitants forced to find ways of managing rising water levels to abandoned some areas altogether
- Governments cannot defend everything at all costs
- More risks from extreme erosion from tropical storms.

Why some coastlines are at greater risk than others?

- Some coasts are sinking/subsiding e.g. river estuaries and deltas sink under their own weight as more sediment is deposited. Millions live on deltas in Bangladesh, Egypt, Nigeria, Vietnam and Cambodia.
- Rocks which make the coast may be hard or soft.
- Coastal storms affect some coastlines more than others. Some are more vulnerable to storm surges e.g. Thames Gateway.
- Some coastlines are threatened by tsunamis.

Small Island developing states (SIDS) and sea level rise: The Maldives

SIDS is a group of low-lying coastal countries first recognised as a distinct group in 1992. Challenges include: small but growing population, limited resources, remoteness and fragile environments.

The Maldives is a nation of 26 coral islands located in the Indian Ocean, population of 350,000. 80% of land is <1m below sea level and nowhere is more than 3m above sea level. Poor country 165th out of 192 nation states. Main occupation is fishing and it is an endangered nation.

Risks include: rising sea levels threaten existence of Maldives, flooding of beach resorts damaging tourism, damage to coral reefs due to warmer seas, money spent on sea defences at the expense of public services, groundwater sources contaminated, agricultural land lost and fishing disrupted.

Management: 3m high wall built around the capital (\$63mil by Japan), smaller island evacuated, Dykes (earthen wall) to hold back sea, height of islands increased, pop., relocated to Australia.

Example: 'Hold the line' management in Borth, Ceredigion

Holding the line means existing coastal defences are maintained and hard and soft engineering is used to keep the coastline in place.

Borth is built on a pebble ridge; wooden groynes were built in the 1970s and trapped sand on the beach to protect the village but were in poor condition by 1990. They needed a new plan.

2000 they decided to 'hold the line' by:

- Four rock groynes built to trap sediment being moved along beach
- Artificial rock reef built parallel to the shore to break power of waves & minimise erosion
- Beach nourishment put in place to increase width of beach of waves break further off shore.

Scheme completed in 2015 and cost £18mil despite original plans stating £7mil but it has been successful in preventing further damage and flooding.

Example: 'Managed retreat' in Medmerry, West Sussex

Managed retreat is when people are moved out of danger zones and Mother Nature is allowed to take control.

New defence scheme in 2014 which redrew the coastline 2km further in land, construction of 7km earth embankment, 4 channels taking freshwater through defence and a breach in the existing sea wall allows land to flood.

It cost £28mil, protected 348 properties, created 183ha of intertidal habitat, saved £300,000 a year maintenance costs, allowed public access, allow cattle to graze, and improved public health with access to countryside and wildlife.

Has it worked?

Performed well in 1st year and no flooding during storms of 2013-14, habitats is developing well, benefits to local economy e.g. tourism.

Example: Shoreline Management Plans (SMPs): Holderness Coast, Yorkshire

Responsibility of local councils to develop SMPs and must consider how many people are threatened by erosion/flooding, how much would it cost to rebuild houses, roads and railways and are there any historic/natural features that should be conserved?

The Holderness Coast has the highest erosion rates in Europe (2m/yr.), highest at spring tides, high winds from NE; beaches are narrow, retreated 4km since Roman times and villages lost. Risks include fertile farmland will be lost, more villages and major roads will disappear.

Management strategies include: Hornsea protected with groynes, a sea wall and riprap. Mablethorpe protected with groynes, rip rap and cliff regarding (reducing angle of slope).

Defences have increased erosion further south at Cowden and Aldborough, beaches starved and cliffs exposed to full force of waves/

Theme 1&4: Coastal Hazards and Management Landforms and Processes

Waves depend on three things: the strength of the wind (stronger wind makes bigger waves), the length of time to wind has been blowing (large waves need wind to blow for a long time), and the fetch (distance over which a wave has travelled (largest waves need longer fetch)).

Wave length: the distance between successive crests of a wave

Wave crest: The highest point of a wave

Wave trough: The lowest point of a wave

Wave height: the wave height of a surface wave is the difference between the elevations of a crest and a neighbouring trough

Swash: movement of sediment up the beach

Backwash: movement of sediment back into the sea

Constructive wave: strong swash and weak backwash, the strong swash brings sediments to build up the beach, the backwash is not strong enough to remove the sediment, the waves are low and further apart

Destructive wave: weak swash and strong backwash, the strong backwash removes sediment from the beach, the waves are steep and close together

Erosional landforms - Wave cut platform and notch



Labelled in red is the notch where the rock has been undercut by erosion from the sea

Formed when a cliff face is eroded by the sea:

- As the waves pound the base of the cliff hydraulic action and abrasion cut a wave-cut notch into the base of the cliff making it vulnerable to collapse.
- Continued erosion at high tide makes cliff unstable.
- Material from cliff is moved by the sea, and abrasion smooths the surface of wave-cut platform left.

Rock pools are small hollows in rocks found at the coastline such as in a wave-cut platform, at high tide they are covered by the sea and low tide some water remains. They are enlarged by abrasion at high tide by small rocks inside and waves, the hollow size then increases.

Erosion and weathering processes

Erosion: the wearing away of cliffs by the sea.

Hydraulic Action: waves crashing against the cliff, compressing water and air into cracks and forcing the rocks apart.

Abrasion: waves pick up rocks from the sea bed and beach and smash them against the cliffs.

Corrosion/Solution: minerals such as calcium carbonate (the main part of the chalk and limestone rocks) are slowly dissolved in the sea water.

Attrition: sand and pebbles are picked up by the sea and smash against one another, wearing them down into smaller and more rounded particles.

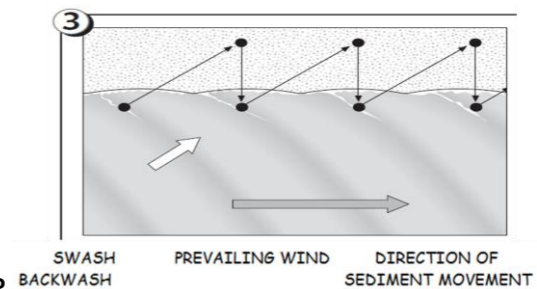
Weathering: the breakdown of rocks in place by elements of the weather

Freeze-thaw action: rainwater enters cracks on the cliff face, temperatures drop at night the water expands and makes the crack bigger, during the day ice melts and more water is added to the larger gap, process repeats until the rock falls apart

Biological: plant roots grow into the cracks in the rock breaking them apart or burrowing animals e.g. worms burrow through soil and cracks in the rock. Rock is broken apart.

Chemical: rainwater enter cracks, weak acid reacts with carbonates in limestone, cracks get bigger

Salt-crystal growth: seawater left on rock, water evaporates leaving salt behind, salt crystals grow and exert pressure on rock, rocks broken apart



What is longshore drift?

Eroded sediment falls into the sea and is transported by the power of the waves and currents along the coast by longshore drift.

- 1) Sediment is pushed up the beach (swash) which is the same angle as the wind direction.
- 2) Backwash then moves straight down the beach due to gravity.
- 3) The process continues along the beach.

Ynyslas sand dunes, West Wales, Ceredigion provide an excellent example of how a sand dune system can be created by longshore drift (see revision guide, pg. 17).

Mass movement – when soil, rocks or stones move down a slope

Rock falls and landslides

Wave action at the foot of the cliff sometimes triggers mass movement of the cliff face above. Rocks, loosened perhaps by winter frosts or heavy rainfall, can fall suddenly to the beach below in a rock fall. Large sections of a cliff can slide rapidly downwards onto the beach. Slumping also happens on the coast when bite-sized chunks are removed from the top of the cliff.

Evidence of rock falls and landslides include – large concave scars on upper cliff and fan-shaped pile of debris at the base of the cliff. Evidence of rock fall at the base of the cliff are angular rocks.

What factors affect rates of landform change in coastal landscapes?

Geology: type of rock that is being eroded and the way the rock types are laid down.

- **Concordant coastlines:** it has the same rock type along the length of the coastline so the rock erodes at the same rate so coast has few headlands and bays.
- **Discordant coastlines:** coastlines where the geology alternates between bands of soft and hard rock. The differential erosion rates result in formation of headlands and bays.

Climate:

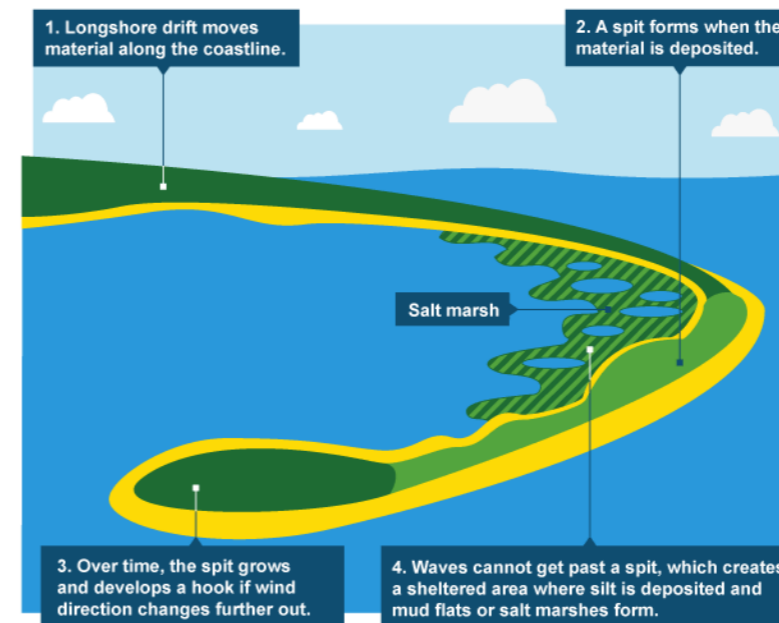
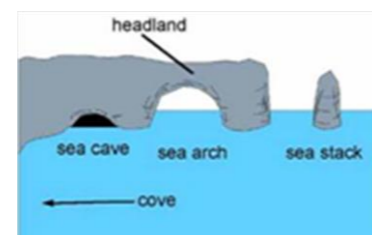
- The prevailing wind affected the angle at which waves break on the coastline, therefore the direction of erosion and transportation. The waves break onto the coastline, and therefore, the direction determines where depositional landforms form e.g. spits.
- Extreme weather events alter landscape; a powerful storm can change the coastal appearance overnight. The more severe a storm the more destructive waves and erosion.

Erosional landforms – formation of headlands, bays, arches and stacks.

Arches and stacks form in **headlands** (an area of land that is made of **hard, resistant rock** jutting into the sea, eroded slowly).

A bay is formed between the headlands due to **softer, less resistant rock** eroding more quickly. Beaches form in sheltered bays.

Arches form when **2 caves are created on either side of a headland**, sea cuts through the back wall by **hydraulic action and abrasion** and once broken right through water passes underneath. **Weathering** erodes roof of the arch so it becomes higher and thinner. Eventually the arch collapses, leaving a single pillar of rock called a stack.



Depositional landforms – beaches and spits

Form when swash is stronger than backwash and more deposition occurs:

- Beach is a build-up of sediment (sand, shingle and pebbles) deposited by waves
- Longshore drift transports beach material along the coast but when it changes direction (e.g. at the river mouth), beach material is carried out to sea.
- This creates a new strip of land which projects out to sea but still remains attached to the land at one end, this called a **spit**.

E.g. Spurn Point on the Holderness coast at the mouth of the River Humber is an example of a spit (4.8km long, 46m in places) see pg. 19.

Key Words

Glacial: cold periods in Earth's history

Inter-glacial: warmer periods in Earth's history

Aerosol: particles of dust, volcanic ash and gas in the atmosphere that reflect sun energy into space

Green-house gases: Co2 and methane trap heat in atmosphere

Carbon sinks: places where carbon is store over long periods

Cyclone: low pressure system, unsettled weather, wind & rain

Drought: high pressure system, little rainfall over long period

Inter-tropical convergence zone (ITCZ): band of atmosphere circling tropical latitudes, low pressure, cloud, heavy rainfall

Monsoon: seasonal pattern of wind brings a wet season

Coriolis Effect: rotation of the Earth deflects movement of hurricanes

Jet stream: strong wind that circulate around the Earth

Maritime: climate condition of land close to the sea

Aspect: direction is which a slope or other features face

Ocean currents: flows of water through seas and oceans, some are warm and some are cold

Air masses: large parcel of air in the atmosphere

Depressions: low pressure system, changeable weather including rain and winds

Anti-cyclones: high pressure system, dry settled periods

Urban microclimate: small-scale, local climate of a large city influenced by its buildings and traffic

Urban heat island: city has temperatures warmer than surrounding rural areas

Evidence for Climate Change?

Ice cores - Greenland and Antarctica, investigate information trapped in ice to uncover evidence of past climate change. each layer of snow contains evidence of temperature and climate from trapped gases. Suggests climate has gone through glacials and inter-glacials and CO2 fluctuates.

Keeling curve - regular measurements taken of CO2 concentrations taken from Mauna Loa, Hawaii, rise in CO2 concentrations since recording began in 1958.

How does low pressure lead to weather hazards?

Climate near Equator is hot throughout the year, the sun heats the Earth and this warm air rises and creates a band of low pressure in the atmosphere (ITCZ). When warm air reaches the tropopause it cools and condenses creating heavy rain storms.

Cyclones form when:

1. ITCZ is overhead
2. Destructive energy created when warmth from sea (>27 degrees) weeks before rapidly rises and heats air above creating towering clouds and torrential rain
3. Coriolis Effect when Earth's rotation makes storm spin upwards as air moves

Case Study - Cyclone Pam

Impacts	Responses
90% of homes destroyed, many were made homeless and 11 people were killed	Several nearby countries helped by sending emergency supplies, personal and military support
Schools were destroyed and water supplies contaminated	Repairs were made to water supply systems and damaged buildings
Farmland was damaged, 80% of coffee crops ruined costing \$2.5 billion to farming businesses	People received emergency medical care
Heavy rain washed away nutrients from soils and vegetation was flooded causing habitat loss	Temporary schools were set up

Case Study - Drought in California

Impacts	Responses
Homeowners told to stop using water, hosepipe bans were an issue	Watering of gardens, cars and driveways was banned
Many forced to flee and evacuate	Compulsory water restrictions
Some homes were destroyed by fire and people were injured	Reduce the amount of electricity produced by HEP
Farmers lost \$810 million in 2015 and food shortages	Leaflets sent out offering advice on how to conserve water at home
HEP dams stopped producing electricity	Create desalination plants that remove salt from sea water
State lost 17,000 jobs in agriculture	Plant crops that require less water or import crops to save water
Wildlife was destroyed as habitats were burned or damaged by drought	Fire services worked to stop fires spreading in the area by burning land between buildings & wildfires
Salmon and trout killed due to increase in river temperatures.	

What are the natural and human causes of climate change?

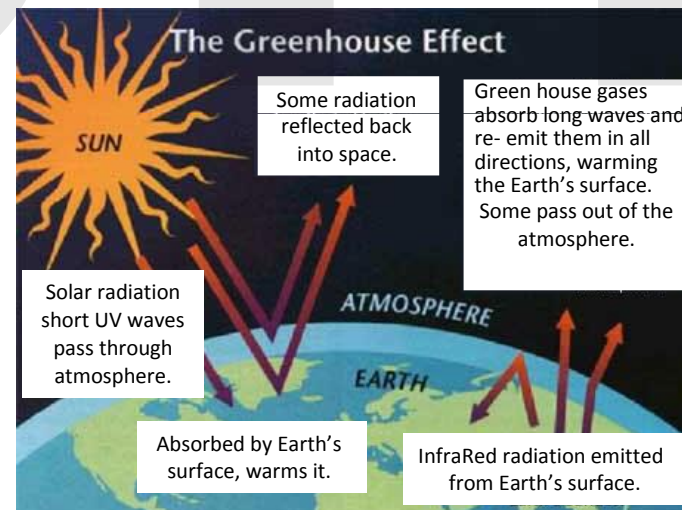
Changes in Earth's orbit (it is sometimes circular and sometimes more eccentric so sometimes it is closer to the Sun than other times happens every 100,000 yrs.) and **wobble** (tilt on axis as it orbits every 41,000 yrs.)

The Greenhouse Effect: (see diagram right)

Volcanic Activity: large eruptions eject ash and Sulphur dioxide into stratosphere, this mixture forms an aerosol which reflects sun energy into space, less solar energy reaches earth so earth's temperatures drop.

Burning fossil fuels: releases large amount of CO2 from carbon sinks (fossil fuels) such as coal and natural gas

Deforestation: reduces the number of trees taking in CO2 for photosynthesis



How does high pressure lead to weather hazards?

Cold air sinks, as it sinks it air heats up and does not pick up any moisture normally leads to fine, dry conditions.

The position of the jet stream fixes low or high pressure systems over an area. If the jet stream is wrapped around an area of high pressure it can remain stationary for long periods of time leading to significantly less rainfall than normal resulting in a drought like the one in California from 2012-2015.

Factors which affect weather & climate in the UK

The UK's climate is temperate maritime and is affected by:

Latitude: The UK is 50-60 degrees in latitude making it closer to the poles in which the sun's angle is low and have a large area to heat up so temperatures remain lower than the equator.

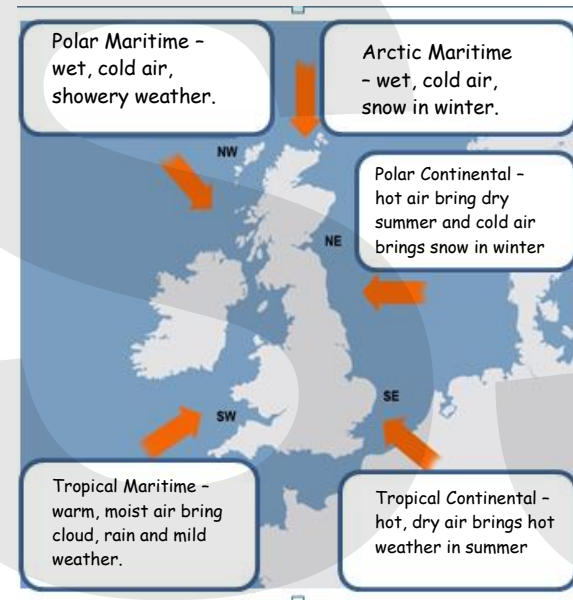
Altitude: Upland areas of UK are much colder than lowlands. Temperatures decrease by 1 degree every 100m in height.

Aspect: or direction of a slope determines the amount of sun received. South facing slopes are warmer than north facing ones.

Jet streams: ribbons of winds 16km above the surface than bring high pressure from the tropics and cold polar air from the north.

Ocean Currents: The Gulf stream (current of sea water from North Atlantic) can bring warm water from Gulf of Mexico and influence temperatures in the UK.

Air masses: 5 effect the UK, bring different weather, see below.



Anti-cyclones vs. Depressions

During the summer **anti-cyclones** bring hot, dry weather in summer and frosty, clear conditions the winter. Cold air is sinking put pressure on the earth (high pressure), drying and heating up as it reaches the ground The jet stream can fix it in position and it can cause heat waves and droughts.

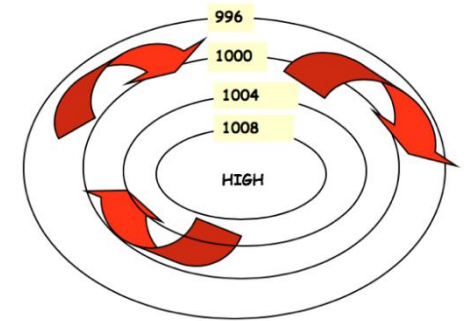
Anti-cyclones on a synoptic chart:

- Pressure increases towards the centre
- Isobars are far apart meaning wind is light
- Wind blocks in clockwise direction

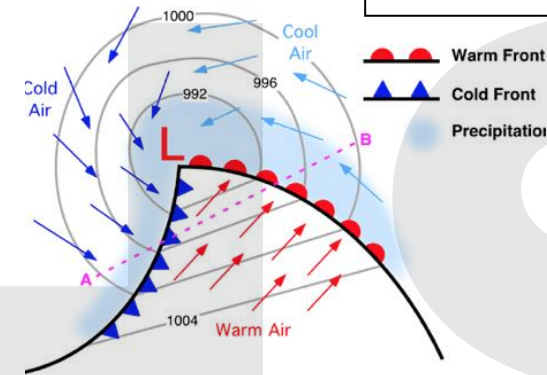
Air lifts off the surface during a **depression** putting less pressure on the earth (low pressure). They are more common in Britain moving east across the Atlantic bringing changeable conditions including wind, cloud and rain. The winter storms of 2014 in North Sea, England was caused by this. Huge banks of cloud form along the **fronts** where cold and warm air meet making rainfall heaviest along these (as warm air rises, cools and condenses over cold air).

Depressions on a synoptic chart:

- Pressure decreases towards the centre
- Isobars are close together so winds are strong
- Wind blocks in anti-clockwise direction



Synoptic chart for Anti-cyclone



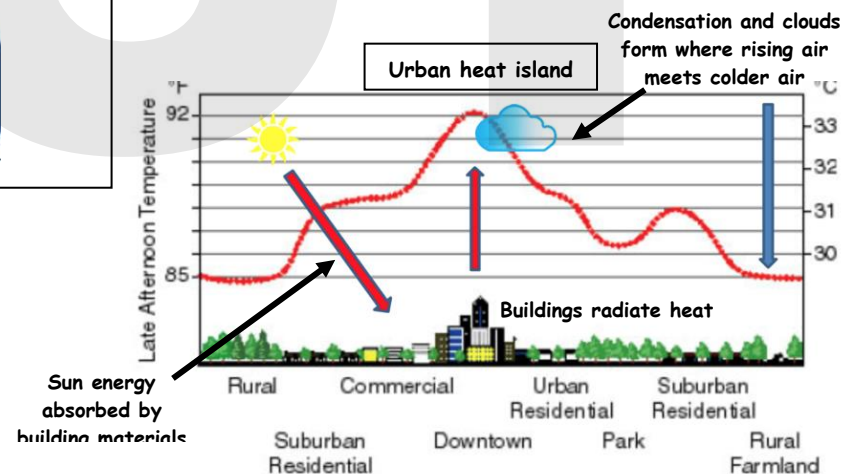
Synoptic chart for Depression

Microclimates

Microclimates are the climate of very small or restricted areas, they differ from surrounding climates and are influenced by a number of factors.

Urban microclimates are normally warmer than surrounding rural areas and this is mainly influenced by:

- Traffic - heat is lost to the air from exhausts. There are a lot more cars in cities than rural areas.
- Buildings - often concrete, tarmac or brick all absorb heat from the sun during the day which is radiated into the atmosphere at night. Badly insulated buildings lose heat energy into atmosphere. Winds are also funneled between tall buildings making them 3x stronger than average.
- Shelter - trees act as a barrier, forcing wind to rise over and creating a shelter belt. Tall buildings in cities have an even greater shelter effect, so wind speeds are lower than surrounding countryside.



Key Words

Ecosystems - community of plants and animals and the environment in which they live, it includes living and non-living parts

Biomes - very large ecosystems e.g. tropical rainforests

Nutrient stores - part of an ecosystem in which nutrients are kept

Nutrient flows - the movement of minerals from one store to another

Key services - the ways in which ecosystems provide benefits for people

Indigenous peoples - tribal groups who are native to a place

Flora (vegetation) - the plants of a particular ecosystem

Fauna - the animals of a particular ecosystem

Producers - plants able to create starch from the sun's energy, bottom of the food chain

Primary consumers - animals that eat vegetation in the food chain

Secondary consumers - animals higher up the food chain, eat primary consumers

Biodiversity - the variety of living things

Water Cycle - continuous flow of water between the earth's surface and atmosphere

Nutrient Cycle - movement and exchange of nutrients in an ecosystem

Food Web - similar to a food chain but larger. The diagram combines many food chains into one picture.

Food Chain - a series of organisms each dependent on the next as a source of food.

Leaching - loss of nutrients from soil by rainfall when it is left bare

Deforestation - the action of clearing trees by human

Agribusiness - farming that is organized by large businesses (MNCs)

Monoculture - type of farming in which only one crop is grown over large areas

Canopy - upper layer of a forest, receives most sunlight

Wildlife corridor - strips of habitat that allow wild animals to migrate from one ecosystem to another

Buffer zones - part of a conservation area in which some activities, such as farming and tourism, may be allowed

Agro-forestry - type of farming in which a mixture of crops, shrubs, fruit and nut trees are grown

Desertification - fertile land becomes desert, typically as a result of drought, deforestation, or inappropriate agriculture

Fallow period - period of time in farming where land is left to rest

Drought-resistant - plants that are able to survive periods with below average rainfall

Sahel - semi-arid region of North Africa, south of the Sahara Desert

The Tropical Rainforest

Location

Grow in a band around the Equator (5 degrees of the Equator) in countries such as Brazil, Costa Rica, Congo,

Named Example

Amazon Rainforest, Brazil

Characteristics

- Heavy rainfall (1,500m-2,000mm a year.
- Concentrated sun energy overhead mean temperatures are over 25 degrees all year
- Rapid plant growth with trees reaching 40m due to climate conditions
- Large biodiversity, large number of flora and fauna

Nutrient Cycle

There are plenty of nutrients in the rainforest existing in the biomass (plants), litter (dead leaves) and soil. Plants take them from the soil and release them back into the soil when the plant dies.

- The biggest store is biomass as there are many large trees
- Not much is stored in leaf litter as the humid conditions allow bacteria to reproduce very quickly decomposing the litter into the soil store.
- The store in soil is also small as leaching occurs when rainwater washes nutrients from soil and high temperature speeds up chemical reactions releasing minerals from soil.
- The largest flow of nutrients is from soil to biomass as there are many trees taking in nutrients.

Water Cycle

- The trees act as a store for water between rainfall events in the soil, water puddles, in plant tissue
- Between rainfall events 80% transferred back to the atmosphere by evaporation and transpiration.
- 200mil people rely on rainforest for water supply

Carbon Cycle

- Most carbon in the rainforest is stored above-ground in the trees, plants, birds, insects and animals
- A lot of carbon is also stored in the soil,
- Some carbon is in living things e.g. roots, beetles and earthworms and the rest in dead organic matter e.g. leaf litter, fallen trees and decaying wood

Key services also include supporting thousands of plants and animals that contain chemicals for agriculture or medicine.

Savanna Grasslands

Location

Found within the tropics 5-15 degrees north and south of the equator. Between tropical rainforests and hot deserts.

Named Examples

Brazil, Tanzania, India and Northern Australia

Characteristics

- High temperatures all year (23-28 degrees)
- It has a wet and dry season
- The wet season is in the summer with heavy convectional rainfall
- Main vegetation is drought-resistant as drought and fire decide the species that survive e.g. Acacia, Baobab
- Soils have a hard crust due to long, dry season and they are leached in the wet season to give a red colour, they are acidic and have few nutrients.

Nutrient Cycle

- Biomass is a smaller store than the rainforest because temperatures are often too dry to allow optimum growth of plants and trees
- Organic matter in the litter store decays quickly because temperatures are high all year round allowing bacteria and fungi to flourish meaning this store is small
- The soil store is also small as nutrients are lost in the rain due to leaching

Water Cycle

- Droughts last 4-6 months a year
- Tourists sometimes dump waste in rivers polluting them
- Resistance to drought is more important than resistance to fire
- Water for tourists is exploiting local reserves leaving plants and animals short of water

Carbon Cycle

- Tropical Savanna covers 20% of the earth's surface
- Fewer trees in the Savanna and less stored carbon
- Regular bush fires release tons of CO₂ into the atmosphere
- During the dry spell plant growth, death and decay continue but at a slower rate

Key services include providing opportunities for tourism as it is home to many species and make them a popular destination which brings the area money

Human Activity in the Rainforest (Amazon)

Reasons for Destruction?

1. **Mining** - clear the rainforest to dig under the ground for resources, in the Amazon there is iron and gold that makes a lot of money for the Brazilian economy
2. **Slash and burn** - trees are cut down and the rest of the vegetation is burnt to quickly provide land for settlements, crops and cattle ranching (grazing cows)
3. **Dams** - The Tucuruí Dam was built in the Amazon in 1984 to generate electricity to power businesses around the area. Large areas of forest have to be destroyed and flooded for this.

How does human activity change the TRF ecosystem?

Positives	Negatives
Money is brought into Brazil's economy	Clears large areas of rainforest especially for mining
Infrastructure improved to transport goods (roads and factories)	Mercury gets into water cycle and can poison animals and people
Increased space for housing	More Co ₂ in the atmosphere as less trees to take it in for photosynthesis
Able to grow a large number of crops on cleared land to sell globally	Canopy (umbrella layer) is destroyed leaving soil bare so when it rains they can be washed away (leaching) into rivers where it can lead to flooding.
	Flooding of local rivers for damns, reduces water supply for indigenous people

How can the TRF be managed more sustainably?

- Buffer zones – allows some human use of the forest, surrounds and helps protect conservation areas. Locals encouraged using it sustainably by planting crops, food and nuts that protect soil from erosion (this is known as agro-forestry). Locals are involved in decisions and education of the value of conservation.
- Agro-forestry – rather than clearing large areas of forest, they plant crops in the spaces between trees rather than leaving the soil bare.
- Forest reserves – certain areas of the forest that cannot be touched unless for research purposes.
- Eco-tourism – encourages locals to become guides for tourists, and to preserve the nature for its beauty.
- Wildlife corridors – allows animals to move from certain parts of the forest with ease, done by planting strips of forest to connect remaining fragments of forest together, means that animals can find new sources of food and find mates in other forests.

Human Activity in the Savanna

Problems in the grasslands

1. Poaching - illegal killing of over 40,000 animals each year in Kenya's national park threatening biodiversity
2. Desertification
 - a. Vegetation helps to regulate the water cycle but slash and burn of savanna trees and bushes to make space for farming reduces evapotranspiration and leads to reduced rainfall.
 - b. Removal of vegetation means leaf litter can't fall into soil so the nutrient cycle is broken and shrubs do not replace nutrients to maintain a healthy soil structure by organic material to the soil.
 - c. Destruction of the canopy exposes the soil to splash erosion so during heavy rainfall water flows over the surface of the ground, eroding the organic soil from the upper layers of the soil.
 - d. On steeper slopes water picks up and carries soil and small rocks, used to erode downwards into the soil in a process called gully erosion.

How has food production affected the Savanna?

A mix of arable (crop) and pastoral (cattle) farming is carried out, farmers used traditional methods such as slash and burn and bush fallow systems to grow maize, root crops and vegetables.

Fallow means the land is left for a period of time without being used to restore the nutrients and leave natural shrub to grow back, leaves are able to decompose and replace organic nutrients taken out by farming. However, soil is not given the full time to recover and these periods have got shorter. There is also risk of wind and rain erosion when it is left fallow.

How can the Savanna grassland be used sustainably?

- **Crop rotation and fallow periods** – grow different crops each year so different nutrients are used. Leave the field fallow to allow soil to regain fertility.
- **Shelter belts** – belts of forest or hedges to protect farmland from effects of water and wind erosion
- **Reforestation** – plants trees to reduce impact of wind and water
- **Irrigation** – water areas of land that are arid (dry) by diverting rivers or digging wells.
- **Reduce grazing numbers** – place limits on no. & type of animals that can graze on land, reducing the destruction of vegetation & desertification
- **Population control** – less land will be needed to produce food and the intensity of farming will decrease
- **Drought-resistant crops** – genetically modified crops that can withstand poor soil and water shortages e.g. Maize

Example of a small scale ecosystem - Sand Dunes

What is a Sand Dune?

Sand dunes are an accumulation of sand stabilized by vegetation.

How do they develop/change from coast to inland?

Need a source of sand and onshore prevailing wind, sand stops when it hits an object, small dune builds up (embryo dune) and pioneer plants grow and become stabilized by root systems and get bigger. Plants die and decompose adding nutrients so new plants are able to grow. Dunes stop growing due to a lack of wind-blown sand.

What key services do they provide?

Opportunity to develop tourism, natural coastal defense against storms and flooding, sand for building purposes.

Threats from human activity:

- Recreation: attractive for leisure facilities e.g. walking, pony-trekking. Marram grass is trampled and is easily killed. Bare sand becomes exposed and blown away to leave hollows (blow-outs) destroying habitats and reducing biodiversity.
- Economic: farmers used areas for grazing animals; cow-dung enriches soil and affects natural processes. Introduces fertilizers. Plants and animal diversity reduced through soil compaction and nutrient enrichment.

How do people use the environment for energy production?

Facts about the wind farm	Advantages	Disadvantages
Gwynt-Y-Mor windfarm opened in 2015	Power say energy should supply 400,000 homes/year	RSPB say wind farms harm birds, many migrating birds will fly through the wind farm
2 nd largest in the world 160 turbines, 150m high	BBC report 100 jobs created at Mostyn docks	National Trust are concerned the wind farm will spoil beauty of the coastline
13km off the coast of N.Wales 16km from seaside resort of Llandudno	WWF Cymru support it as it helps reduce CO ₂	Locals are against the project as they see it as an eyesore against natural beauty of the area
Cost £2billion		