

# **GCSE Geography Knowledge Organiser**

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# **GEOGRAPHY OVERVIEW**

## Key Terminology

### SEEP

S**ocial** = Issues to do with peoples lives

E**conomic** = Jobs, business and money

E**nvironmental** = The Environment

P**olitical** = Countries and Governments

**Stakeholder** = Somebody who has an interest in an issue

**Timescale** = Are you talking short term ( days and weeks ) Or long term ( months and years ) ?

**Spatial** = What scale are you looking at ? Is it *local* scale, *regional* scale , *national* scale or *global* scale ?

### **Sustainability**

*“Meeting the needs of the present without compromising the ability of future generations to meet their own needs”*

*Enough , For all, Forever*

# Geography Connectives

**At the end of every sentence ask yourself – ‘So ?’ , ‘And ?’ and ‘Why ?’**

*This means that ...*

*As a result of this ...*

*This leads to ...*

*The result of this ...*

*This results in ...*

*In the future this may lead to ...*

*As a consequence of this ...*

*This occurs because ...*

*The reasons for this is ...*

*This causes ...*

*An example of this is ...*

*The reason for this is ...*

*... leading to ...*

*... meaning that ...*

*The impact of this is ...*

*This produces ...*

*This may bring about ...*

*...and because of this ...*

*This is due to ...*

*This suggests that ...*

*...and this means that ...*

*One reasons for this is ...*

*...and due to this ...*

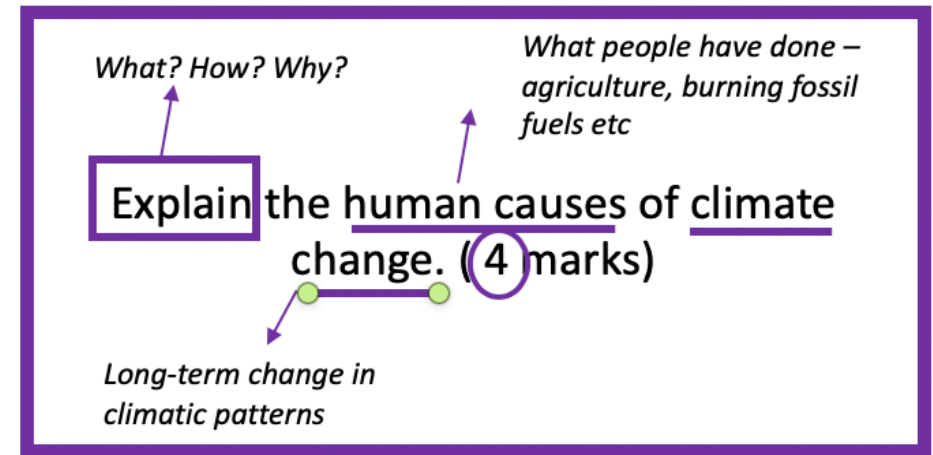
# BUG the exam question

Before you answer any question remember to **BUG** the question

**B** – box the command work

**U** – Underline any other key words

**G** – glance at the mark



## Developing your points using the PEEL structure

### Point

What is the point you are making ?

### Evidence

Which examples / facts / data link to your point ?

### Explain

Develop your point using connectives such as 'This means that' or 'therefore' or 'this shows that'

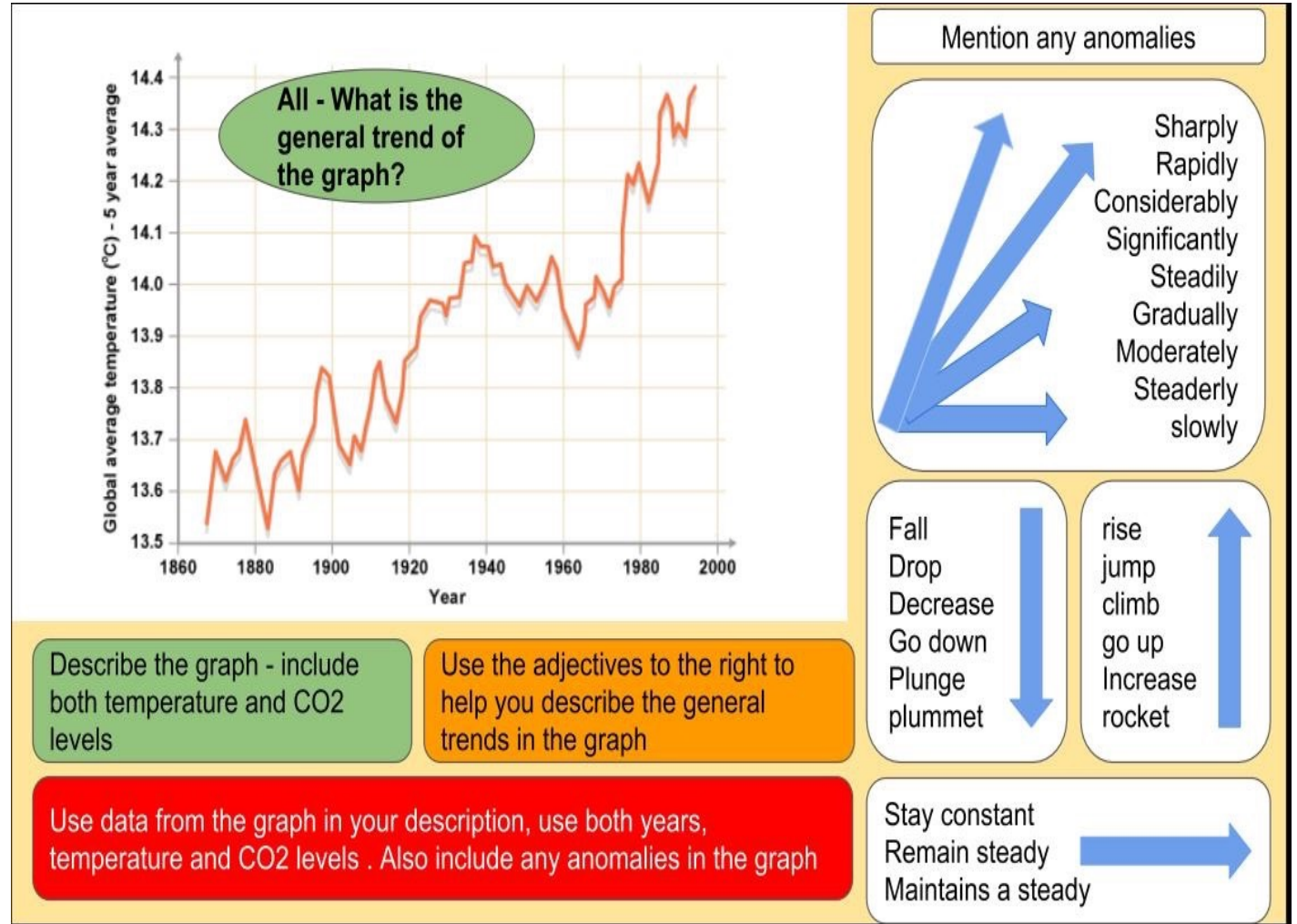
### Link

How does your point link back to the question ?

# Reading a graph in Geography

## PEA

<b>P</b>	<b>Pattern</b>	E.g. "Its increasing"
<b>E</b>	<b>Evidence</b>	E.g. "Between 1990 and 2005 it increased ..."
<b>A</b>	<b>Anomalies</b>	Is there anything different ?  A sudden drop ? Point it out.



# Reading maps in Geography – 'CLOCK'

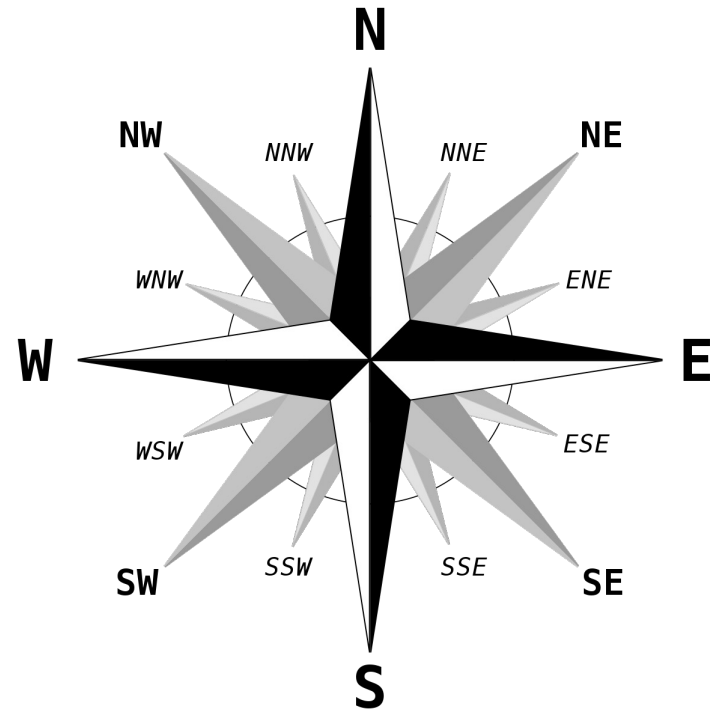
**C** = Country

**L** = Latitude / longitude

**O** = Oceans and Seas

**C** = Compass points

**K** = Kilometres ( distance and scale

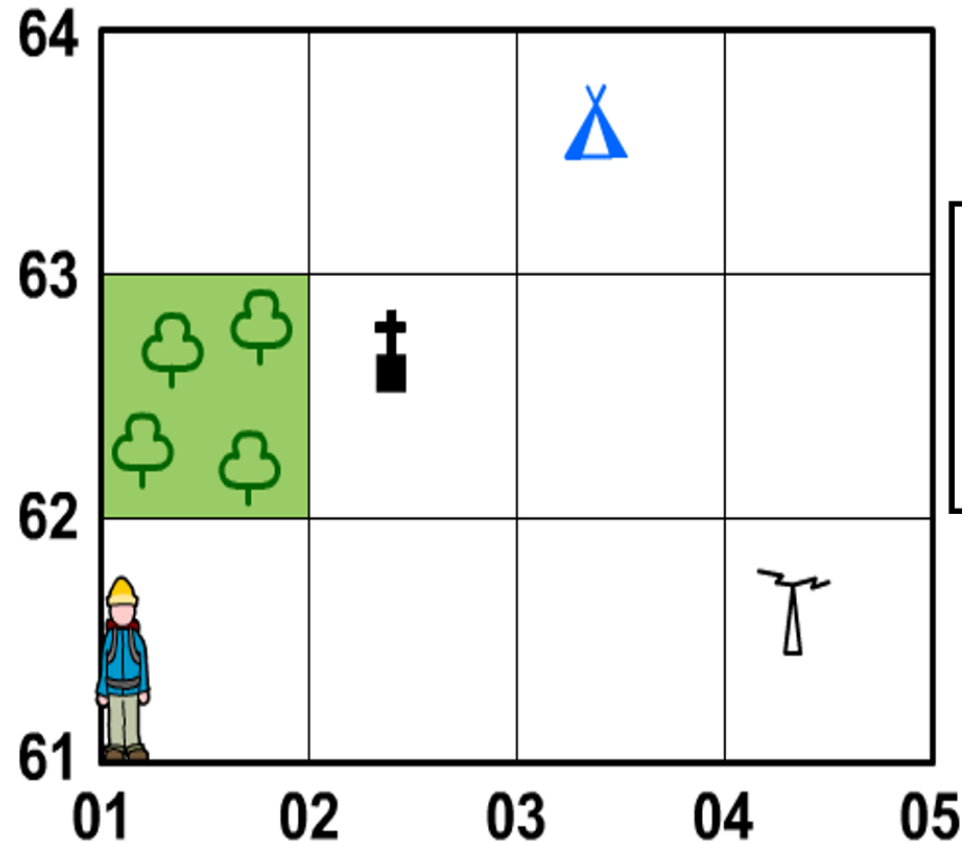




# Using OS maps in geography

## Follow the 3 Grid reference rules

1. Always go across the landing and then up the stairs .
2. If you are 'in' a square, then go down and left.
3. If you are given a grid reference and need to find it ,go up and right.



# Decision making exercises checklist.

**Did you ...**

1. Plan your answer ?
2. Rank your option choices ?
3. Develop your points using TAT ?
4. Link to SEE ? ( *Social , Economic, Environmental* )
5. Mention stakeholders ?
6. Use the resource booklet ?
7. Link to scale – *local, regional and national* ?
8. Link to time – *short term vs long term* ?
9. Think about the bigger picture – national or global issues ?

# **1.1 Urbanisation in contrasting global cities**

## Megacities and Global cities

### Key Terminology

Megacities – cities with a population of over 10 million people

Global cities – cities that have a global importance

**Global cities** are those that exert a dominant influence over continental and global economies and processes.

This is INDEPENDENT of population size, as global cities *do not* have to have huge populations (but usually do) to exert a huge influence. A global city is generally considered to be an important location in the global economy such as London, New York and Tokyo.

**Megacities** are defined purely by size – those with over 10 million people. Most megacities are found in NIC and LICs.

There are 498 megacities, of these 101 are in China and 57 are in India.

Where cities expand to engulf surrounding settlements, they form a **Conurbation**.

**There are many reasons why some cities develop into major megacities or global cities:**

- 1. Changes in Natural Increase** – cities tend to help to lower mortality rates as access to imported medical care and technology, better access to food and improved sanitation bring down death rates. This means that birth rate can exceed death rates and populations grow naturally.
- 2. Push factors** - agricultural change and revolution – to encourage megacity growth and the increase in urbanisation people often have to move or migrate from rural areas to urban areas. In Britain we had an Agricultural revolution from 1750 to 1850 which forced people from the land into newly emerging industries in rapidly growing cities.
- 3. Cities are declared capital cities** – Governments can change the capital city if they wish. Brasilia in Brazil was declared capital in 1960 after being planned in 1956. It now has 2.5million inhabitants from nothing in the 1950s!
- 4. Ports and trading cities** – coastal locations are advantageous as they allowed increased global trade.  
**Colonial influences** – colonial powers such as the UK and France created many urban areas, often in coastal areas as they sought to exploit resources within their new territories. Lima was created by the Spanish in Peru, whilst Rio de Janeiro was established by the Portuguese in Brazil.
- 6. Economic reasons** – TNCs and the global economy have focused production in urban areas, and this causes many cities to grow into centres of production globally, that can be used to create wealth for governments and create import substitution of goods.

## Megacities and Global cities

### Migration and culture:

Global cities attract economic migrants from all over the world. Migration leads to cultural diversity. More than 100 languages are spoken in 30 of London's 33 boroughs. The 2011 Census showed that 22 percent of London's residents do not speak English as their main language. That's just over 1.7 million people.

### Governance and decision-making:

Business managers in one city can make decisions that affect people worldwide. For example, Tata is an Indian MNC with its headquarters in Mumbai and businesses in over 100 countries. Politicians and civil servants can also have worldwide decision-making roles. The UN employs 41,000 people. 6,389 are based in their headquarters in New York.



What are Global cities like ?

### Finance and trade:

The world's most important global cities are financial centres. Banks have their head offices here. Dealers working at financial markets like FTSE buy and sell commodities on the world markets.

### Transport hubs:

The top global cities are all well-connected to the rest of the world by major airports or ports. These allow the flow of people, tourists and trade. About 1,400 flights take off or land at London's Heathrow airport every day.

### Ideas and information:

Many of the world's global cities are the home for major broadcasting companies. Newspapers, TV stations and filmmakers are based in global cities. BBC World News is an international TV channel broadcasting 24 hours a day to over 300 million households in 200 countries.

## Mumbai - an Indian Mega-city and global city.

### Key Terminology

Natural Increase – increase in population as a result of higher birth rates and lower death rates.

Push Factors – Reasons people leave an area (negative)

Pull Factors – Reasons people go to an area (positive)

Mumbai is located in the region of Maharashtra

Population of 18.4 million people

Why has Mumbai grown?

Natural increase – migrants tend to be of working age and therefore are more likely to have children.

Rural to urban migration -

People are attracted by jobs and better training opportunities.

Rural areas have large poverty levels, poor standard of housing, healthcare and sanitation. Farming is also becoming more difficult.

Urban and Economic Change

The economy is rapidly increasing as a result of young, professional, well-paid men and women many of whom have moved from rural areas and have gained graduate qualifications from university. The result is an emerging middle class.



### Why is Mumbai a Global City ?

**Access to the ocean:** Mumbai has direct access to the ocean, with a natural deep harbour which is easily accessible for modern container ships, promoting exports and imports.

**Mumbai's location in India:** Mumbai is located on the western coastline of India. This allows quick and easy access via boat or plane to the major emerging economies of the middle east, including the United Arab Emirates (Dubai).

**So how important is Mumbai's location?** 25% of all international trade within India is handled by the dock in Mumbai.

**Well connected** to other locations within India and abroad.

Home of **Bollywood**

**MNC headquarters** such as that of Tata steel are located here

Nheva Sheva is **India's largest container port** and can ship goods far quicker than any other Indian port.

**Mumbai international airport** is an important hub airport, connecting the Middle east to Europe and the pacific regions.

# Mumbai – Problems of a rapidly growing city : Housing Issues

**Chawls** – 4 and 5 storey single rooms along a corridor with shared facilities.

These are poorly ventilated and overcrowded.

**Squatter homes/slums** - simple single or two story buildings without planning control.

Sanitation is poor and 73% share communal latrines.

**Pavement Dwellers** – huts which line the streets. People, largely children pay rent to criminal gangs.

Open to abuse by gangs and can be destroyed by the authority at any point.

**Dharavi is an informal settlement, located in central Mumbai.**

Home to 1 million people on 1KM squared of unwanted land.

## Key Terminology

**Formal Occupations** – employment that is registered and under contract. Tax is paid and rules are followed regarding minimum wage and working conditions.

**Informal occupations** – cash in hand and unregulated. No tax is paid and there is not a regular wage.

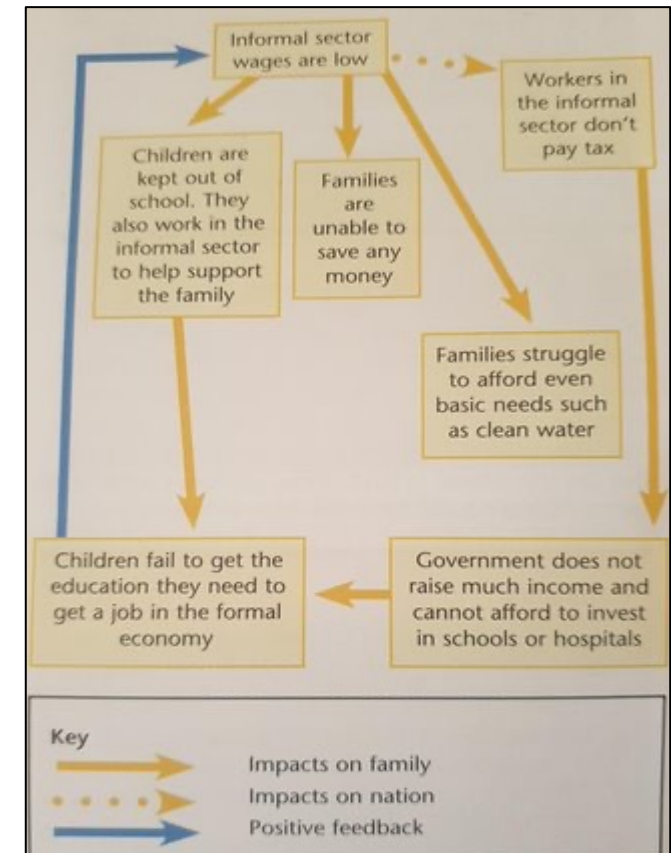
**Ragpicker** – an individual who sorts for sellable waste ie plastic and metal

### Challenges of living in Dharavi

- Long queues for toilet blocks and water taps
- Open sewers
- Poor constructed buildings that collapse and leak
- Poor air quality from small factories
- Lack of healthcare
- High crime rates
- Little education

### Or is it a model of a sustainable community ?

- ✓ Low rise, self built houses
- ✓ Close to work so minimal transport needs
- ✓ Diverse range of family run businesses
- ✓ 15,000 factories
- ✓ Employs quarter of a million people
- ✓ Contributes £700 million to Mumbai's economy
- ✓ Ragpickers recycle 80% of Mumbai's waste



## Mumbai – Housing solutions : Improving the slums

### Key Terminology

**'Top Down' Development** – where initiatives are decided by public officials and business leaders

**Self-help Scheme** – initiatives to allow individuals to build a future for themselves

**Micro-credit** – small loans at reasonable rates

**NGO's** - Non-government organisations. E.g. Save the Children and Oxfam

### The Vision Mumbai Report Recommends:

- i. Improving roads and improving congestion on trains
- ii. Slum clearance
- iii. Building 1.1 million low cost houses
- iv. Reducing slum living from 60% to 10-20%
- v. Improving air quality, sanitation and water supply
- vi. Creating jobs in construction, tourism and retail.

### The Redevelopment of Dharavi

Dharavi's location next to Mumbai's financial district makes it worth \$10 billion.

Large areas have been bought by property developers

In return they must provide affordable housing in high rise flats

Luxury apartments and offices are being built for profit

#### Issues

Displacement of slum dwellers

Destruction of a community

Lack of jobs in new location resulting residents moving back

Loss of industry



# Self-help schemes in Dharavi, Mumbai

## The scheme:

- Councils provide materials for slum dwellers to improve their houses, e.g. Concrete for walls, roof tiles
  - Standpipes, toilet blocks, waste collection points
- Health centres & schools means slums slowly become better quality
  - Slum dwellers given legal ownership of land

## Positives:

- ☺ Improves social and environmental conditions
- ☺ Cheaper and quicker than building every resident a proper house of rehousing them
  - ☺ Keeps communities together
  - ☺ Don't need to find new sites of land

## Negatives:

- ☹ Wouldn't cost a lot for city authorities to build health centres and schools
- ☹ Won't get rid of problems so sanitation cannot easily be improved for existing housing
  - ☹ Encourages illegal squatting
- ☹ Can only give legal ownership to people on land the council owns
  - ☹ Slum will remain in an unplanned state
  - ☹ Slum dwellers sell materials





### **SPARC toilet blocks offer:**

- ✓ **Electrical lighting making them safe for night time use.**
- ✓ **Separate toilets for children to use, ensure privacy and safety**
- ✓ **SPARC have now built over 800 toilet blocks across Mumbai in the last 5 years, each with at least eight separate toilets!**

**This is an example of a bottom up development which encourages the local community to become involved in the project.**

**You could argue though that this is a job that the Mumbai government should be addressing, and NOT local NGOs! ( non-government organisations )**



## Mumbai – Problems of a rapidly growing city : Transport Issues

465km of railway links Mumbai to its suburbs, but there are only 4 railway crossings causing congestion for the 7.5 million commuters. However, trains are overcrowded – at peak times they carry 3 times the number they were designed for. The Trains already run every 3 minutes so increasing this capacity isn't possible.

The solution ? A mass Transit scheme. The Mumbai Monorail

### Why a monorail?

- ✓ Sustainable cities!
- ✓ Monorails are a form of public transport, reducing the congestion of cars.
- ✓ Green transport – Reduction in total emissions due to fewer cars generating atmospheric pollutants.

A monorail was decided as the best option, as investments in buses would have caused an increase in traffic congestion. Monorails run above the roads on specially designed tracks (see photo), so in theory, traffic congestion should be reduced! Monorails can travel at up to 40kph, so passengers can be transported quickly and efficiently around the city centre.

Tickets are cheap (10p per person), but the route DOES NOT travel through the main area of the city. As a result, only 15,000 journeys are made each day, most of these being by tourists!!!

**Conclusion:** The monorail is arguably an attention grabbing prestige project, designed to impress other countries by showing how developed and futuristic Mumbai is. This is FAR from the truth!



## London – A HIC global city.

London is located in the south-east region of England, Europe.

London has a total population of 9 million people. Compare this to Mumbai's 18 million!

London was founded in Roman times (Londinium) and located for its:

1. Access to water supply (River Thames)
2. Flat land
3. A port dating back to medieval times to trade with Europe.

### How does London's location and connectivity promote economic development?

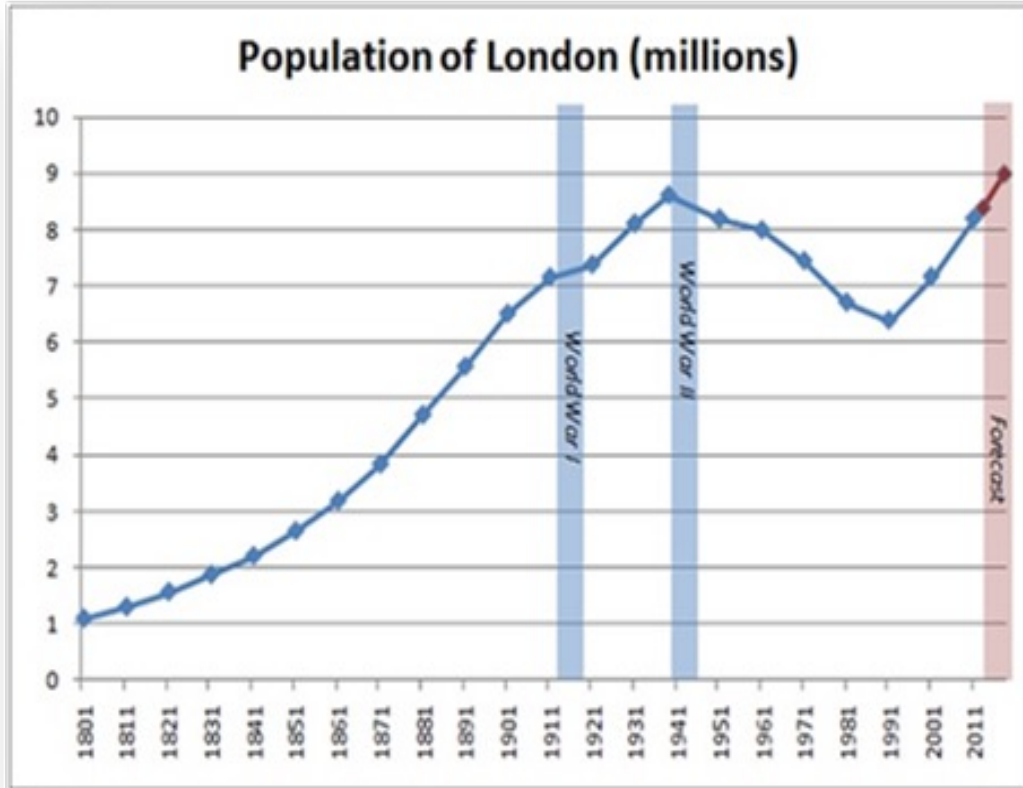
The south east of England covers one tenth of the land area but has over one third of the UK population living there.

The south east of England benefits from:

- ★ good transport links
- ★ easy access to the rest of Europe and beyond
- ★ being the seat of Government
- ★ the City - the financial heart of England



## London – how has it changed over time?



**Urban Sprawl** – the outwards growth of cities

London's population is in a period of growth.

It grew from just over 1 million in the 1801 census, to a peak of over 8.6 million in 1941.

Following this period the population of London went into decline, slipping to just over 6 million in 1991.

Since then government initiatives and a booming economy have allowed the population to grow to 8.3 million in the 2011 census, and it is predicted to continue to grow.

This can all be seen on the graph.

Since 1985, redevelopment has taken place in Canary Wharf, a large **brownfield** site including Queen Elizabeth Park (2012 Olympics, Newham).

### Cause of growth

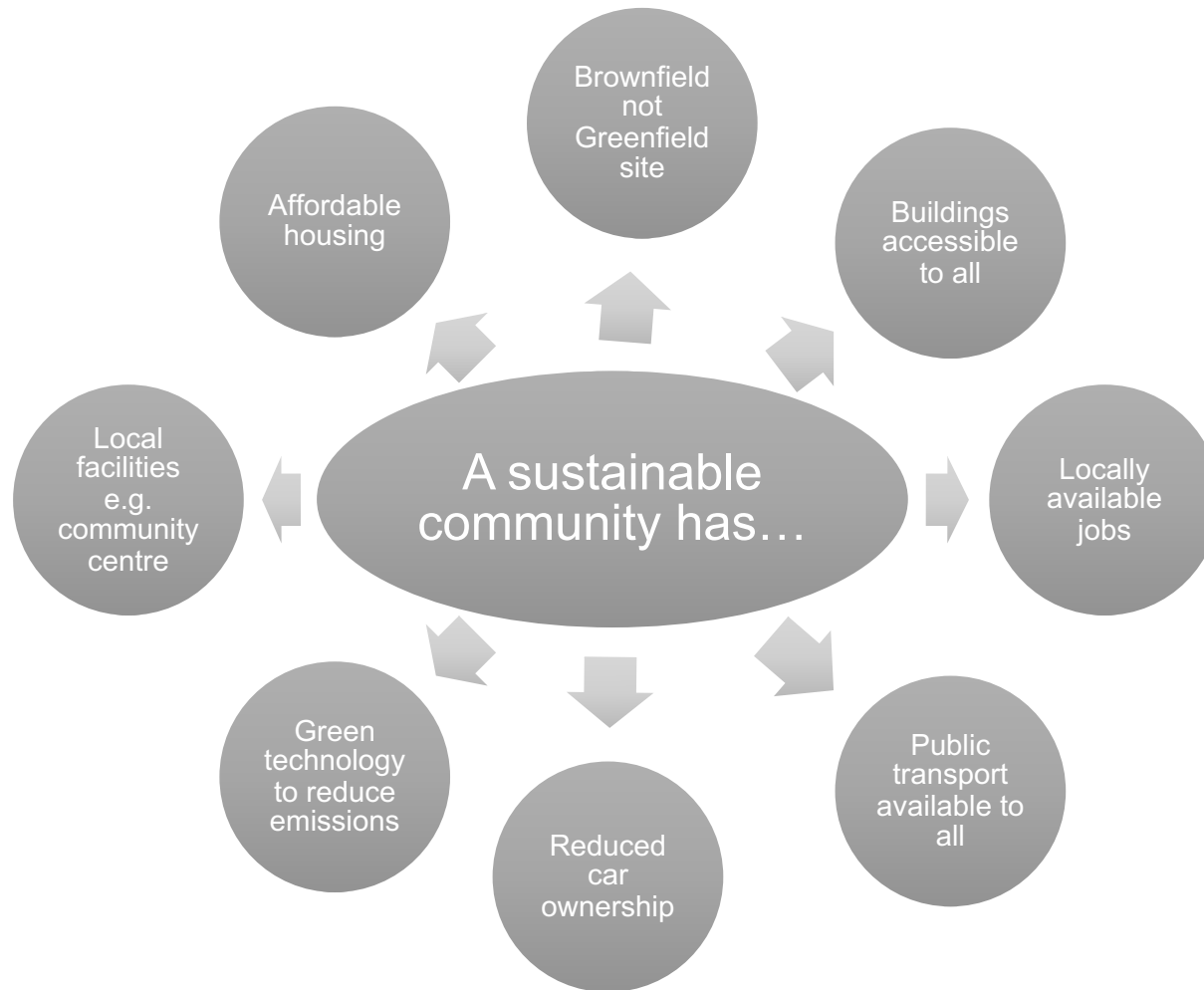
1. Internal (within the UK) migration has been negative; that is the numbers of people moving out of London has been greater than the number of UK residents moving in.
2. International net migration has always been positive during the time period shown, so there have always been more foreign born people moving into London than out of it
3. Natural Change has been positive, so births have been above deaths and this has boosted the population size.

## Sustainable communities

### Key Terminology

Sustainable Communities – a place where the needs of all individuals are met and can comfortably be maintained in the future.

Green Technology – renewable, environmentally friendly technology



Here are some other ways that communities can be made more sustainable.

Sustainability is not just about transport and leaving cars at home.

Sustainability refers to consumption of other resources such as energy and food as well.

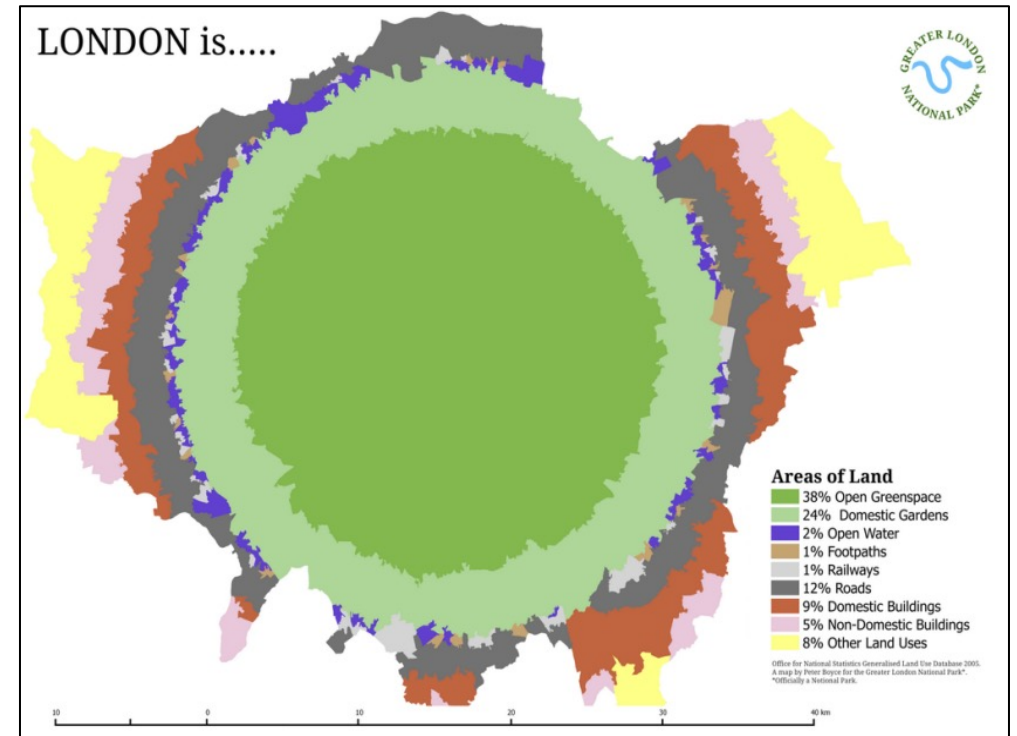
**The Priority is Public Transport.**

Wealth is generated in the CBD so it is important that everyone is able to access it. The underground saves space as it doesn't need to access the surface

The areas hosting the Olympics like Stratford and nearby Tower Hamlets were in dire need of regeneration as they had;

- a lot of abandoned old industrial sites,
- low achievement at school in terms of GCSE points score
- industrial wastelands,
- higher than average unemployment than the rest of London and
- higher deprivation and poverty for the people that lived there
- Lower household incomes than the London average

The London Olympics of 2012 was a fantastic sporting spectacle and put the spotlight of the World on our capital city. Part of the aims of the Olympics was to completely transform an area of East London that is lagging behind the rest, East London. The idea was to leave a lasting legacy or impact not just for sport but for the urban area in the East of London.



**Providing adequate open spaces**

- Greenbelts or areas where local authorities choose to restrict building around cities offers open space for recreation purposes
- Many areas in cities have designated areas of open space in the form of parks, playing fields and individual gardens.

# A Sustainable Future for London : London's Waste strategy

**By 2026 no biodegradable waste ( including food waste ) will be sent to Landfill**

**By 2030 65% of all waste will be recycled**

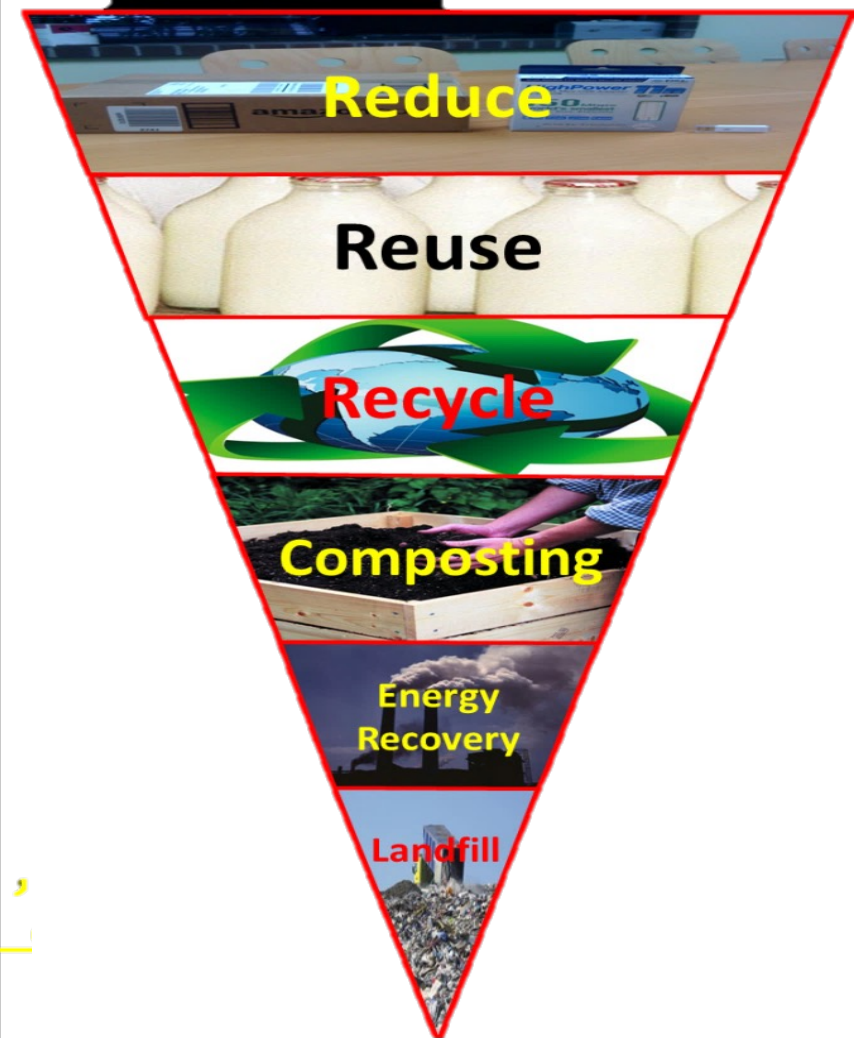
**Rolling out coffee cup recycling points across London**

**Phase out single use plastic bottles, cups, straws and micro-plastics in cafes**

**Pilot five water refill schemes in 2018 and evaluate these to inform a city-wide roll out**

**Launch a campaign cutting the use of single use plastic bottles and work with local businesses to act as local water refill points**

**Drinking fountains: Install an initial 20 drinking water fountains for summer 2018 and work with TfL to identify suitable locations on the transport network for installing drinking water fountains**





# Sustainable Transport Strategies in London

## Solution 1 : Congestion Zone

London's main response to traffic congestion and pollution was to create the congestion charge zone in 2003.

The congestion charge zone has created a 'low emission zone' inside central London. This means that any vehicle travelling into central London apart from fuel-efficient vehicles, must pay a daily fare ( £15 ) to enter the zone.

Since 2003 there has been a 6% increase in bus passengers as a result of the zone. The zone also creates £148 million a year, money which is invested in improving London's transport network.



## Solution 2 : Cycle-share Scheme (Santander Cycles)

The Barclay's cycle hire scheme was launched in 2010 with 6000 bikes and 400 docking stations. The aim is to increase cycling by 400% by 2026 to reduce emissions from cars and other transportation.

To improve the uptake of people using the scheme London built the Barclay's cycle superhighways – 12 routes currently run through London which are separated cycle lanes – away from other traffic to improve safety.

Despite reducing emissions many say the scheme could be more successful at current most bikes are used 3 times a day on average whereas in Barcelona's bike scheme – bikes are used 10 times a day.

## Solution 3 : Hydrogen Buses

London's new Hydrogen buses were first introduced in 2012 in time for the Olympic games. The buses use hybrid technology and it produces 40% less Carbon Dioxide and is 40% more fuel efficient than previous London buses.

The buses are cleaner, quieter and more efficient. Transport for London aim to increase bus transport by 60% by 2025 from 2005. At the moment there are only 8 hydrogen hybrid buses but Transport for London hopes to increase this to make up 20% of all buses by 2025.



## Case study of a sustainable community – Bedzed, London.

### Economic:

- Reduce fuel cost of residents
- Lower energy running bill
- Combining live/work assist startup
- Business Improved site ecological value

### Social:

- Public transportation Live/work combined
- Private open space in each home
- Improve air quality
- Community internet
- Closer relationship between neighbours

### Environmental:

- ❖ 100% renewable energy
- ❖ Solar panels
- ❖ Charging station for electrical cars
- ❖ Wind powered ventilation systems
- ❖ Rainwater storage tank underground -Rainwater used for flushing toilet and irrigating gardens
- ❖ Conservation strategies (spray taps/ showers, dual/low flush toilets)
- ❖ On-site ecological water treatment Waste
- ❖ Recycling facilities - Each home includes under-sink bin divided into 4 sections
- ❖ Recycled timbers
- ❖ Reused structural steels -Materials sourced locally
- ❖ Timber used in preference to steel/ aluminium
- ❖ Houses face south for solar gain
- ❖ Roof gardens on top of workspaces
- ❖ Transportation: -Footpaths and cycle routes encourage walking and biking -Electric/hybrid cars have priority
- ❖ Supermarket internet home delivery
- ❖ Public transportation

	Pros of the London Olympics	Cons of the London Olympics
<b>Socially</b>	<p>☺The athletes' village has been relaunched as a housing estate called the East Village, the rooms have had kitchens added and walls knocked through. Almost half of these 2,818 new homes (40%) will be affordable. Eventually the whole Olympic Parkland will become five new neighbourhoods housing 8,000 people.</p> <p>☺The Olympics has helped schools in the area – there was a shortage of spaces but a new school opened in the grounds of the park. Chobham Academy will cover all levels of education.</p> <p>☺The aquatics centre now uses its 50m pools as facilities for the community and schools, as well as elite athletes.</p> <p>☺Unemployment OVERALL fell across London during the Olympic period</p>	<p>☹Professor of Economics “The ‘affordable rents’ for the 2,800 new homes will be unaffordable to Newham’s poorest households.”</p> <p>MP in the Olympic borough of Tower Hamlets, said: “The impact of the infrastructure investment has been really fantastic... But – and there’s a big but – in my borough unemployment actually went up during the Olympics.”</p> <p>☹During the construction of the Olympics, very few jobs were created for local people. There are still high levels of unemployment in the borough and it was a missed opportunity to train people up for work. Tower Hamlets got very little out of the Olympics.</p>
<b>Economic</b>	<p>☺Stratford got a Tube station to help connect the area to the rest of London - Stratford is now second only to King’s Cross as the most connected part of London.</p> <p>☺The Olympics brought more than £9bn of investment to east London, much of which went into transport. Lloyds TSB estimated that the Olympics will generate £10 billion in extra income for the UK economy</p> <p>☺ALL of the Olympic venues have been sold. The final building to be sold off was the £300m media centre, which will now primarily house Infinity – a data company who want to store information for large corporations.</p>	<p>The Olympic stadium is estimated to have cost £701 million pounds, almost 3 times the original estimate (source). This angered many local people.</p> <p>The total bill for the Olympics was £8.77 billion of tax payer’s money. That was £5billion over budget.</p> <p>Existing businesses had to move, including H. Forman and Sons, a salmon-smoking factory with 50 employees</p> <p>Rents and property prices have gone up as a result of the Games</p>
<b>Environmentally</b>	<p>☺Many of the grounds in the Olympic Park have been kept as parkland and are open to the public for use as a picnicking and play area. New green spaces and wildlife habitats were created, including ponds, woodlands, and artificial otter holes.</p> <p>☺The stadiums were made of at least 25% recycled materials The River Lea that runs through the Olympic Park was improved as has the quality of its water. Green areas were placed along the banks of the river.</p> <p>☺The Olympic Site was built largely on 560 acres of brownfield land, property that had been neglected, unused, and contaminated.</p>	<p>Much wildlife had to be relocated; 4,000 smooth newts, 100 toads and 300 common lizards as well as fish including pikes and eels were moved by the Olympic Delivery Authority.</p> <p>Many of the materials for the stadiums and the Olympic Park came from overseas</p> <p>The games produced 3.3 million tons of CO2</p>

# **1.2 Urban and rural processes and change in the UK**

## Urban change

In 2010 a key date was passed, the World's urban population passed 50% for the first time in history

The World Health Organisation of the UN estimate that *“By 2030, 6 out of every 10 people will live in a city, and by 2050, this proportion will increase to 7 out of 10 people.”*

- In 1900 the world's biggest cities were predominately in Europe and North America
- Today, the vast majority of the world's biggest cities are found in Asia, with megacities found on every continent
- Asia also has the largest number of millionaire cities today, whilst Europe and North America struggle to make it onto the largest cities list
- The world cities have changed slightly but less than the location of megacities. Despite dropping off the top ten list of most populous areas London and Paris remain dominant world cities with huge influence over European and world economies

### Key Terminology

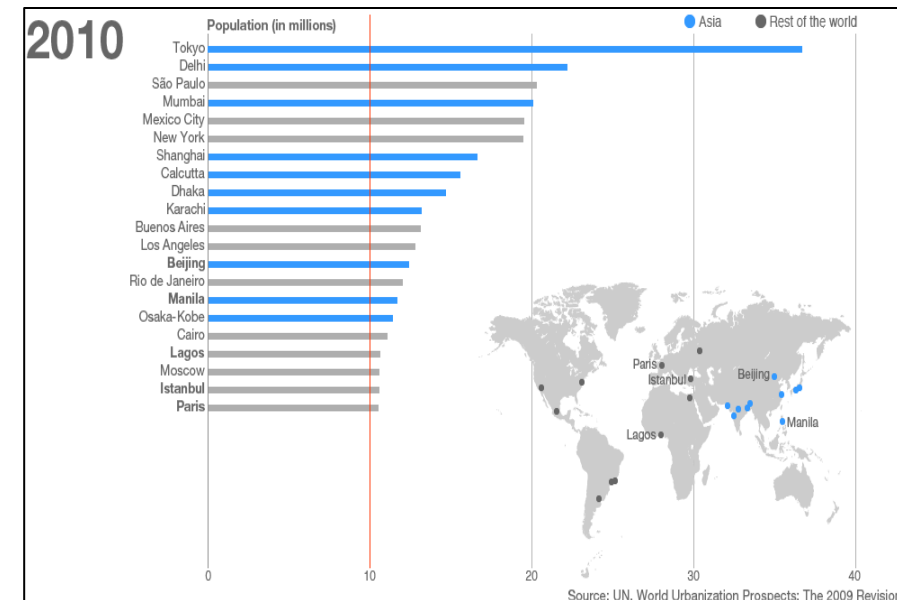
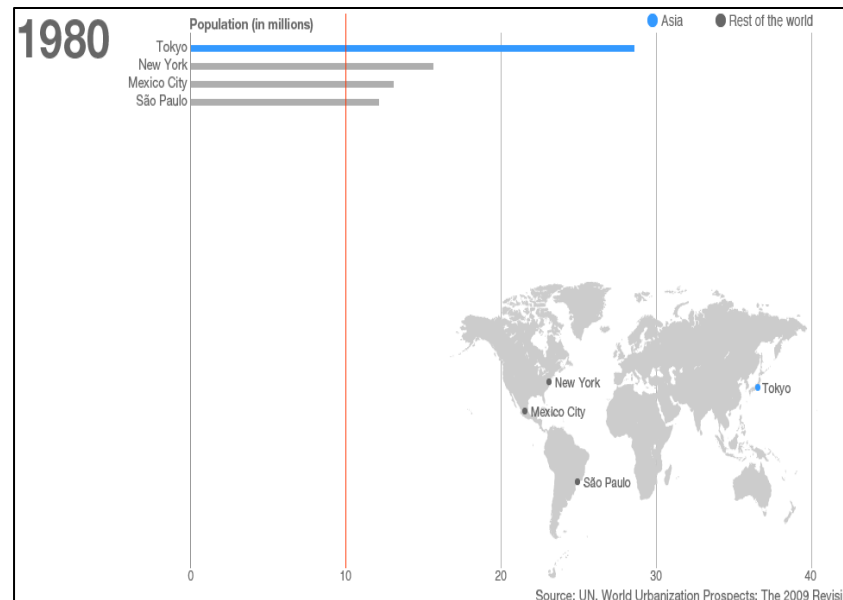
Urbanisation – increase in the PROPORTION of people living in towns and cities.

Suburbanisation – an increase in the PROPORTION of people living in the outer areas of a town or city.

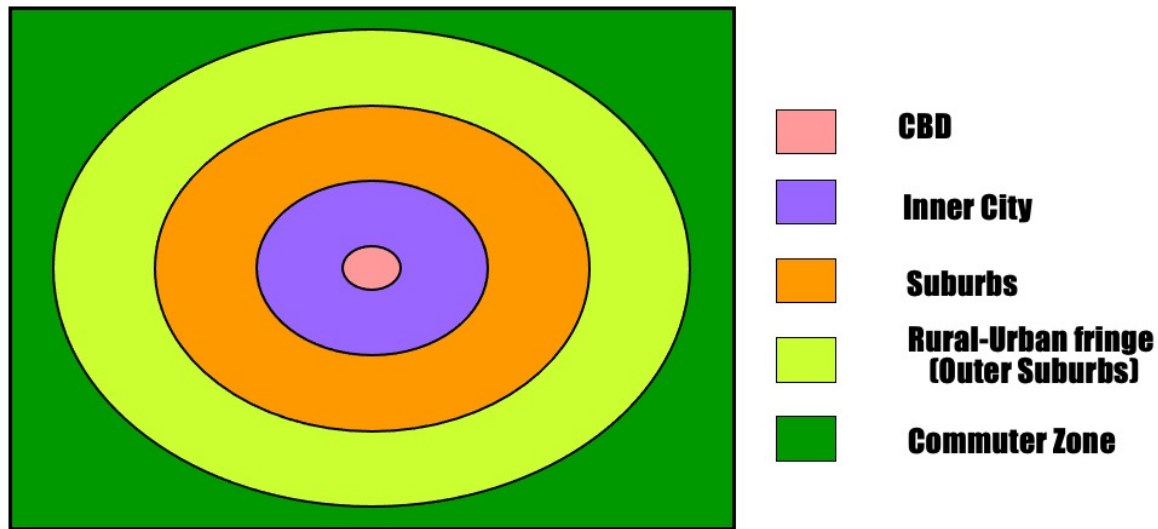
Counter-urbanisation – The movement of people out of urban areas into rural areas.

Re-urbanisation – the process of people moving back into an urban area that has been previously abandoned.

Infill – the rededication of land in an urban environment, usually open space for new construction.



## The Burgess Model: shows land use in a town/city



- Houses get bigger as we move away from the centre.
- Gardens get bigger as we move away from the centre.
- The types of houses change as we move away from the centre.

Land use in towns and cities can be grouped into 5 zones.

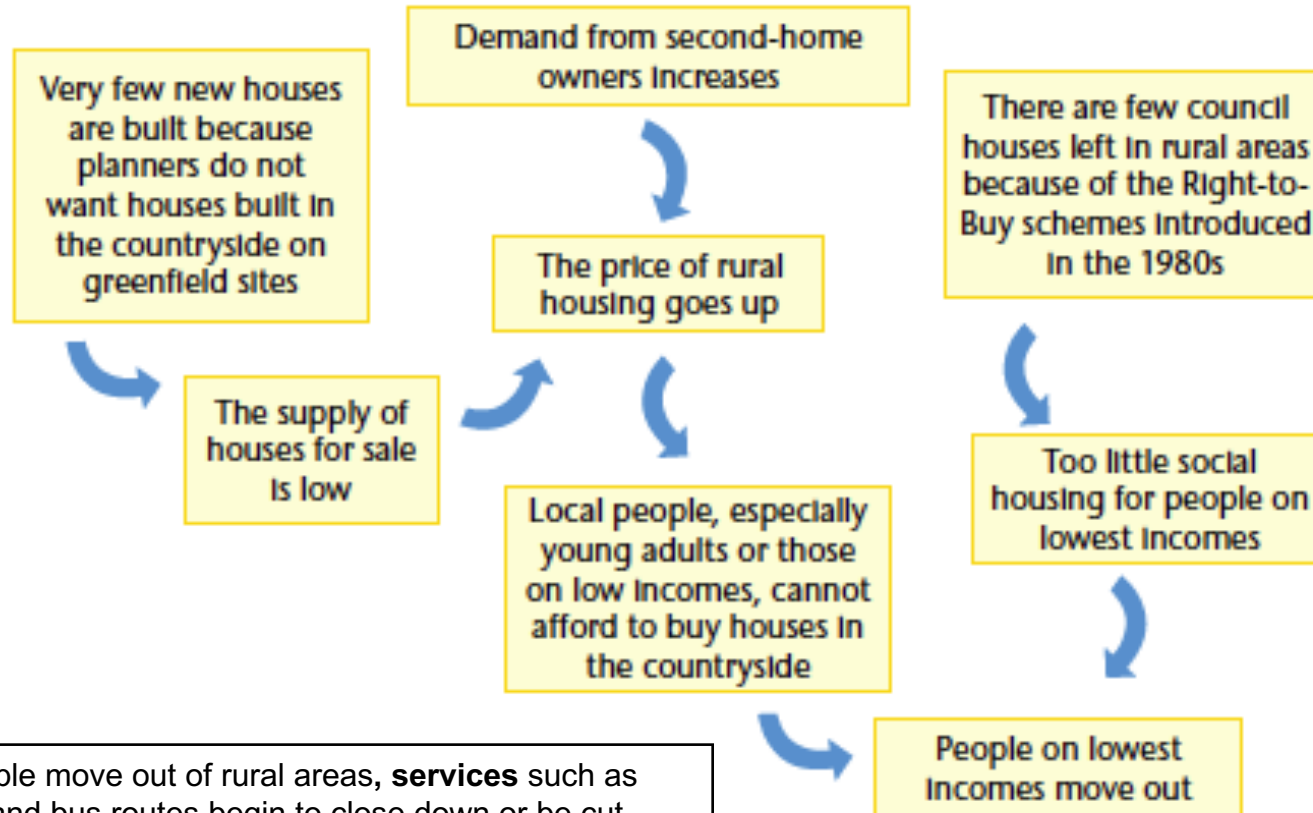
The oldest part is in the middle, where there are shops and businesses. Houses are usually smaller and closer together.

Land use in the city centre is expensive, as many different people would like this site so they compete for it. Therefore as you move away from the CBD the land becomes cheaper.

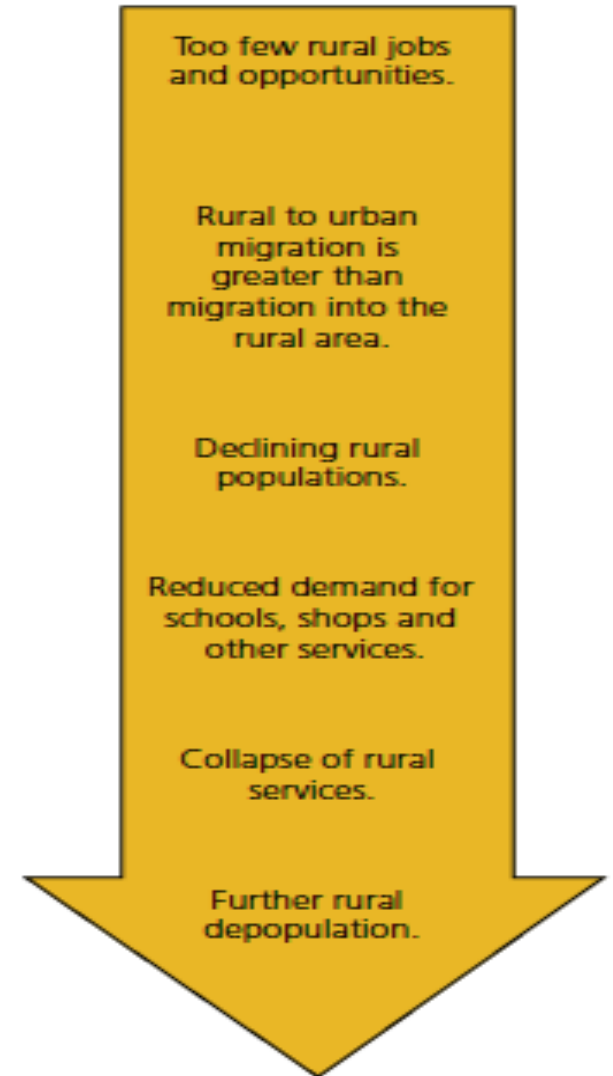
## Urban and Rural Change : Rural Depopulation

**Rural Depopulation** is “The process of change that involves population movement from the countryside to cheaper urban areas”.

Prices of houses are rising and the cost of fuel and commuting has increased. This has made living in the countryside unaffordable for many young people.



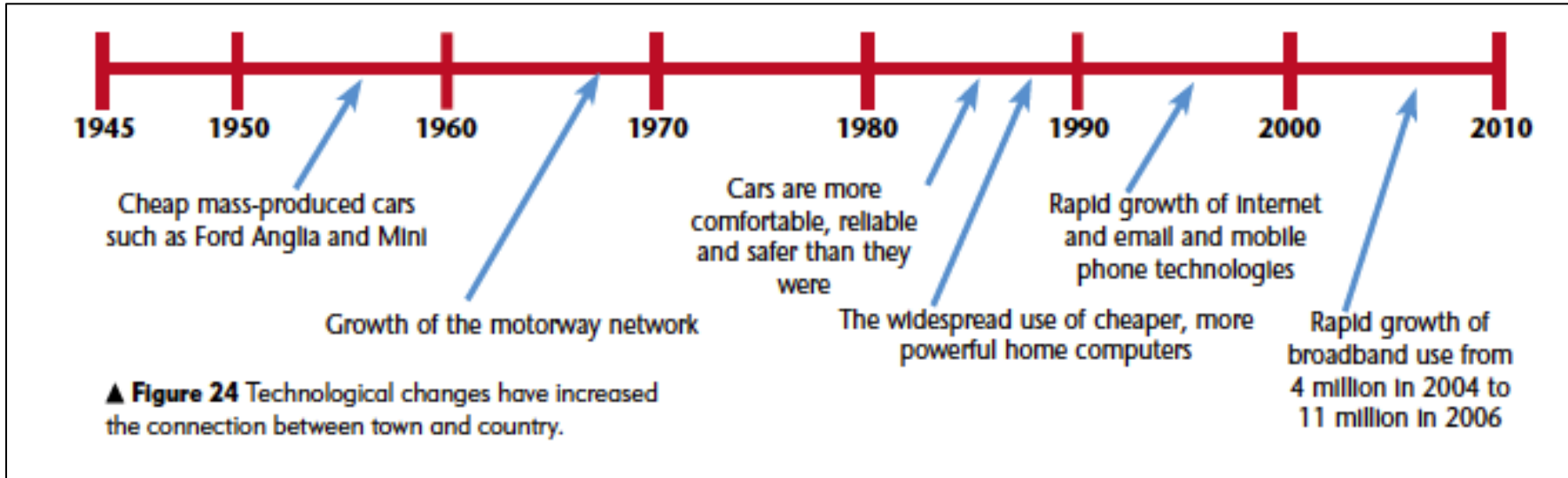
As people move out of rural areas, **services** such as shops and bus routes begin to close down or be cut back.



How rural depopulation creates unsustainable communities

## Urban and Rural Change : Counter-urbanisation

**Counterurbanisation** is “The process of change that involves population movement from urban areas to the countryside”.



People began to move to the countryside and **commute** to work in the cities. The reasons for this included ...

- The difference between house prices in a city and its surrounding region
- Flexible working hours that allow workers to begin days anywhere between 7am and 10am
- Fast Rail links
- New motorway construction
- Increase in mobile telecommunications (3G & 4G)
- Affordability and availability of cars
- Decline of old heavy industry

### Factfile: Commuting

- Average commuting times in the UK are going up. In 2003 it was 45 minutes. By 2015 the average commute had risen to 54 minutes.
- 616,000 people commute into the City of London each week day.
- 1.8 million people in the UK (one in ten UK commuters) travel for over three hours a day. These are so-called 'extreme commuters'.



# Where should we build ?

## Key Terminology

Green belt – a border around a certain area preventing development and allowing wildlife to return.

Greenfield sites – areas of land that have never been built on.

Brownfield sites – areas of land that have previously been built on but no longer used.

NIMBY (Not In My Back Yard) – opposition to new initiatives in a local area

Suburban Sprawl – the rapid growth in suburban areas



	Positive	Negative
Brownfield	<ul style="list-style-type: none"> <li>•The infrastructure around the area usually exists saving money.</li> <li>•It is making good use of waste ground.</li> <li>•It will make the area look better.</li> <li>•It is easier to get planning permission.</li> <li>•New employment opportunities</li> </ul>	<ul style="list-style-type: none"> <li>•The land has to be cleared of any existing structures this costs money.</li> <li>•More homes in the town or city means traffic jams will get worse.</li> <li>•House prices may increase, forcing local people out.</li> <li>•Land may be contaminated by old industry and cost lots to clean up</li> </ul>
Greenfield	<ul style="list-style-type: none"> <li>•It is overall cheaper to build as less preparation needs to be done. Therefore the houses are cheaper.</li> <li>•There is nothing to clear on the land.</li> <li>•More space for larger gardens.</li> <li>•Land is not contaminated</li> <li>•The area is more pleasant to live in.</li> <li>•Access to road network may be easier</li> </ul>	<ul style="list-style-type: none"> <li>•It may mean more traffic on country roads</li> <li>•It means less peace in the countryside</li> <li>•New major roads will need to be built to allow access.</li> <li>•It will drive wildlife away.</li> <li>•More of the countryside gets covered in concrete. This leads to the town growing out.</li> <li>•More infrastructure such as shops and schools may need to be built for the people who move there.</li> <li>•Trees will probably have to be cut down</li> </ul>

## Urban renewal/ re-urbanisation

### Why did people leave cities?

Older housing

Lack of space

Poor air quality

Traffic

High crime rates

Increase in public transport and car ownership making commuting easier.

Increase in outer city jobs

### How did councils attract people back to the city?

Repurposing old buildings for modern use ie shops, cafes, gift shops

Creation of attractions ie shopping centres, waterfronts

Development of new housing to attract young, skilled workers

Improve quality of green spaces and leisure facilities

## Changing patterns of retailing

### Key Terminology

**Catchment area** – the area from which it gets its customers

**Convenience goods** – low cost items that consumers buy frequently ie bread

**Comparison goods** – expensive items that are bought less frequently and people are more likely to shop around for ie washing machine

**Range** – the distance that a consumer is willing to travel to buy a product

**Threshold** – the minimum population size needed to create demand for an item of service

**Showrooming** – The phenomenon of people looking at something in a shop and then buying it cheaper online

Small shops selling convenience goods have smaller catchment areas than specialist shops

Cheaper products have a smaller range as there is little benefit to shopping around

Threshold is determined by how often a product is bought. Hairdressers, newsagents and grocery stores have small thresholds as they are low cost and frequently bought, while car dealerships and specialist shops have higher thresholds as they are bought less frequently.

Larger towns have a wide variety of shops so they have a larger retail catchment, this means that shops in smaller towns and cities struggle to compete.

## Key Terminology

**Central Business District (CBD)** – traditional town centre location for a wide variety of shops and services

**Pedestrian zone** – a zone of land where vehicles are only allowed at certain times of the day

## Where does retailing occur?

Central Business Districts have a wide range of shops and services. Roads spread out from the CBD giving them a large catchment and threshold population.

District shopping centres are located in the suburbs. They provide for the immediate catchment and are made up of convenience stores.

Shopping centres are located in the town or city centre. Covered shopping centres have a variety of shops under one roof.

Retail parks are located in out of town locations close to arterial roads and ring roads.

### Features of retail locations

- Consumers can visit many shops in a small, covered area
- Often contains large department stores
- Limited parking can be a problem
- Parking close to shops can be expensive
- Large surface car parks are usually free
- Good road links gives easy access

# Out of town shopping centres

Since the 1980s in the UK there has been a rapid growth of out of town shopping centres such as Bluewater. A local example is **Kingsway**.

They are usually close to main roads, providing easy access for shoppers from several large urban areas.

Proximity to suburban housing estates provides a workforce for the centre.

Many retailers have changed location to out-of-town centres because of business competition and the availability of large areas of unused land which is cheap in comparison to land within the town or city centre.

Many shoppers prefer these centres because usually all of the shops are under one roof and there is a lot of choice available; it also feels like a 'day out'. Parking is also usually free.

## Is technology changing how and where we shop?

There has been a massive increase in the number of people who buy products online.

Holidays, train tickets and flights are also now increasingly bought online.

Banking online is more convenient and easier than visiting a bank, leading to high street closures.

### Impacts of increased online shopping

#### Social impacts

Loss of jobs in high street stores

Less choice on the high street

People are able to compare prices, therefore they are likely to get a better deal

People able to access the internet have a wider choice of options

Older or less affluent people may be less likely to shop online, therefore reducing their choice

#### Economic impacts

Shops may close due to fewer people visiting the high street

Less money being spent in towns – this means councils don't have as much money to spend on the area

Empty shops don't bring in money from taxes

Fewer people visiting the high street means less money is spent in the remaining stores

#### Environmental impacts

Fewer cars in city centres will reduce air pollution

The high street environment looks untidy

Derelict shops may be vandalised

The environment is not invested in, therefore the town may decline further

## Death of the high street ?

In 2015 1 in every 8 shops in the UK was vacant.

### Reasons:

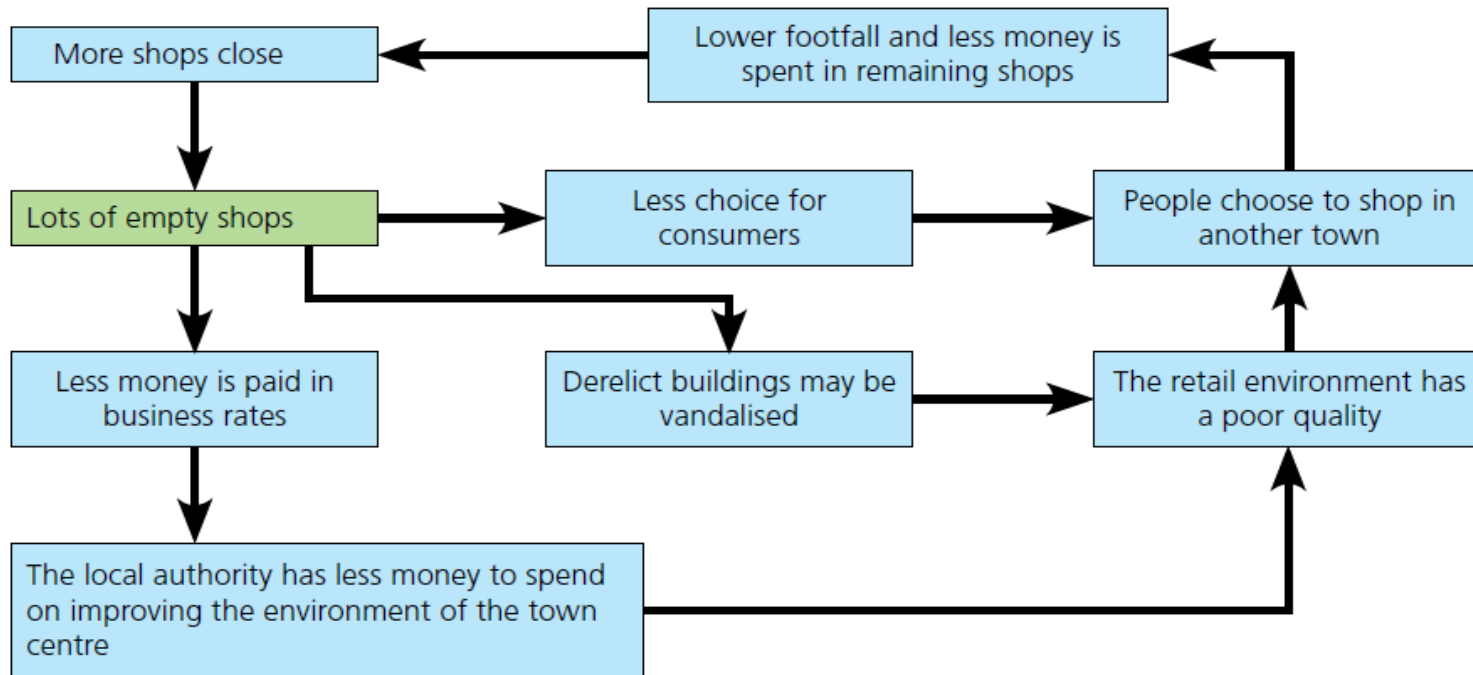
Convenience of online shopping

Opportunity to compare prices easily online

Difficulty and cost of parking in town centres

Success of large out-of-town retail parks where parking is free

Large supermarket chains can offer more choice and often at lower prices than smaller high street shops



**This pattern leads to a negative cycle of decline.**

## Strategies to improve the high street

- Pedestrianised shopping streets
- Traffic calming such as ramps and pinch points
- Permitting street entertainers such as buskers
- Improving signs and wayfinding information for pedestrians
- Providing street furniture such as flower beds and benches
- Reducing the cost of short-stay parking
- Creating park-and-ride schemes
- Special high street events such as French or Christmas markets
- Allowing pop-up shops to sell from vacant shops

**The high street fights back**



## Sustainable communities

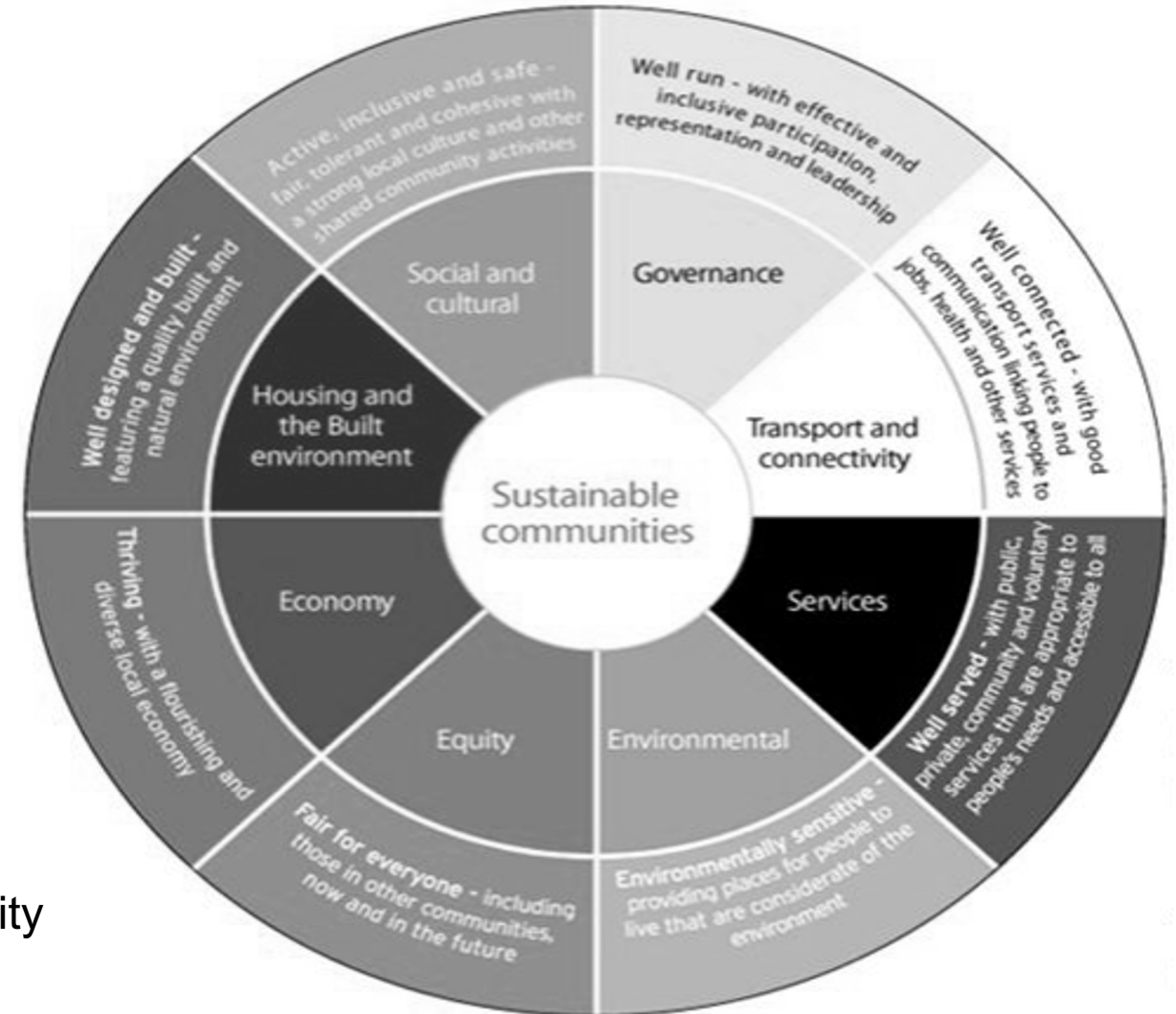
### Key Terminology

Sustainable Communities – a place where the needs of all individuals are met and can comfortably be maintained in the future.

Green Technology – renewable, environmentally friendly technology

A sustainable community might involve:

- Brownfield site
- Job availability
- Public transport available
- Schemes to reduce care ownership
- Green technologies
- Facilities for all ages
- Housing that meets all social needs
- Affordable housing



The Egan wheel is a model of a Sustainable community

## Case study of a sustainable community – Bedzed, London.

### Economic:

- Reduce fuel cost of residents
- Lower energy running bill
- Combining live/work assist startup
- Business Improved site ecological value

### Social:

- Public transportation Live/work combined
- Private open space in each home
- Improve air quality
- Community internet
- Closer relationship between neighbours

### Environmental:

- ❖ 100% renewable energy
- ❖ Solar panels
- ❖ Charging station for electrical cars
- ❖ Wind powered ventilation systems
- ❖ Rainwater storage tank underground -Rainwater used for flushing toilet and irrigating gardens
- ❖ Conservation strategies (spray taps/ showers, dual/low use toilets)
- ❖ On-site ecological water treatment Waste
- ❖ Recycling facilities - Each home includes under-sink bin divided into 4 sections
- ❖ Recycled timbers
- ❖ Reused structural steels -Materials sourced locally
- ❖ Timber used in preference to steel/ aluminium
- ❖ Houses face south for solar gain
- ❖ Roof gardens on top of workspaces
- ❖ Transportation: -Footpaths and cycle routes encourage walking and biking -Electric/hybrid cars have priority
- ❖ Supermarket internet home delivery
- ❖ Public transportation

# Leisure – Rural Honey-pot Sites

A **Honey-pot Site** is a location which attracts a large number of people (like bears to a pot of honey) because it is either:

1. exceptionally beautiful or interesting
2. accessible by road and within easy reach of large numbers of people.

The **carrying capacity** is the number of visitors a place can handle before damage occurs - honey-pot sites usually exceed this.



## Some solutions to problems found in tourist honey-pot sites:

**Reduce invasive plant and tree species & encourage planting of indigenous ones**

**Promote cycling and walking for commuting and recreation in the national park**

**Limiting off-road parking and paving footpaths to minimise erosion**

**Relocate power lines underground to improve view**

**Develop support groups to allow access to the park for socially excluded sections of the population**

**Increase parking charges to discourage visitors in certain areas**

**Work with the Welsh Government to reduce second / holiday home ownership**

**Improve access to information on looking after the park through social media / podcasts/downloads**

**Set up community groups of volunteers to assist with conservation of key areas of the park**

## Leisure Case-study – The Peak District National Park : causes and effects

The Peak District was the first of Britain's 15 national parks and opened on 17th April, 1951.

It covers 555 sq miles ( about the size of Greater London).

The Peak District reaches into five counties: Derbyshire, Cheshire, Staffordshire, Yorkshire and Greater Manchester.

**14 million** people visit each year.

An estimated 20 million people live within an hour's travel time of the Peak District.

**38,000** residents

**14.8 million** tourists visit each year.

**85% travel by car.**

Visitors spend **£730 million** a year

**11,000 jobs** are created in the Peak district from tourism

Local businesses like shops, cafes and pubs benefit

Farmers use barns for holiday homes and fields for campsites

### Effects of tourists

Areas such as Hartington are not designed for traffic as the roads are very narrow. **Traffic jams** are very common.

**Parking** is a serious problem– especially on summer weekends.

Some people park on grass verges and this is causing **damage**.

Many homes are 'second' homes – which leaves them empty for most of the year. **House prices are also high**.

Dovedale stepping stones suffer serious **footpath erosion**.

## **Leisure Case-study - The Peak District National Park : Management strategies**

The Peak district is investing in additional bus routes

Linking up walking routes with Car parks and Railway stations

Roadsides have been fenced off so that cars cannot damage grass verges.

The Peak District National Park Authority is trying to make the Peak District one of the best places in the UK for cycling. The park current boasts 65 miles of cycle trails which are free from traffic including the Monsal Trail and The High Peak Trail

A second aspect of the plan for the future involves making public transport cycle friendly to ensure that bikes can be carried on both trains and busses in the near future.

The final aspect of the cycling plan for the future revolves around constructing cycle hire hubs at railway stations to encourage visitors to enter on Trains and then use bikes

Many bins have been installed

Signs encourage people to be responsible and to follow the countryside code.

## Sport : The London Olympics 2012

	Pros	Cons
<b>Socially</b>	<p>☺The athletes' village has been relaunched as a housing estate called the East Village, the rooms have had kitchens added and walls knocked through. Almost half of these 2,818 new homes (40%) will be affordable. Eventually the whole Olympic Parkland will become five new neighbourhoods housing 8,000 people.</p> <p>☺The Olympics has helped schools in the area – there was a shortage of spaces but a new school opened in the grounds of the park. Chobham Academy will cover all levels of education.</p> <p>☺The aquatics centre now uses its 50m pools as facilities for the community and schools, as well as elite athletes.</p> <p>☺Unemployment OVERALL fell across London during the Olympic period</p>	<p>☹Professor of Economics “The ‘affordable rents’ for the 2,800 new homes will be unaffordable to Newham’s poorest households.”</p> <p>MP in the Olympic borough of Tower Hamlets, said: “The impact of the infrastructure investment has been really fantastic... But – and there’s a big but – in my borough unemployment actually went up during the Olympics.”</p> <p>☹During the construction of the Olympics, very few jobs were created for local people. There are still high levels of unemployment in the borough and it was a missed opportunity to train people up for work. Tower Hamlets got very little out of the Olympics.</p>
<b>Economic</b>	<p>☺Stratford got a Tube station to help connect the area to the rest of London - Stratford is now second only to King’s Cross as the most connected part of London.</p> <p>☺The Olympics brought more than £9bn of investment to east London, much of which went into transport. Lloyds TSB estimated that the Olympics will generate £10 billion in extra income for the UK economy</p> <p>☺ALL of the Olympic venues have been sold. The final building to be sold off was the £300m media centre, which will now primarily house Infinity – a data company who want to store information for large corporations.</p>	<p>The Olympic stadium is estimated to have cost £701 million pounds, almost 3 times the original estimate (source). This angered many local people.</p> <p>The total bill for the Olympics was £8.77 billion of tax payer’s money. That was £5billion over budget.</p> <p>Existing businesses had to move, including H. Forman and Sons, a salmon-smoking factory with 50 employees</p> <p>Rents and property prices have gone up as a result of the Games</p>
<b>Environmentally</b>	<p>☺Many of the grounds in the Olympic Park have been kept as parkland and are open to the public for use as a picnicking and play area. New green spaces and wildlife habitats were created, including ponds, woodlands, and artificial otter holes.</p> <p>☺The stadiums were made of at least 25% recycled materials The River Lea that runs through the Olympic Park was improved as has the quality of its water. Green areas were placed along the banks of the river.</p> <p>☺The urban wasteland of the Lower Lea Valley was cleaned up, with soil being cleaned on site. The Olympic Site was built largely on 560 acres of brownfield land, property that had been neglected, unused, and contaminated.</p>	<p>Much wildlife had to be relocated; 4,000 smooth newts, 100 toads and 300 common lizards as well as fish including pikes and eels were moved by the Olympic Delivery Authority.</p> <p>Many of the materials for the stadiums and the Olympic Park came from overseas</p> <p>The games produced 3.3 million tons of CO2</p>

# **1.3 A global perspective of development issues**



## Development keywords

Key term	Definition
Development	The change that a place goes through to improve the standard of living and quality of life, including income, equality and education.
Sustainable development	Development that occurs which meets the needs of the present without ruining it for future generations.
Development indicator	Ways to measure the level of development of a place.
Social development indicator	Measurements of how people live in an area, e.g. Health (life expectancy, numbers of doctors per 1,000), Education (% in primary education) and Equality (fair distribution of wealth, equal gender pay).
Economic development indicator	Measurements of the wealth of an area, e.g. Gross Domestic Product per capita (GDPpc), Gross National Product or types of jobs (primary, secondary, tertiary, quaternary).
Composite ( combined ) development indicator	Where the measurement of development takes more than one development indicator, e.g. The HDI.
Gross National Product per capita (GDP pc)	Gross Domestic Product (the total value of all goods and services in that country) plus earnings from foreign investment divided by total population (an average).
Purchasing Power Parity (PPP)	Compares what the same amount of money can buy in different countries taking into account the different cost of living.
Human Development Indicator (HDI)	A measure from 0-1, where 1 is the most developed. It uses GNP pc, number of years in school, and life expectancy to get a good measure of how people are invested in by the government.
Globalisation	The process of a place becoming more interconnected to the world trade, communication, culture and technology.
Infrastructure	The basic structures and services needed by any society such as water supplies, sewage systems, roads or bridges



Key term	Definition
Low Income Countries (LICs)	Poorer countries with a Gross National Income of less than \$1,045/year, per person, e.g. DR Congo and Mali.
Medium Income Countries (MICs)	Countries with a Gross National Income of between \$1,045 and \$12,735/year, per person. Split again between Lower Middle Income (\$1,045-\$4,126 and Upper Middle income). Lower MIC e.g. s India and Turkey. Upper MIC egs Brazil, China and South Africa.
High income Countries (HICs)	Richer countries with a Gross National Income of more than \$12.375/year, per person, e.g. UK, USA, Germany.
Newly Industrialised Countries (NICs)	Countries that are developing fast because of rapid growth in recent years, e.g. Brazil, Russia, India and China (the BRICs).
Multinational Companies (MNCs)	A company that manufactures and trades across the world. They usually have their headquarters in MICs, where the profit goes to shareholders, e.g. Nike, Apple, Google and Amazon.
Brandt Line	An imaginary line that has split the world into the 'Rich North' and the 'Poor South', based on GDP pc in the 1980s.
Poverty Line	The estimated minimum level of income needed to secure the necessities of life (food, water, shelter).
Formal jobs	Jobs that the government are aware of and that pay tax so can help reinvest into the country. They have contracts and come with workers protection.
Informal jobs	Jobs that don't pay taxes, that don't have formal contracts, benefits or protection. HICs have very few informal jobs with LICs having a lot.
Primary economic sector	All jobs involving extracting raw materials, rearing animals and growing crops.
Secondary economic sector	A type of industry where raw materials are made into something, often called manufacturing.
Tertiary economic sector	Providing services including retail (shops), tourism, education, health and banking.
Quaternary economic sector	Section of employment that is knowledge-based, e.g. ICT and research.

## What is development and how can we measure it ?



Development is the changes that a place goes through to improve the standard of living and quality of life, including income, equality and education.

Development involves reducing levels of poverty, increasing wealth, bringing benefits to all.

It should also reduce the gap between rich and poor, create equality between men, women and people of all race and religion, making everyone safe, make sure everyone has a right to education and that everyone has their needs met of food, water and shelter.

Many indicators can be used to measure development .

These can be **social indicators** such as *Birth rate, Life expectancy or literacy rate*

Or they can be **economic indicators** such as *GDP ( gross domestic product ) , GNI ( Gross national income ) or employment rate.*

GDP and GNI give the total money in a country , and if it is then divided by the amount of people e in the country it is called GDP or GNI *per capita*. It is always in \$ so countries can be compared.

Using just an economic indicator isn't accurate, as it is an average ( and there can be lots of inequality in a country ) and it depends on what the government spends their money on as to whether is raises standard of living / quality of life.

Therefore the best measure is a **composite** ( combined / more that one ) indictor such as *HDI* ( Human development index ) which measures GNI, life expectancy and education.

## What is development and how can we measure it ?

Countries can be categorised into High Income Countries ( HIC's ) , Low Income Countries ( LIC's ) or Newly Industrialising Countries ( NIC's )

HIC's are richer countries with a Gross National Income of more than \$12,375/year, per person, e.g. UK, USA, Germany.

LIC's are poorer countries with a Gross National Income of less than \$1,045/year, per person, e.g. DR Congo and Mali.

MIC's are countries with a Gross National Income of between \$1,045 and \$12,735/year, per person. Split again between Lower Middle Income (\$1,045-\$4,126 and Upper Middle income). Lower MIC e.g. s India and Turkey. Upper MIC egs Brazil, China and South Africa.

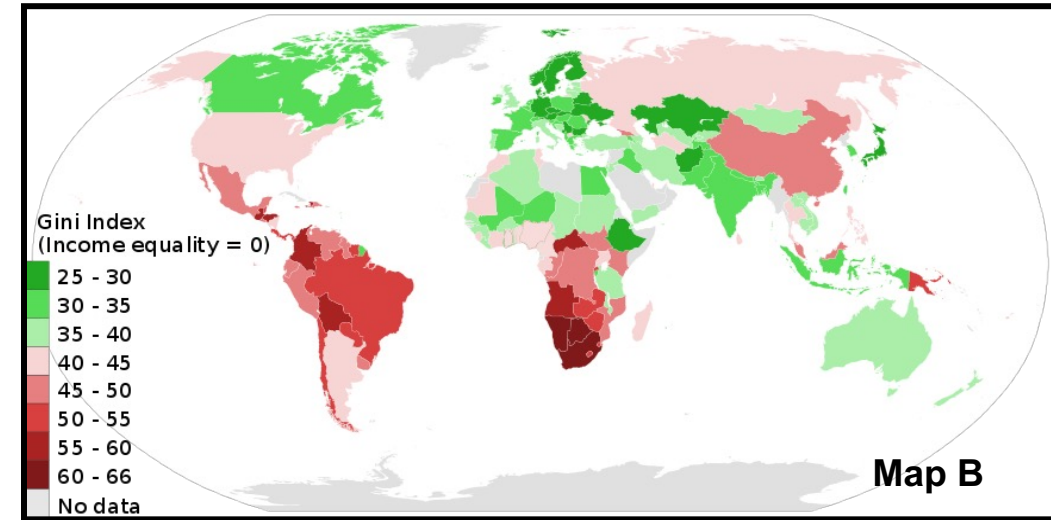
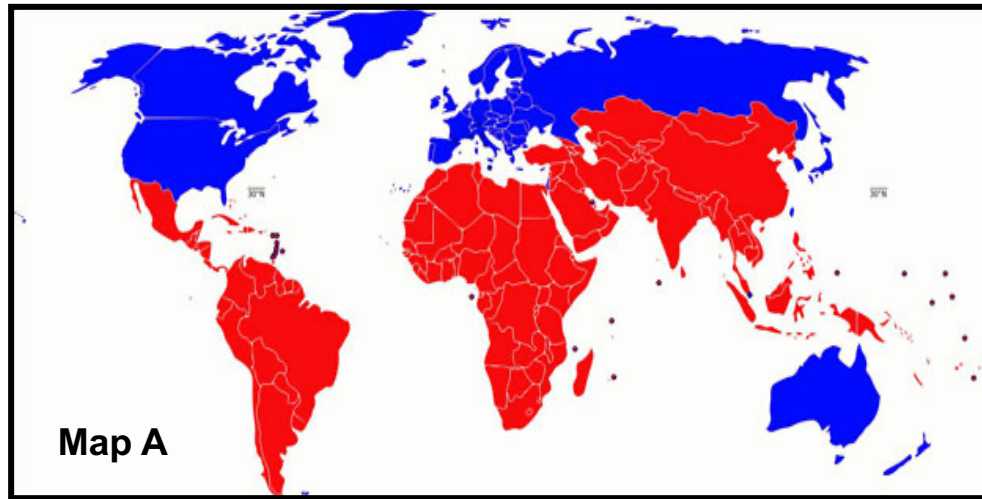
NIC's Countries that are developing fast because of rapid **industrial** growth in recent years, e.g. Brazil, Russia, India and China (the BRICs).

Countries develop in a variety of ways. Some have resources such as gold or oil. Some sell crops. Some use industry. Some are lucky enough to have features or climates that attract tourists e.g. Egypt. Many countries develop through trading with other countries and some have benefitted from the growth of Globalisation.

However, other countries find it harder to develop. This may be due to its physical geography such as poor climate ( too hot or cold ) , natural hazards e.g. drought, few natural resources to use or sell or because its landlocked

Or it may find it hard to develop due to human causes such as suffering from conflict and political instability, poor infrastructure ( roads / rail ) or because there is little investment by business.

## The Brandt Line



**The Brandt Line** In the 1980s, the Germany Chancellor, Willy Brandt defined the world as the 'Rich North' and the 'Poor South'. This is shown in Map A.

This is a useful starting point but is now very out-of-date and too simplistic. Many 'poor' countries have now developed and are LIC's or HIC's.

The modern way of classifying countries is by their income levels - measured in US\$ and adjusted for **Purchasing Power Parity (PPP)** so high costs of living in countries such as Sweden do not distort the figures. This is shown in Map B

## Scattergraphs

A scattergraph is a type of graph that shows the relationship between 2 indicators

The X-axis will show 1 indicator and the Y-axis the other.

Crosses are then placed to show the points where the 2 indicators meet

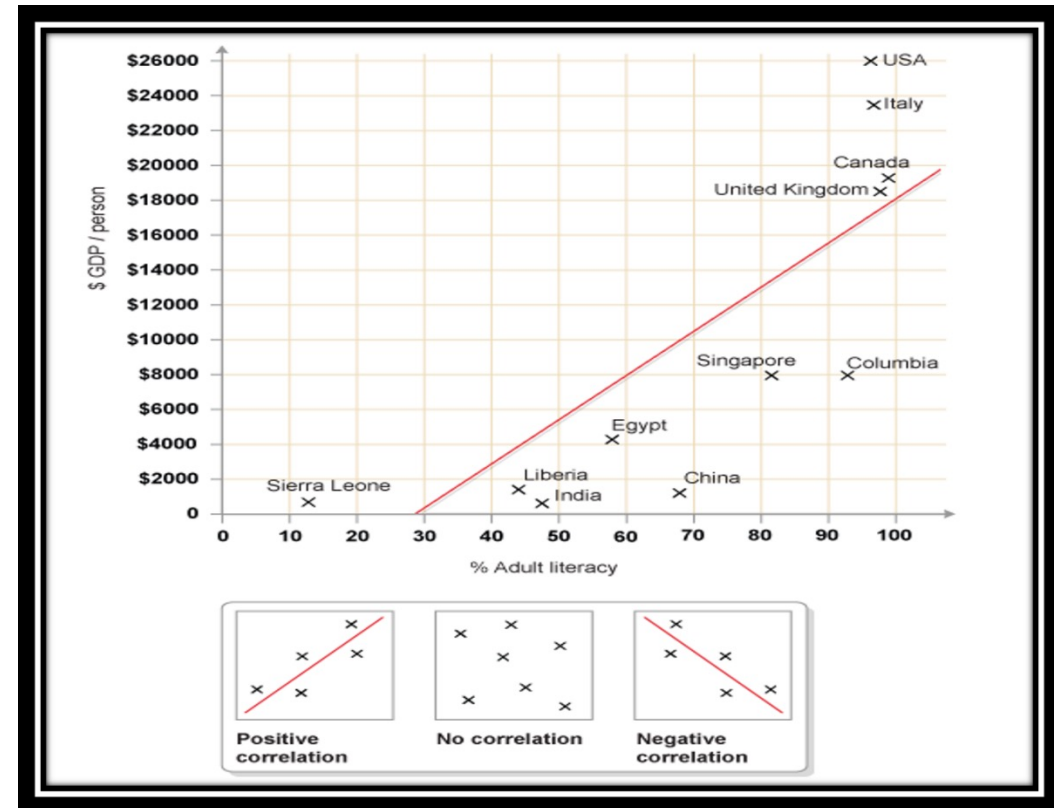
A **line of best fit** is then drawn. This line needs to have the same number of points on each side of the line

A **positive relationship** is where 1 indicator increases as the other indicator increases e.g. GNI and Life expectancy

A **negative relationship** is where 1 indicator increases as the other indicator decrease e.g. GNI and Infant mortality

**No correlation** is when there is no link between the 2 indicators.

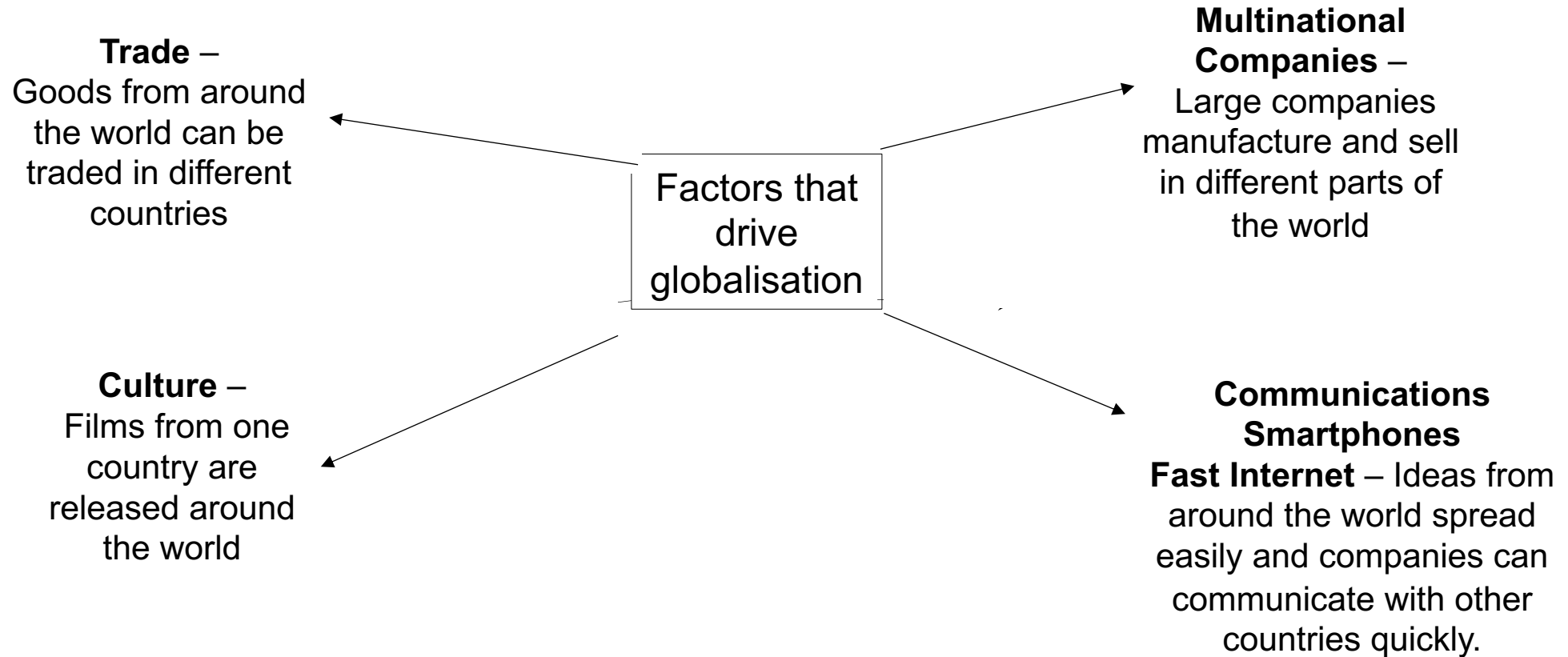
An **Anomaly** is where there is a relationship ( + or - ) but some data does not fit the pattern



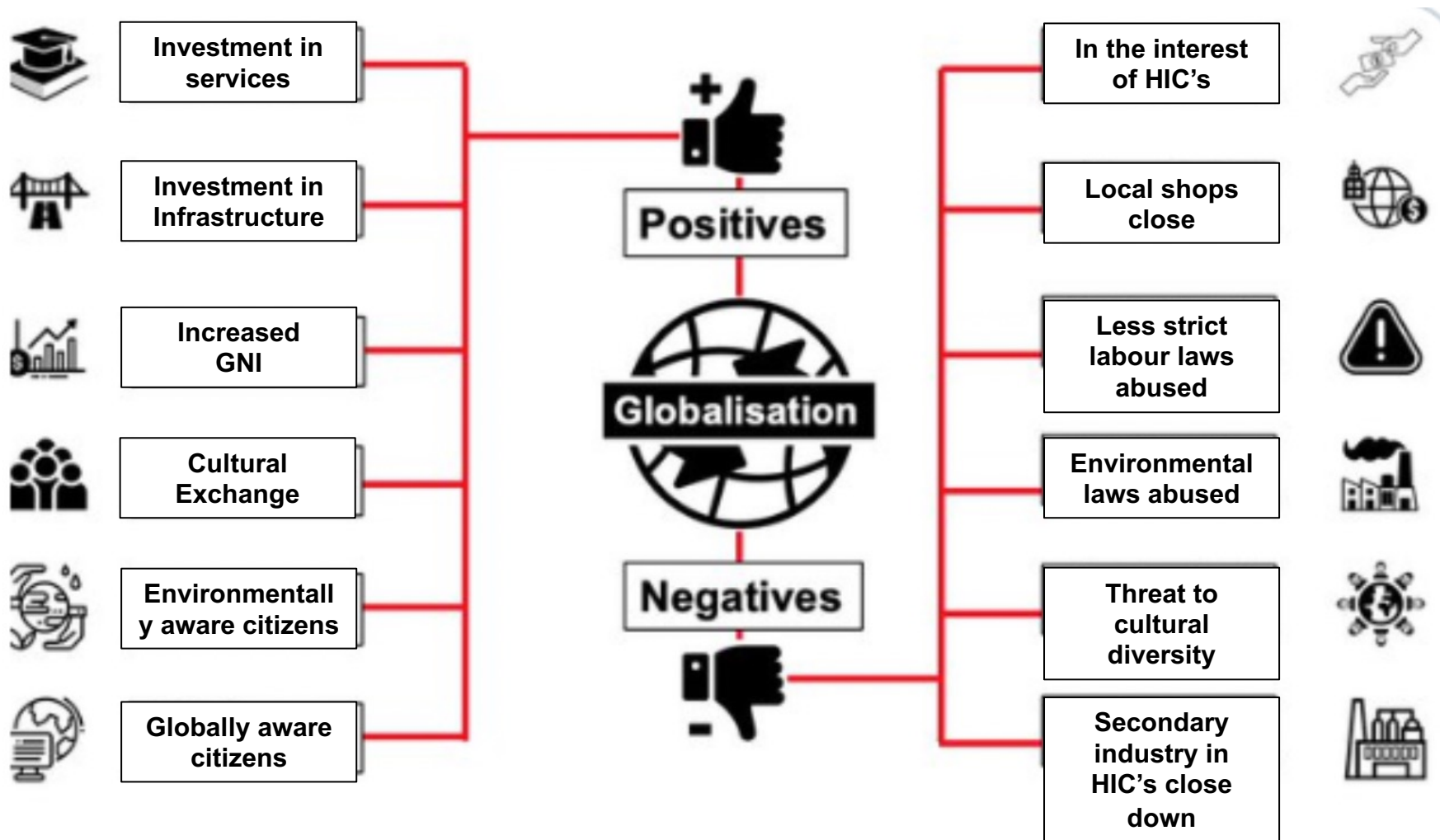
## The growth of Globalisation



**Globalisation:** “When available goods and services, or social and cultural influences gradually become similar in all parts of the world”



# Positives and negatives of Globalisation



# Global trade

Every country on the planet trades with other countries. This is to make money to help the country develop or because no country can produce everything it needs.

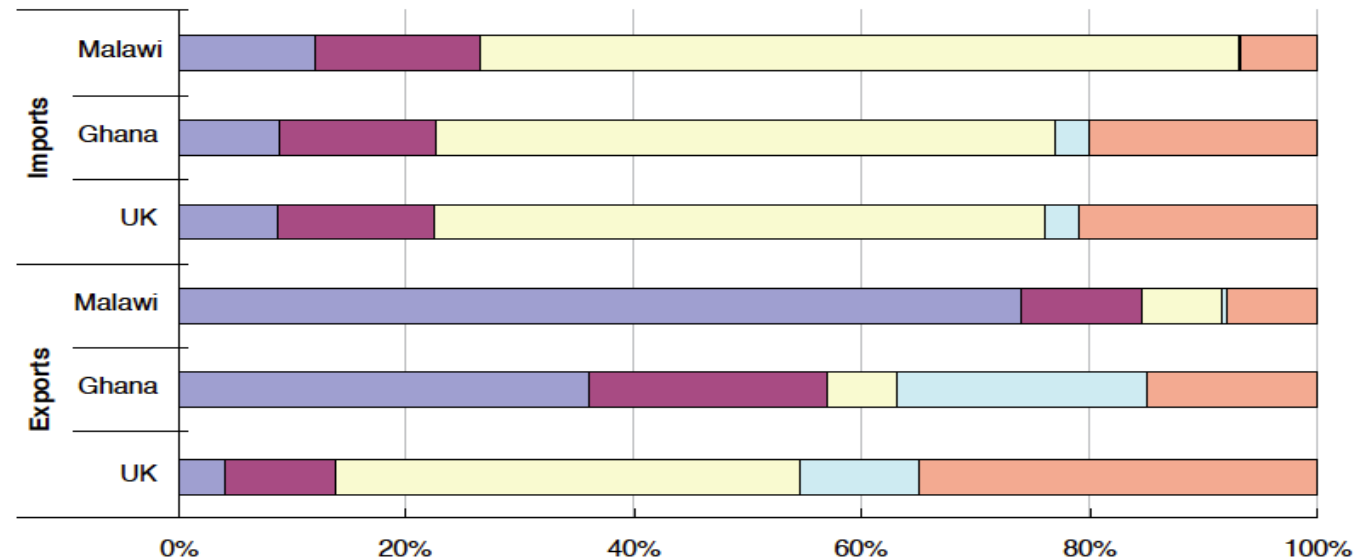
Goods from overseas are known as **imports** and good sent from a country elsewhere are called **exports**

Trade is made easier where partnerships have been agreed between countries. These trading partnerships are called **trade blocs**. The European Union ( EU ) is an example of a trade bloc

HICs trade more in higher value goods which have more 'added value'. ( see diagram 1 )

LICs trade mainly in lower value primary products or raw materials ( see diagram 1 )

Diagram 1





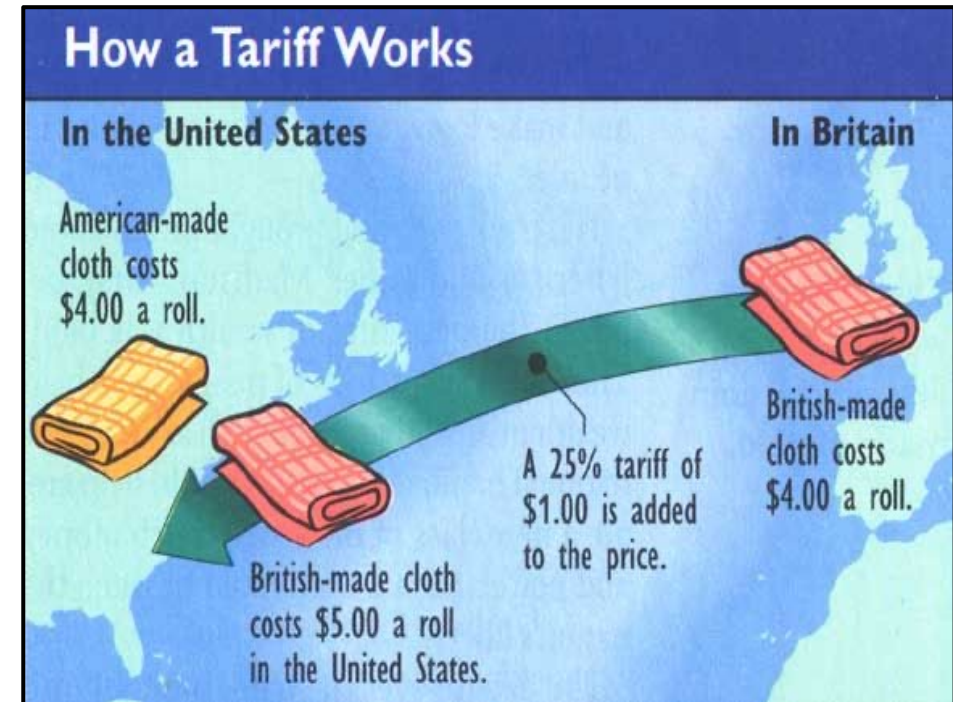
## Global trade

Since the 1980's, the world has moved towards **free trade**, that is, trade without limits, duties or controls. Each country within a trade bloc has a free trade with other countries in the bloc.

An advantage of Free trade is that countries can export as many goods as they wish. A disadvantage is that a country can find itself swamped by cheap imports from other countries, with job losses in its own producing industries.

To avoid this some countries protect themselves from cheap imports in one of three ways.

1. Placing **quotas** that restrict the amounts of imports each year
2. Placing an import duty or **tariff** on imports. This is a tax on imports to make them more expensive.
3. Paying a **subsidy** to businesses so that their own goods can be sold at a lower price.



# TATA Steel

Tata Steel is an Indian MNC with headquarters in Mumbai. Earning US\$103 billion in 2013-14 meant it was the world's 60<sup>th</sup> largest company (4 places below Tesco) and if it were a country, it would be the world's 61<sup>st</sup> largest economy!

Of Tata's earnings, 67% came from outside India. They earn 580,000 worldwide and own steel makers, car manufacturers, chemicals, energy and hotels. In the UK Tata owns 38 companies, employing 50,000 people.

In 2006 TATA bought Corus steel a company with plants in Wales.

**Tata statement:** "Most of the people who work for us—and many who do not—live nearby, raise their children here and pursue their lives in the communities surrounding our works. We are an integral part of those communities and are intimately involved in supporting them. As a major employer, our performance strongly influences the prosperity of the region. Our involvement is not just economic, though. We also concentrate on social development, education, health, safety and the environment. Many of our employees are recruited locally. Because we also want the best young people to join us, we help schools nearby to educate and motivate them.

However, in 2015-2016 Steel makers in the UK reached crisis point as cheap steel which was being imported from China, was being sold for less money than it cost Corus steel to make in Wales. This is because Chinese steel was being subsidised by the Chinese government and because its labour costs are lower.

The EU tariff on Chinese steel is just 16% whereas the USA charged 236%. TATA claimed its UK plants were losing £1 million a day.

If somebody could be found to buy Corus steel from TATA then it could close leading to a spiral of decline ( the opposite of the Multiplier effect ) . 15,000 UK workers would lose their jobs with another 25,000 indirect jobs losing theirs (parts suppliers, services etc

In June 2018 there was an announcement to merge Tata steel with a German company that would see £20 million investment in making it more efficient, meaning production until at least 2026 and secure jobs.

Spokesperson  
for European  
Steel

China makes more steel than it needs and it's dumping it on the UK market at cheap prices. We need the EU to protect the UK market by imposing a more expensive cost (a higher tariff).

MP for  
South  
Wales

The UK needs to increase the tariff in the Chinese steel however it wants to keep on good terms with China to trade more with them.

# Fairtrade



**Fairtrade:** A method of trading where farmers get guaranteed, fair prices for goods

**Under normal trade conditions, producers, for example cocoa growers are subject to fluctuations in market prices. This makes life difficult as they never know their income and it can be very low.**

**Fairtrade** changes the way trade works through better prices, decent working conditions and a fairer deal for farmers and workers in developing countries.

Ghanaian cocoa beans are ranked number one in the world for their quality

Almost all of it is exported, making cocoa Ghana's second most important export after gold.

Cocoa production employs 3.2 million farmers out of a total population of 25.3 million.

Almost all are smallholder farms without access to healthcare, clean drinking water or electricity who live in remote and deprived areas. The majority of farmers have low levels of education with 43-60% being illiterate.

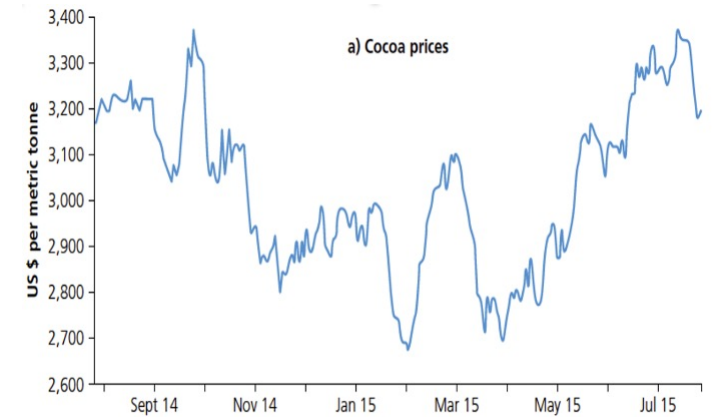
## Case-study : Kuapa Kokoo

Kuapa Kokoo is a cocoa-growing cooperative created in 1993. It is Fairtrade certified and owns 45% of Divine Chocolate Ltd. They receive \$2000 per tonne of Cocoa ( about 10% more than world prices ) Their Fairtrade premiums are invested in a variety of sustainable ways in order to improve the livelihood of its members:

**Social:** Construction of wells for drinking water, pit latrines, schools and mobile health services. Education services and day-care centres.

**Economic:** A Fairtrade Premium of \$200 per tonne to invest back in to communities.

**Environmental:** Education programmes in organic farming & using waster products to create goods to be exported (eg soap making from the cocoa husks).



## Multinational Companies ( MNC's )

### TNC's and MNC's

TNC's = Trans-National Companies and MNC's = Multi-National Companies are companies which operate in multiple countries. They usually have their headquarters' in HICs with production in LICs, selling worldwide.

Walmart is the worlds richest company. It earned \$485.9 billion in 2017. This means it has a revenue higher than 182 countries in the world!

MNCs have been successful in reducing costs (especially labour) to such minimal levels it leaves two main winners: The MNC and the Retailer.

**Outsourcing** is the process by which a company employs other companies to make its products for it and not directly owning production facilities

Many companies like Nike **outsource** production. This means they can drive costs down further by squeezing small factory owners who are desperate for contracts and avoid taking responsibility for poor working practices if they are exposed by the media.

### Case-study 1 : Nike In Vietnam

Positives of Nike operating in Vietnam	Negatives of Nike operating in Vietnam
400,000 jobs have been created and the skills of local people have been improved	Factories gained reputation of sweatshops
Nike pay higher wages than most companies	There were no trade unions or strikes for pay in Vietnam
They help to create the multiplier effect	Nike has a large demand for water and energy
Helps to attract more MNC's	The company and advertising can undermine local culture
Nike pay tax which the government can spend	It often subcontracts its good to other companies which makes it hard to monitor
They can sometimes build infrastructure which can also benefit the country	Nike can leave at any time – they moved from China when the costs there increased

## Case-study 2 : Apple

### Apple in China

The location of Apples Headquarters are in Silicon Valley in San Francisco USA  
Steve Jobs founded Apple in 1976

Apple built up \$100 billion in cash reserves ( which is more than the US government

Cheap labour to manufacture one mobile phone in China would be \$7.10 ( roughly 8 hours work ) but if the same phone was manufactured in America it would cost \$337

Apple outsource the making of their phones in China to a company called Foxconn.

Nets have had to be put up around the factory buildings so it stops factory workers jumping to their deaths

### Impacts on the environment

Environmental regulations are lower in China

Apple products are designed to use less material, smaller packaging and be free of toxic substances

Apple recycled used material, for example glass and metal can be reprocessed for a new product

### Impacts on people in China

Many workers work long hours ( more than 76 hours a week and 11 days in a row, with no breaks in a cramped and hot factory . They do not receive paid holiday or sickness benefits. Many workers have tried to protest against these conditions.

There have at least 12 suicide attempts in the spring of 2012

At least 62 workers fell sick after inhaling n-hexane ( a chemical used to clean touch screens )

62% of factory workers thought the factory provided sufficient protective equipment to prevent work injuries

66% of the factory workers were partly proud to work for their factory

### Impacts on people in America

Benefits for working for Apple such as paid holidays, health and life insurance

## Aid

Countries can also receive aid from other countries. Some of this aid is **short term emergency aid** – given to help after disasters or disease outbreaks, although most aid is **long term development aid**.

Countries give aid for many reasons – for diplomacy and good relations, for economics ( to sell goods there , or to buy goods from them ) and for political tactics.

There are problems with giving aid – it may be tied aid ( you have to do something in return ) or you can be asked to buy products that you don't need in return for aid

Sometimes the aid money is spent on building prestige projects such as large Dams, that are not always the best solution for the problems being faced.

You can get to rely on the Aid ( dependency ) and not become self sufficient.

The worst form was loans given to LICs from the World Bank in the 1970's and 80's for big projects. Money was often squandered by corrupt officials and the debt repayments totalled ten times more than the original loan. This has helped to keep countries poor.

'Foreign aid might be defined as a transfer of money from poor people in rich countries to rich people in poor countries.'

**Douglas Casey, Classmate of Bill Clinton at Georgetown University**

Types of Aid	Advantages and disadvantages
<b>Short-term Emergency Aid</b>	Immediate help - provides food, clothes, medical supplies and shelter Goes to places and people most in need Not tied, and less chance of corruption
<b>Long-term Sustainable Aid</b>	Working with local people to help them find solutions to their problems that will help them to work their way out of poverty Provides resources to kick start the solutions such as equipping schools or providing farming equipment Encourages development of local skills and use of local raw materials

Case Study of short term emergency aid :  
Emergency Aid sent by the UK after Typhoon Haiyan hit the Philippines in 2013

**What emergency aid did the UK send?**

- Emergency shelter for 245,000 people
- Safe drinking water for 650,000 people
- Food for over 325,000 people
- Blankets and cooking provisions for 78,000 people
- 20,912 shelter kits
- 100,000 kg rice
- 3,374 tents
- 23,164 buckets.



## Case Study of long term development aid : Goat aid in Malawi

Advantages of Goat Aid	Disadvantages of Goat Aid
<p>Selling milk, cheese, fur etc that the goat has produced can help raise finances to improve the communities quality of life.</p> <p>Children can be taught how to care for an animal and learn respect from a young age.</p> <p>If the goats breeds then the kids can be sold.</p> <p>It brings villagers together as they look after the animals together.</p> <p>Manure can be used as fertiliser – which can help with poor soil quality.</p> <p>Goats breed easily which makes it sustainable.</p>	<p>The goats need shelter and poor families cannot afford this.</p> <p>The goats need food and water which some families may not be able to afford.</p> <p>Transporting the goat across Africa could be expensive and difficult and there is no guarantee that the money given to charity will actually buy a goat.</p> <p>Veterinary care would be expensive.</p> <p>The family would need to be taught how to care for the goat properly.</p>



# 2.1 Coasts & Coastal Management

## Coasts: Waves

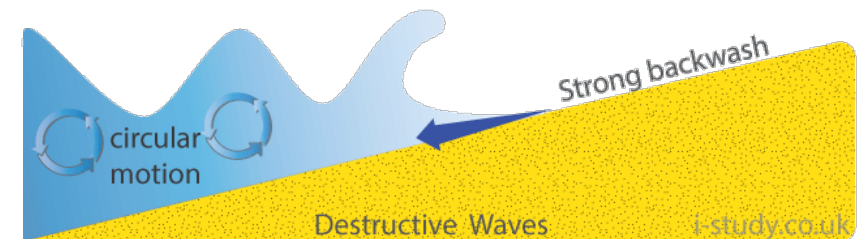
Key Term	Definition
<b>Constructive Wave</b>	A low energy wave characterised as having a strong swash and a weak back wash. Leads to the build up of a beach.
<b>Destructive Wave</b>	A high energy wave characterised as having a strong backwash and a weak swash. Leads to the removal of beach material.
<b>Swash</b>	The forward motion of waves up a beach.
<b>Backwash</b>	The backwards motion of waves down a beach.
<b>Fetch</b>	The distance travelled by wind or waves across open water.
<b>Frequency</b>	How often the waves occur. Low frequency = 6-8 waves per minute High frequency = 10-14 waves per minute
<b>Wave Peak</b>	The highest point of the wave.
<b>Wave Trough</b>	The lowest point of the wave, occurs between two peaks.

### Constructive Waves:



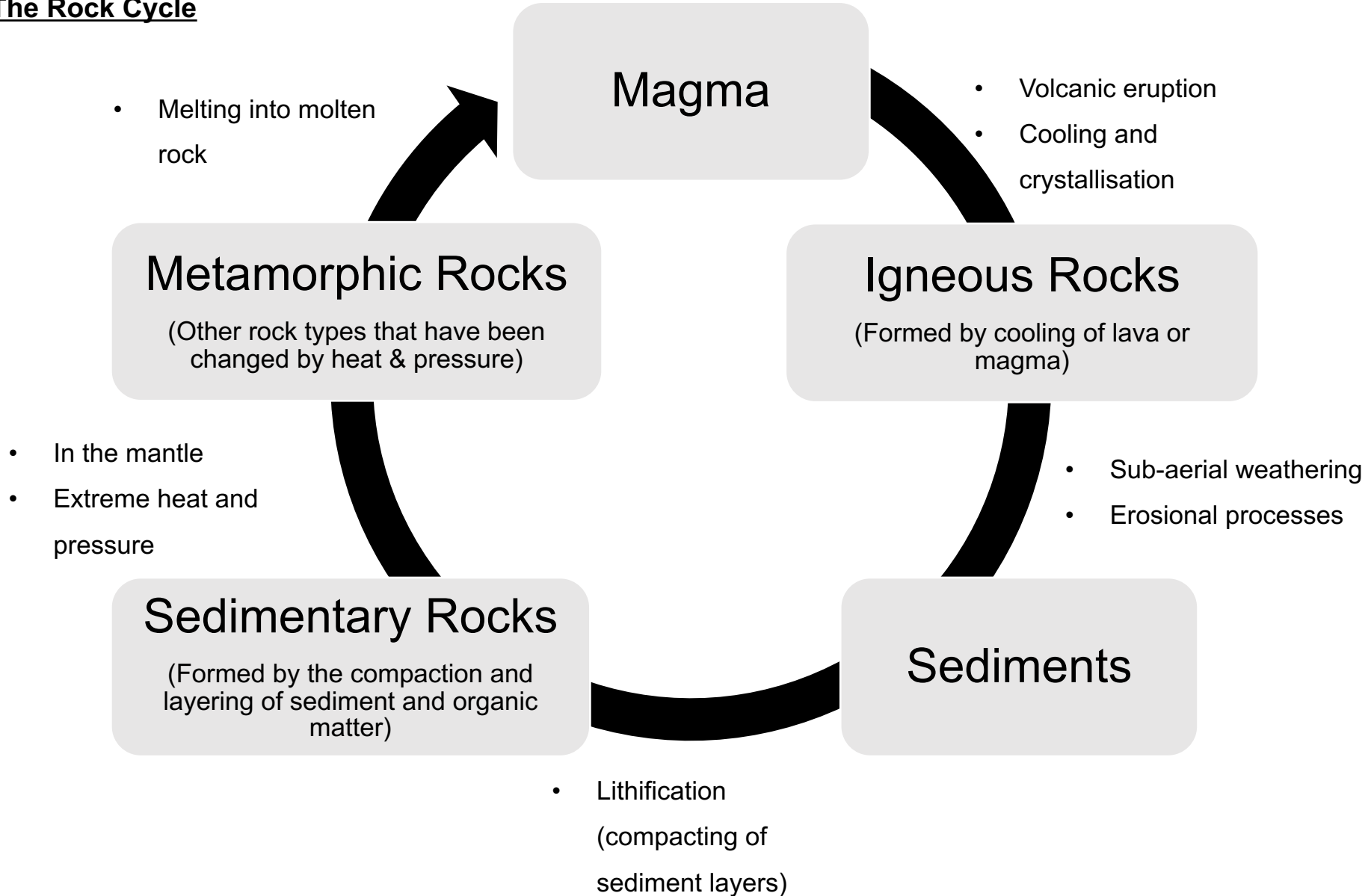
- Strong swash AND weak backwash
- Contribute to the build up of beach material
- Elliptical wave orbit
- Low frequency and long wave length
- Shallow wave height

### Destructive Waves:



- Weak swash AND strong backwash
- Leads to the removal of beach material
- Circular wave orbit
- High frequency and short wave length
- Steep wave height

**Coasts: The Rock Cycle**



## Coasts: Sub-Aerial Weathering and Mass Movement

### Sub-Aerial Weathering

The breakdown of rocks at Earth's surface, without the influence of marine erosion.

### Biological Weathering

Breakdown of rock due to plants or animals

- Animals burrowing into the cliff face, displacing rocks
- Plant roots growing into rock cracks and breaking them apart

### Chemical Weathering

Breakdown of rock through changing its chemical composition.

- Carbonation (acidic rain dissolving rocks)

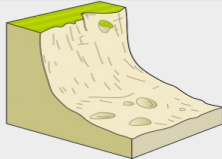
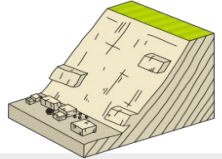
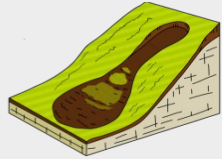
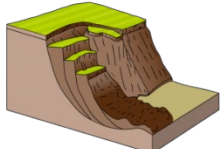
### Physical Weathering

The breakdown of rock without changing its chemical composition.

- Freeze-Thaw (water getting into cracks, freezing- pushing rocks apart, thawing then repeating process until rock breaks apart)
- Wetting and Drying (shrinking and expanding of material)

### Mass Movement

Large movements of soil and rock debris down slopes in response to the pull of gravity.

Types of Mass Movement	Description	Diagram
<b>Rockfall</b>	Rock fragments break away from cliff face due to weathering	
<b>Landslide</b>	Blocks of rock slide downhill along a slide plane	
<b>Mudslide</b>	Saturated soil flows down a slope	
<b>Slumping</b>	Saturated soil slumps along a curved surface	

## Coasts: Marine Erosion Key Terms

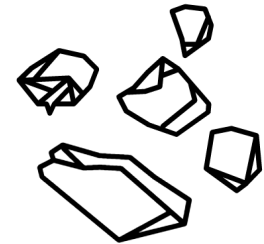
### **Hydraulic action**

Air becomes trapped in joints and cracks on a cliff face. When a wave breaks, the trapped air is compressed which weakens the cliff and causes erosion.



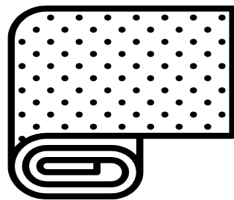
### **Attrition**

Waves smash rocks and pebbles on the shore into each other, and they break and become smoother.



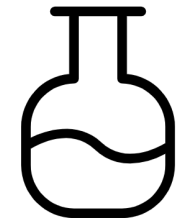
### **Abrasion**

Bits of rock and sand in waves grind down cliff surfaces like sandpaper.



### **Solution**

Acids contained in sea water will dissolve some types of rock such as chalk or limestone.



## Coasts: Erosional Landforms (Headlands & Bays)

Alternating bands of hard and soft rock.



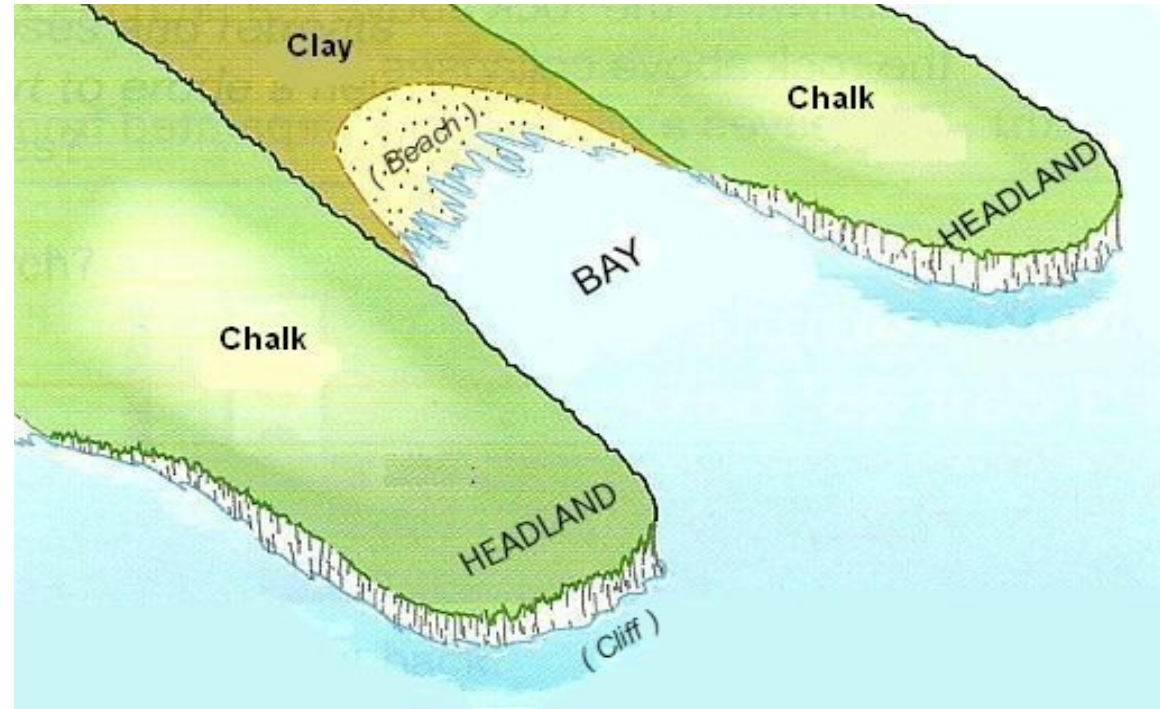
The bands of soft rock, such as sand and clay, erode more quickly than those of more resistant rock, such as chalk.



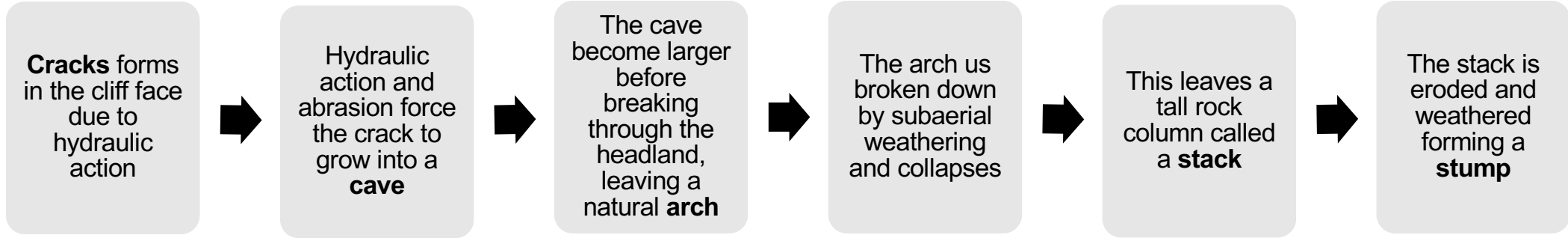
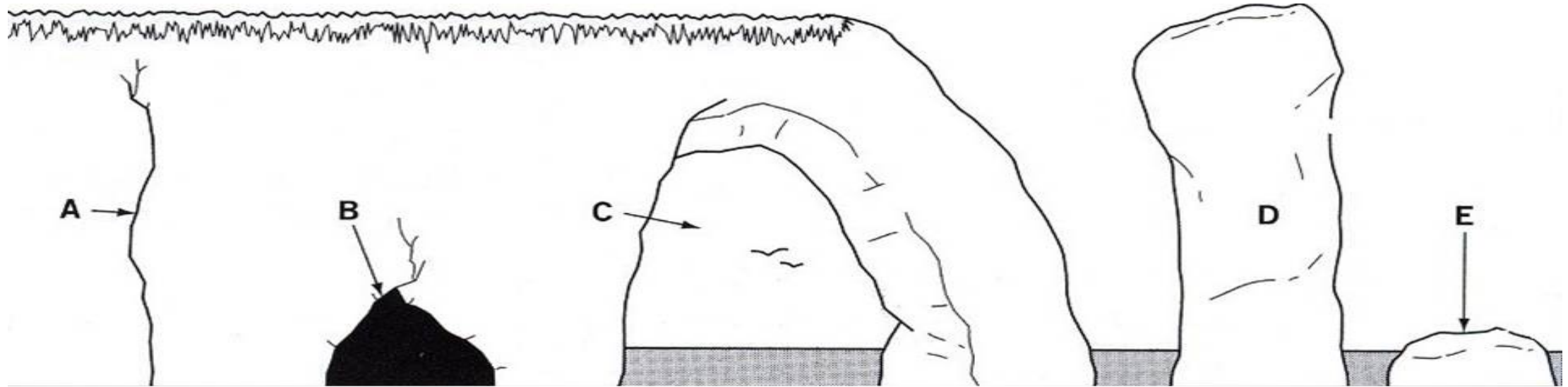
This leaves a section of land jutting out into the sea called a headland.



The areas in-between headlands, where the soft rock has eroded away, are called bays



**Coasts: Erosional Landforms (Caves, Arches, Stacks, Stumps)**



## Coasts: Erosional Landforms (Wave-Cut Platforms)

1 Weather weakens the top of the cliff.



2 The sea attacks the base of the cliff forming a wave-cut notch.



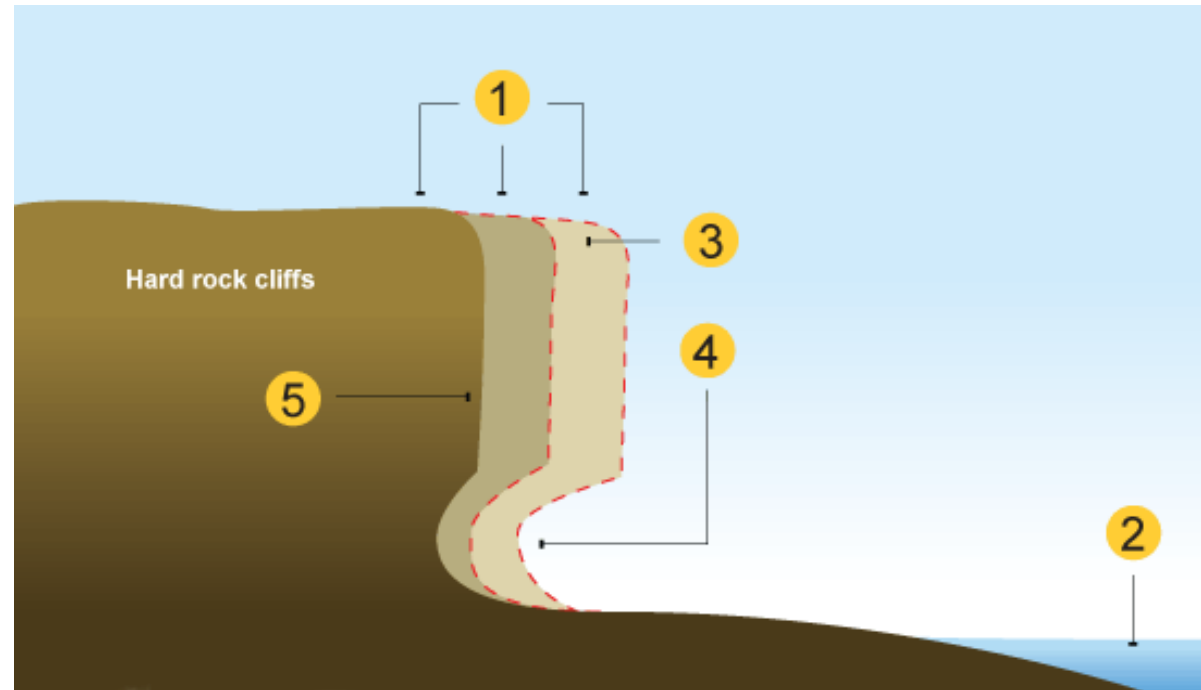
3 The notch increases in size causing the cliff to collapse.



4 The backwash carries the rubble towards the sea forming a wave-cut platform.



5 The process repeats and the cliff continues to retreat





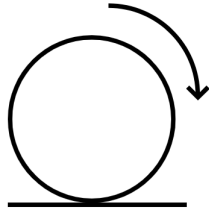
## Coasts: Transportation Key Terms

### Transportation

The movement of material in the sea and along the coast by waves.

#### Traction

Large pebbles and boulders are rolled along the seafloor.



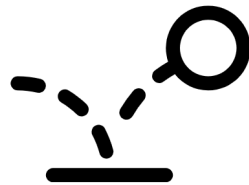
#### Suspension

Beach material is suspended and carried by the waves



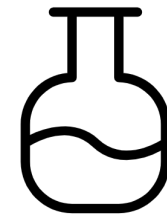
#### Saltation

Beach material is bounced along the seafloor



#### Solution

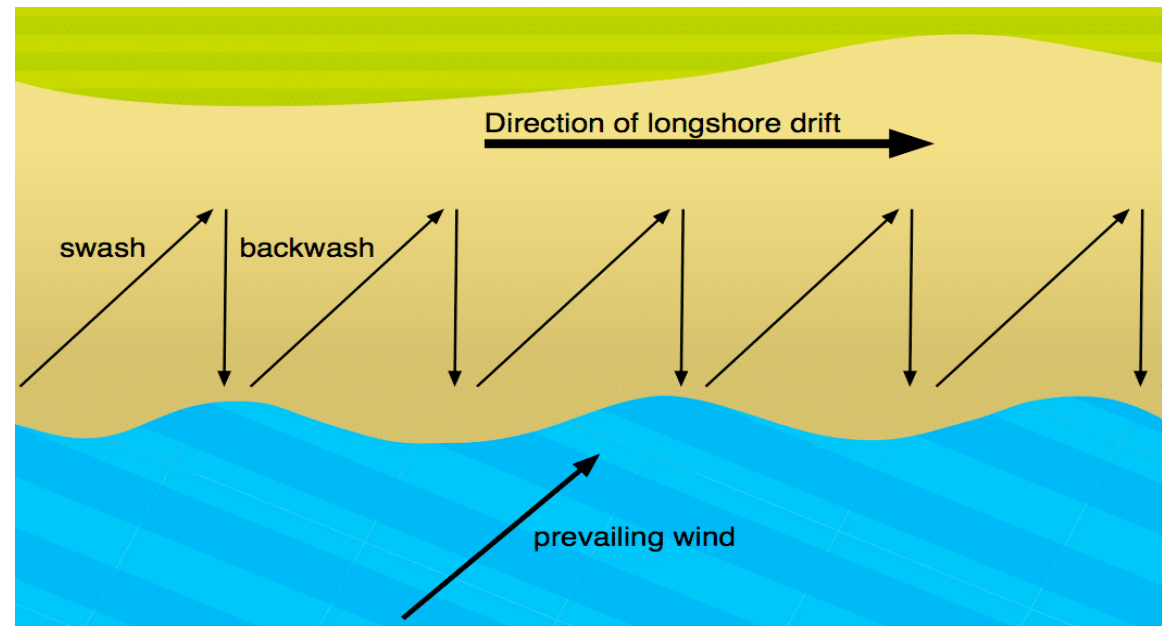
Material is dissolved and carried by the water



## Coasts: Longshore Drift

The movement of material along the coast is called longshore drift.

- The prevailing wind blows waves carrying sediment into the beach at an angle
- The waves break on the shore and due to gravity the water runs back, perpendicular to the angle of the shoreline
- The sea carries the sediment back down the beach in its backwash
- This results in a zigzag motion as sediment is transported laterally along the coastline



## Coasts: Depositional Landforms (Beaches)

Beaches are found between the high water mark and low water mark



Formed by constructive waves depositing material



Sand beaches are flat and wide, particles are small and the beach profile is gently sloping



Shingle beaches are steep and narrow, particles are large and the beach profile is steeply sloping

## Key Terms

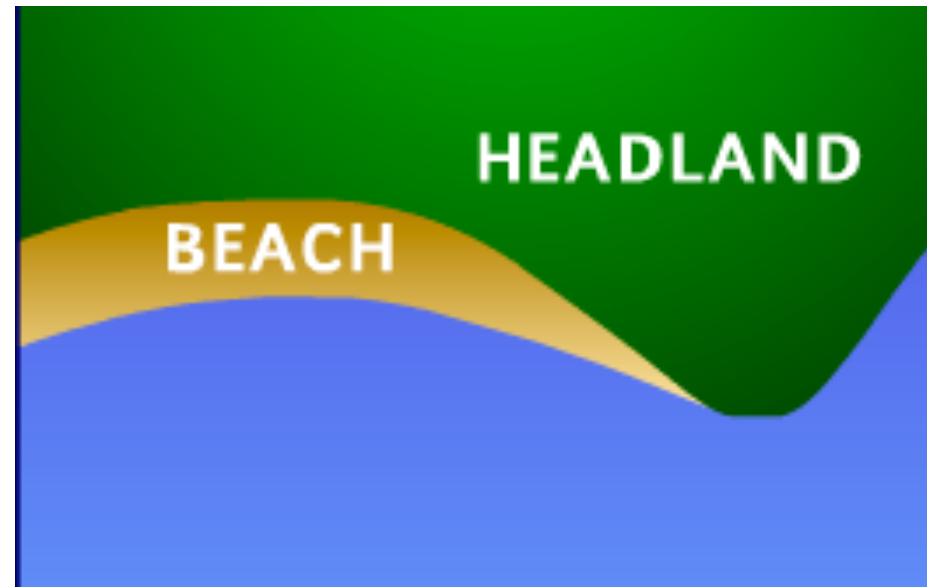
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### **Sediment**

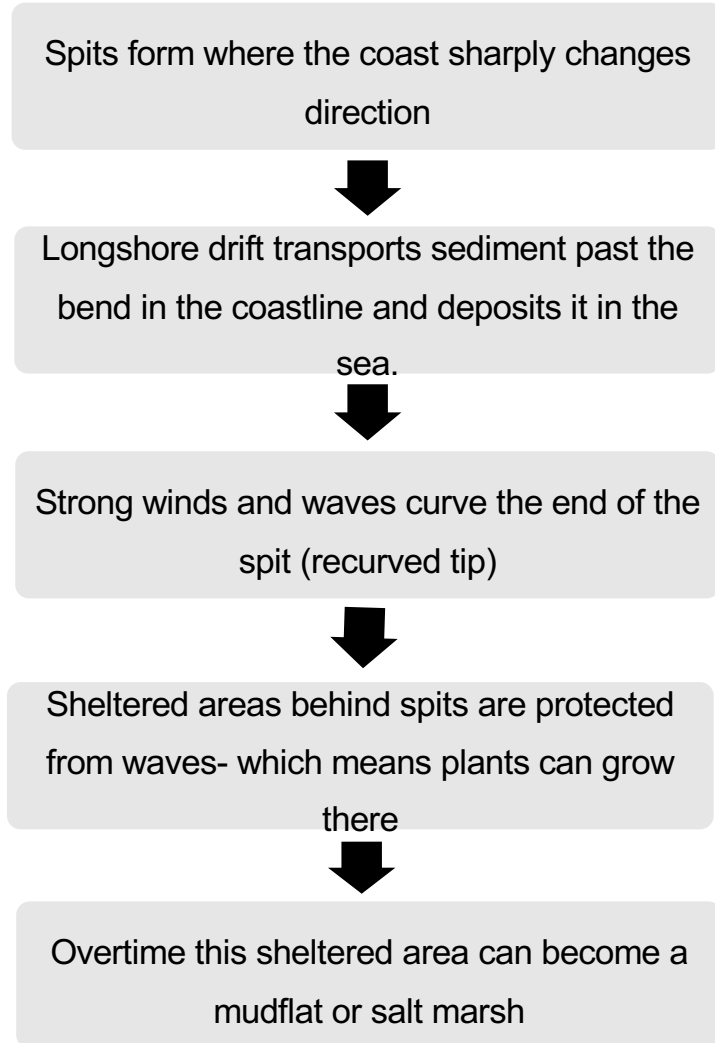
Sediment is a naturally occurring material that is broken down by processes of weathering and erosion

### **Shingle**

Small rounded pebbles



## Coasts: Depositional Landforms (Spits)



## Key Terms

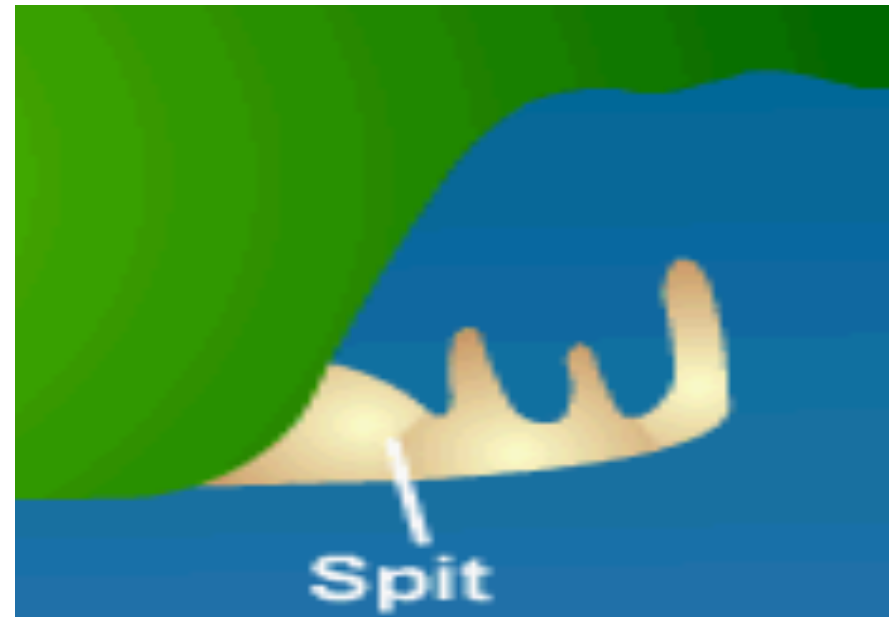
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### **Mudflat**

Also known as 'tidal flats' – it is a stretch of muddy land left uncovered at low tide

### **Saltmarsh**

An area of coastal grassland that is regularly flooded by seawater



## Coasts: Depositional Landforms (Bars)

Formed when a spit joins together  
two headlands



The bar cuts off the bay between  
the headlands from the sea



A lagoon forms behind the bar

## Key Terms

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### Lagoon

A pool of shallow salt water separated from the sea by a low sand bar or coral reef

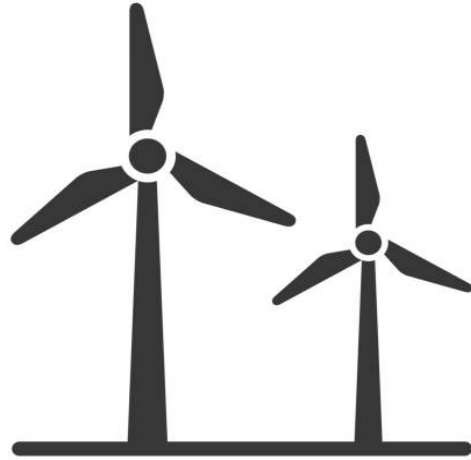


**Coasts: Human Activity and The Coast**

**The uses of the coast:**



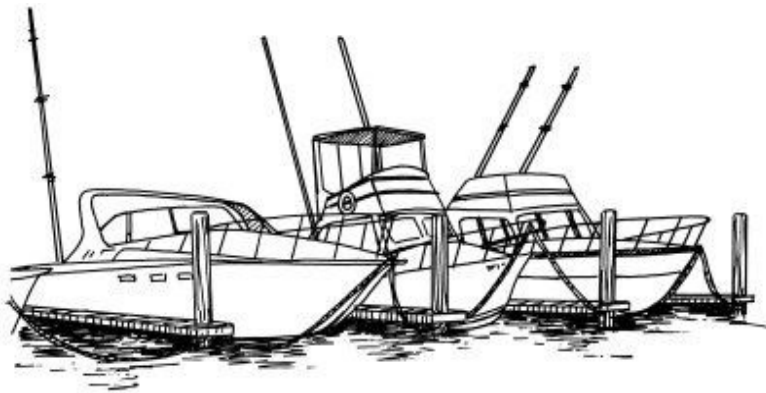
**1. Water Sports**



**2. Offshore Wind Farm  
(Energy)**



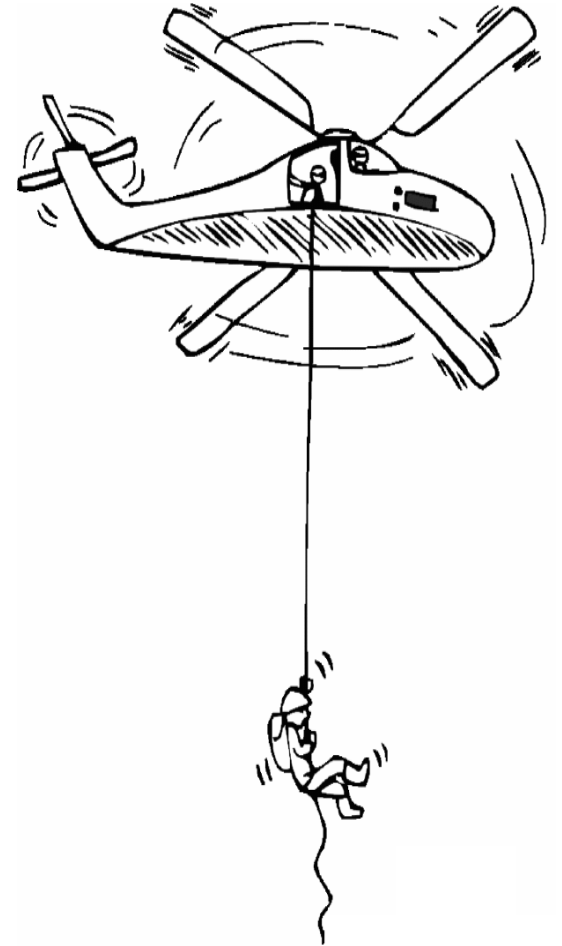
**3. Tourism**



**4. Ports and Harbours**



**5. Fishing**



**6. Security and Rescue**

**Coasts: Human Activity and The Coast**

**Threats to the coast:**



**1. Coastal Flooding**



**2. Beach Litter/ Garbage Dumping**



**3. Oil Spillages**



**4. Over Fishing**



**5. Coral Bleaching**



**6. Increased Erosion**

## Coasts: Coastal Management

### Shore Line Management Plans:

- Local councils prepare shoreline management plans to prepare and protect against coastal flooding
- Councils will weigh up the benefits of building the defences against the cost of building them

Option	Description	Explanation
<b>Do Nothing</b>	Do nothing and allow gradual erosion	<ul style="list-style-type: none"><li>• Option if the land has a lower value than the cost of building expensive sea defences</li></ul>
<b>Hold the Line</b>	Use hard-engineering techniques to defend the coastline	<ul style="list-style-type: none"><li>• Hard-engineering techniques are only used when the land being protected is particularly valuable</li><li>• Sea defences need continuous maintenance and upgrading which is expensive</li></ul>
<b>Retreat the Line</b>	Allow a break in existing coastal defences to allow land to flood naturally between low and high tide	<ul style="list-style-type: none"><li>• Option if the area is at high risk of erosion. It usually occurs where the land is of low value (e.g. farm land)</li><li>• People will need to be evacuated from flood risk areas.</li></ul>
<b>Advance the Line</b>	Build new coastal defences further out to sea	<ul style="list-style-type: none"><li>• Most expensive option as it requires a huge engineering project.</li></ul>

### Key Terms

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#### **Hard Engineering**

Man-made structures built to control the flow of the sea and reduce flooding and erosion

#### **Soft Engineering**

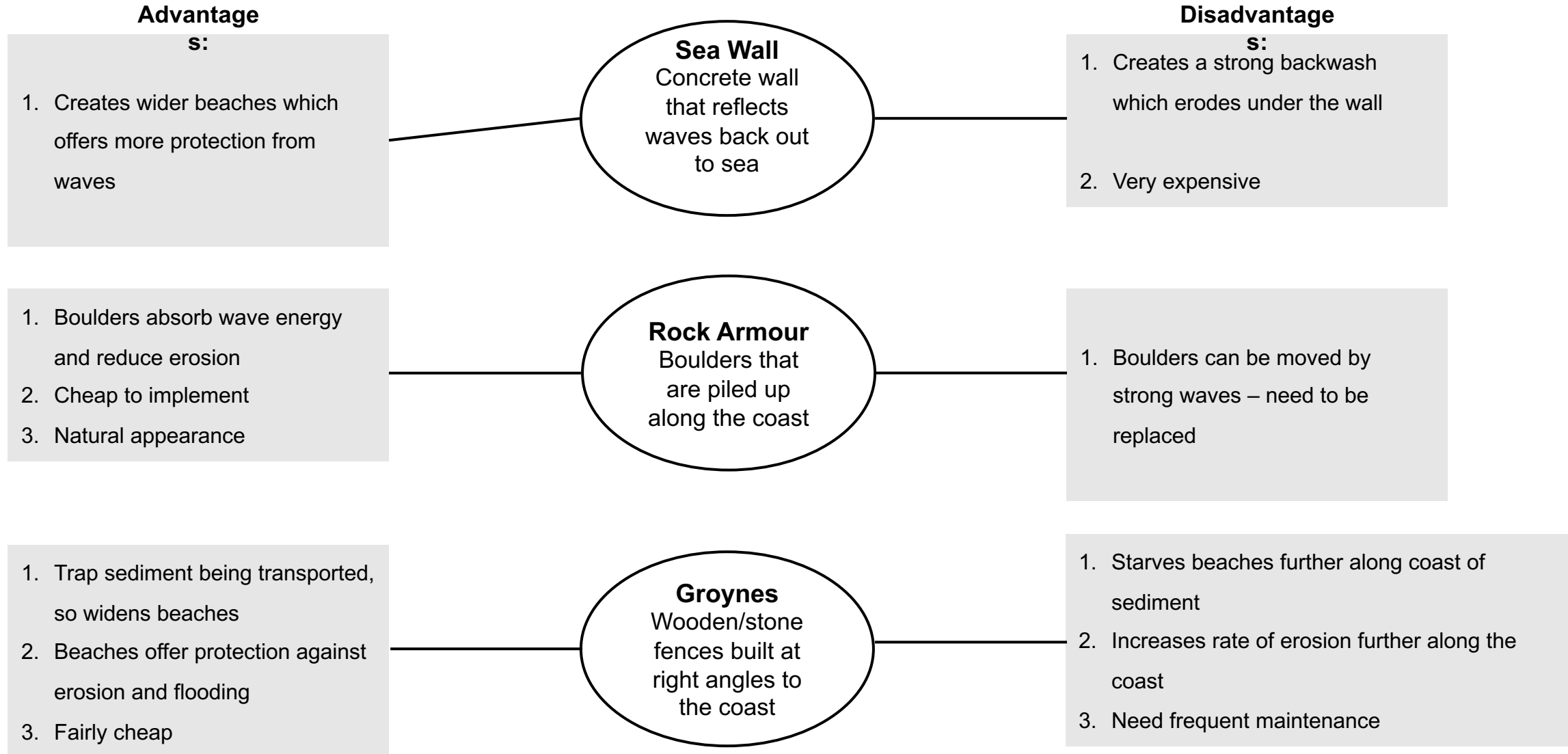
Schemes set up using knowledge of the sea and its processes to reduce the effects of flooding and erosion

#### **Shoreline Management Plan**

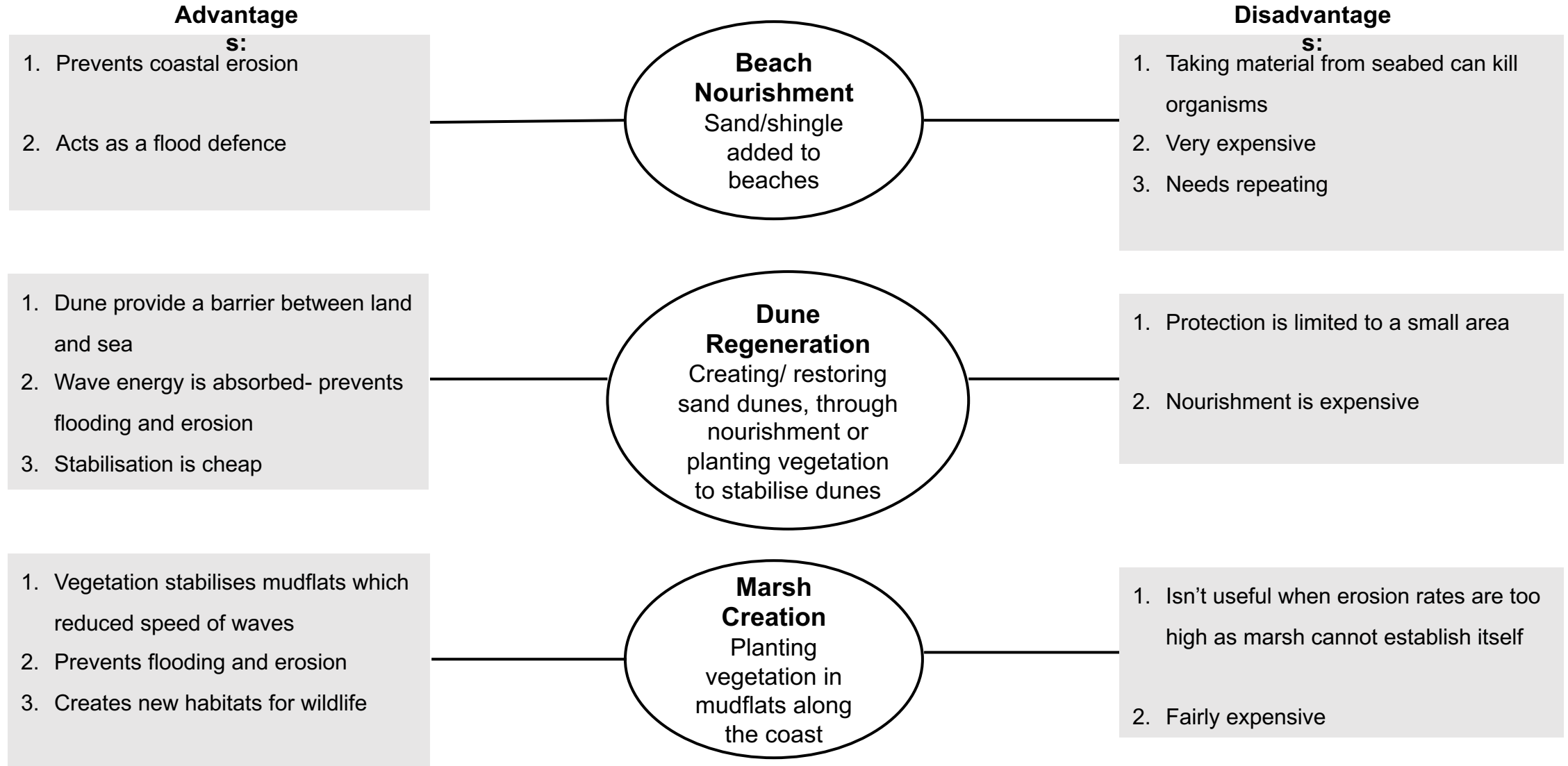
A non-statutory document that provides an overview of the long-term risks associated with coastal processes.



## Coasts: Coastal Management- Hard Engineering Strategies



## Coasts: Coastal Management- Soft Engineering Strategies



## **Coasts: Holderness Case-Study (1)**

**Location:** Holderness, East Yorkshire, UK

**Distance:** 61km from Flamborough Head (headland) - Spurn Head (a spit)

**Erosion:** 1.8m of land lost/ year (fastest eroding coastline in Europe)

### **Reasons for rapid erosion:**

1. Easily eroded rock type (boulder clay cliffs are likely to slump when wet)
2. Narrow beaches don't slow the speed of oncoming waves
3. Sea defences worsening the erosion rates further along the coastline (groynes trap sediment, so beaches further along coast are malnourished)
4. Powerful waves- deep water, storm surges and long fetch

## **The Effects of Rapid Erosion-**

### **Social Impacts:**

1. Homes near the cliffs are at risk of collapsing into the sea (e.g. in Skipsea)
2. Accessibility to some settlements affected as cliffside roads have been lost due to erosion
3. Gas terminal at Easington is at risk (only 25m from cliff edge)  
This terminal accounts for 25% of Britain's gas supply

### **Environmental Impacts:**

1. Some Sites of Special Scientific Interest (SSSI) are threatened (e.g. the lagoons near Easington)

### **Economic Impacts:**

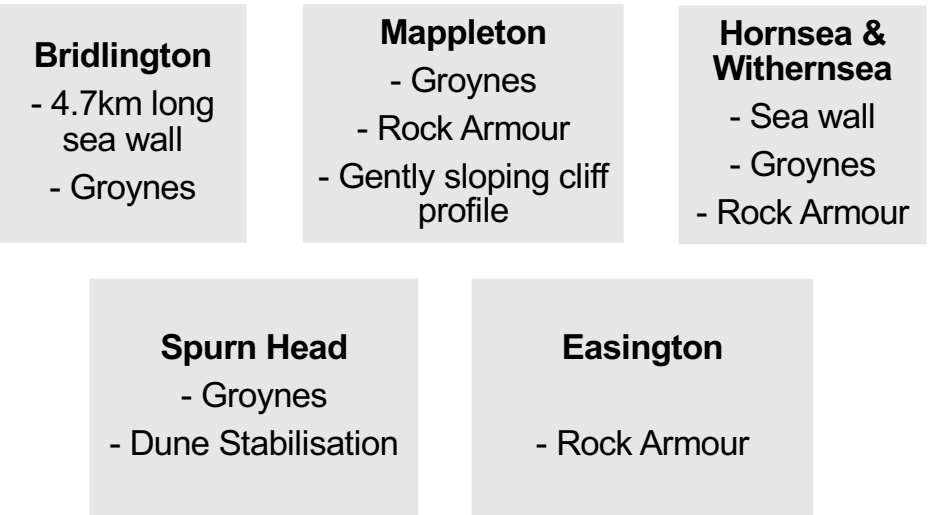
1. Property prices along the coast have fallen sharply
2. Businesses and jobs are lost (e.g. Seaside Caravan Park at Ulrome is losing approx. 10 pitches/ year to erosion)

## Coasts: Holderness Case-Study (2)

### Coastal management: The Issues

1. Terminal groyne syndrome (where the rate of erosion following the last groyne is increased) e.g. Cowden Farm, South of Mablethorpe is now at risk
2. Groynes prevent eroded material being transported to the Humber Estuary = increased risk of flooding there
3. Coastal erosion has increased at the Lincolnshire Coast (south of Holderness)
4. Spurn Head is at risk of being eroded away as less sediment is being added to it
5. Sea defences need continuous maintenance = expensive

### Engineering Strategies along the Holderness Coastline:



**Skipsea** and **Great Cowden** do **NOT** have coastal defences and so are experiencing enhanced erosion due to '**Terminal Groyne Syndrome**'

**Terminal Groyne Syndrome** – Accelerated erosion of the beach down drift of the last groyne. There is a lack of sediment because longshore drift has been interrupted by the groynes.

## **Coasts: Climate Change and the Coast**

### **Sea levels are rising due to Global Warming**

- Global sea levels are rising at a rate of approx. 2mm per year
- Predictions estimate that by the year 2100, sea levels could have risen between 30cm-1m

#### **Key Terms:**

##### **Global Warming**

The gradual increase in the overall temperature of the Earth's atmosphere

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**Global Warming has two effects that causes Sea Levels to rise:**

#### **Melting Ice**

- Increased temperatures melt glacial ice caps
- This melted ice water returns to the oceans
- This increases the volume of water in the oceans and causes the sea levels to rise

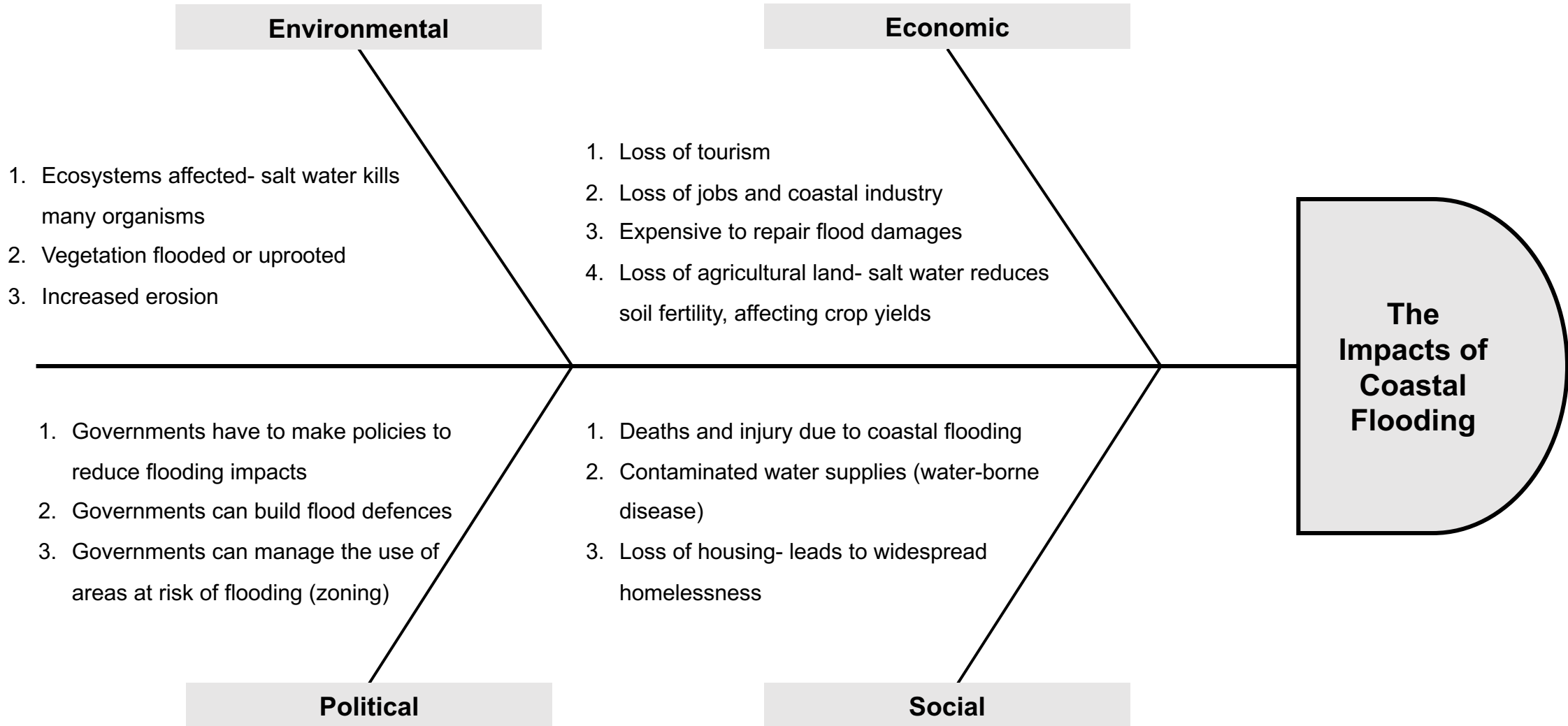
#### **Thermal Expansion**

- Increased global temperature causes oceans to get warmer
- Heated water particles expand
- This expansion increases the volume of water, causing sea levels to rise

Rising sea levels mean that low-lying parts of the world are at increased risk of coastal flooding.

**E.g.** Bangladesh and the Maldives

## Coasts: The Impacts of Coastal Flooding



## Coasts: The Maldives Case-Study

**Location:** The Maldives, Group of Islands in the Indian Ocean

**Number of Islands:** Approx. 1200- of which 200 are inhabited

**Average Island Height:** 80% of land is below 1m

**Population:** Approx. 440,000 people

**The Problem:** Due to rising sea levels, scientist predict The Maldives will be completely submerged within 50- 100 years

### Key Terms:

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#### **Submerged**

To be completely covered by the sea/ocean

#### **Desalination**

The expensive process of removing salt from sea water, making it drinkable

#### **Carbon Neutral**

Action to remove as much carbon dioxide from the atmosphere as each put into it.

## **The Impacts of Coastal Flooding on the Maldives**

### **Social**

1. Severe flooding causes housing damage, leaving whole communities homeless
2. Less fresh water available- saltwater contaminates freshwater supplies so locals have to rely on rainwater or build expensive desalination plants

### **Environmental**

1. Loss of beaches- flooding erodes beaches which destroys animal habitats
2. Loss of soil- soil on the island is shallow and easily washed away, leaving the land infertile so crops cannot grow

### **Economic**

1. Loss of tourism- largest industry in the Maldives. If main airport cannot operate then international tourism will be lost
2. Disrupt fishing industry- fish are the Maldives largest export. Coastal flooding may damage fish processing plants

### **Political**

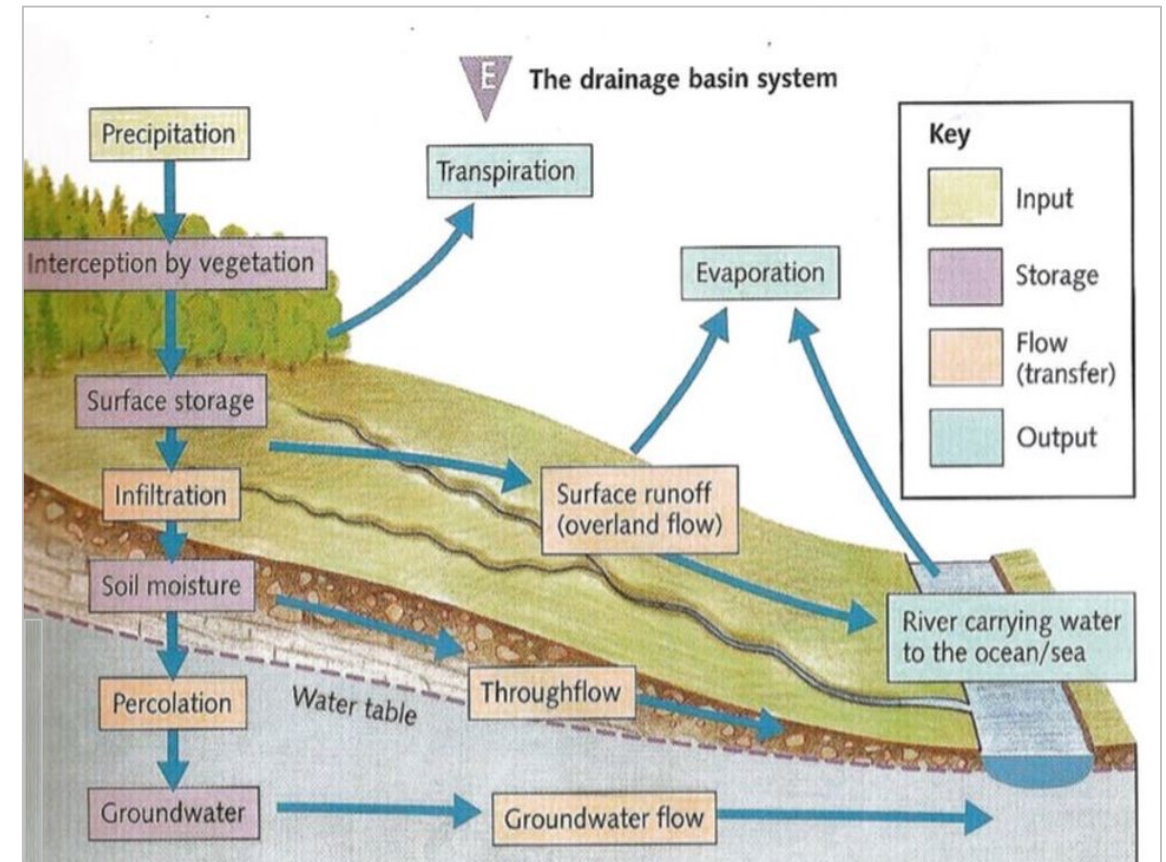
1. Maldivian government has asked the Japanese government to give them \$60 million to build the 3m high sea wall that protects the capital city, Malé
2. The Maldives has pledged to become carbon neutral so as not to contribute to global warming
3. Government is considering buying land in countries like Indian and Australia and moving Maldivians there (environmental refugees)

# 2.2 Rivers & River Management



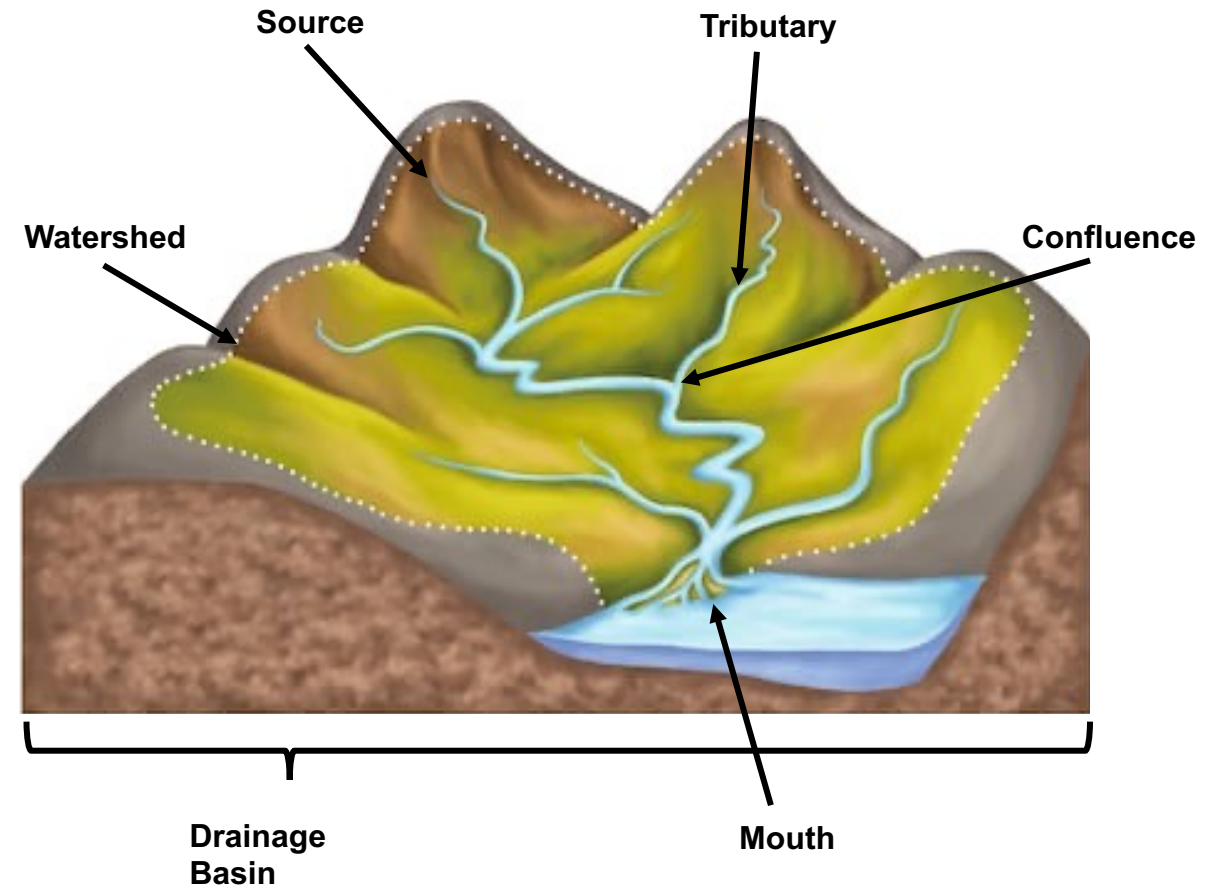
## Rivers: The Hydrological Cycle

Key Term	Definition
<b>Precipitation</b>	Water released from clouds, including: rains, sleet, hail and snow
<b>Interception</b>	When trees or man-made objects block precipitation from reaching the ground
<b>Transpiration</b>	When moisture from plants and leaves is lost to the atmosphere
<b>Evaporation</b>	When water is heated by the sun and rises into the atmosphere as water vapour
<b>Condensation</b>	When water vapour is cooled and turns back into water droplets to form clouds
<b>Surface Runoff</b>	Water flowing across the surface of the land, whether in a channel or just over the land
<b>Infiltration</b>	When water first soaks into the soil
<b>Throughflow</b>	When water travels through the soil towards a river or the sea
<b>Percolation</b>	The slow downward movement of water from the soil into the bedrock
<b>Groundwater Flow</b>	The movement of water through the bedrock
<b>Water Table</b>	The level of saturated ground in the soil- it rises and falls depending on the amount of rain



## Rivers: The Drainage Basin

Key Term	Definition
<b>Watershed</b>	The area of high land forming the edge of a drainage basin
<b>Source</b>	Where a river begins
<b>Tributary</b>	A small river or stream that joins a larger river
<b>Confluence</b>	The junction at which two rivers meet
<b>Channel</b>	This is where the river flows
<b>Mouth</b>	Where the river meets the sea
<b>Drainage Basin</b>	This is the area of land drained by a river and its tributaries



## Rivers: The River Valley

- The path of a river as it flows downhill is called its course
- Rivers have an upper, middle and lower course
- Rivers form channels and valleys as they flow downhill
- Rivers erode the landscape and wear it down
- Long profile = shows you how the gradient changes overtime
- Cross profile = shows you a cross-section of the river

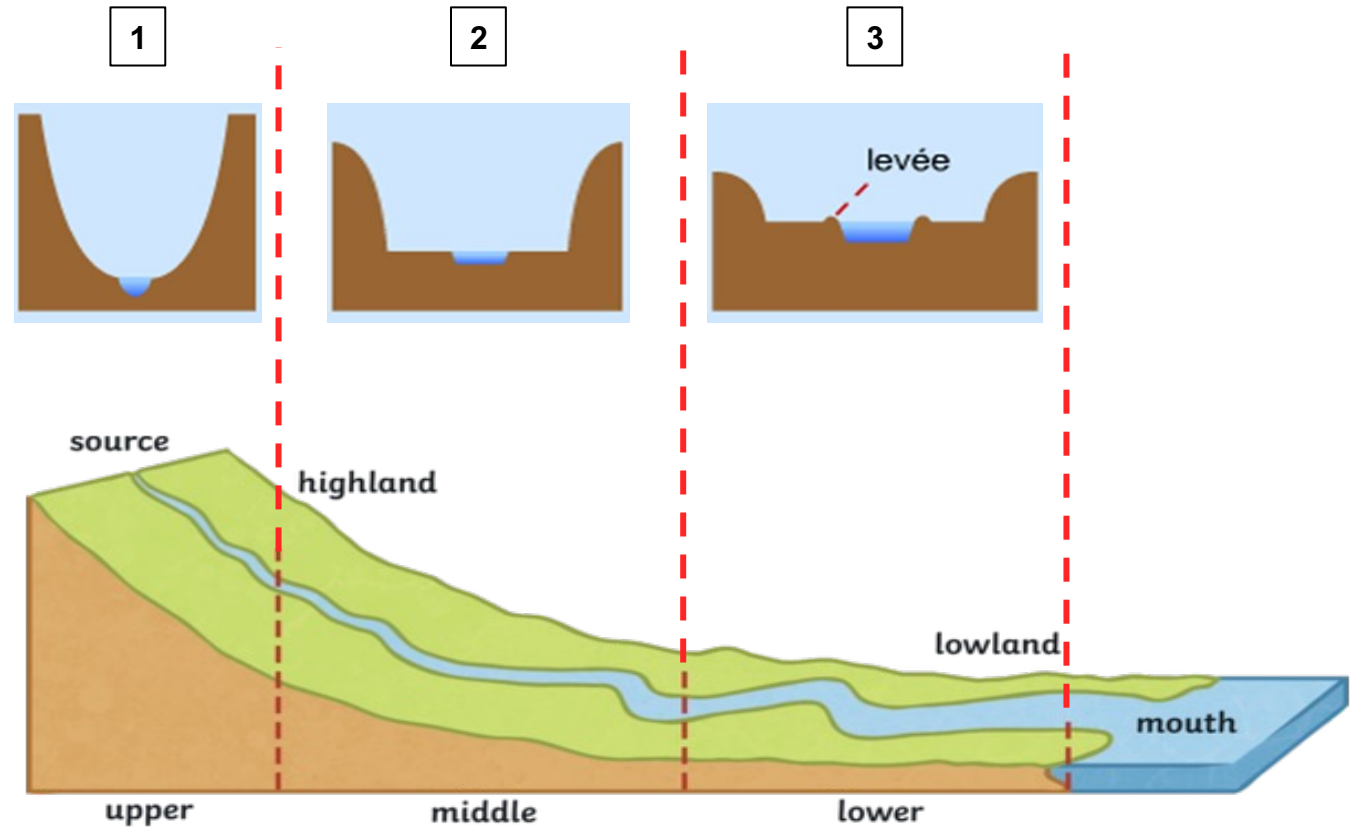
Course	Gradient	Valley and Channel Shape
1. Upper	Steep	<ul style="list-style-type: none"> <li>• V-shaped valley, steep sides</li> <li>• Narrow, shallow channel</li> </ul>
2. Middle	Medium	<ul style="list-style-type: none"> <li>• Gently sloping valley sides</li> <li>• Wider, deeper channel</li> </ul>
3. Lower	Gentle	<ul style="list-style-type: none"> <li>• Very wide, almost flat valley</li> <li>• Very wide and deep channel</li> </ul>

### Vertical Erosion

This deepens the river valley and channel making it V-shaped. Dominant in the upper course of the river.

### Lateral Erosion

The widens the river valley and channel. Dominant in the middle and lower course of the river.



## Rivers: The Bradshaw Model

- The Bradshaw model is a theory which shows how the size of the river affects stream flow
  - As the river flows downstream, tributaries feed more water into the stream system leading to a higher discharge
  - This increased volume of water leads to the river having more strength and thus more power to vertically and laterally erode leading to an increase in channel depth and width
  - Load particle size is smaller downstream and the channel bed is smoother
- 

### **Key Terms:**

#### **Discharge**

The volume of water flowing through a river channel

#### **Velocity**

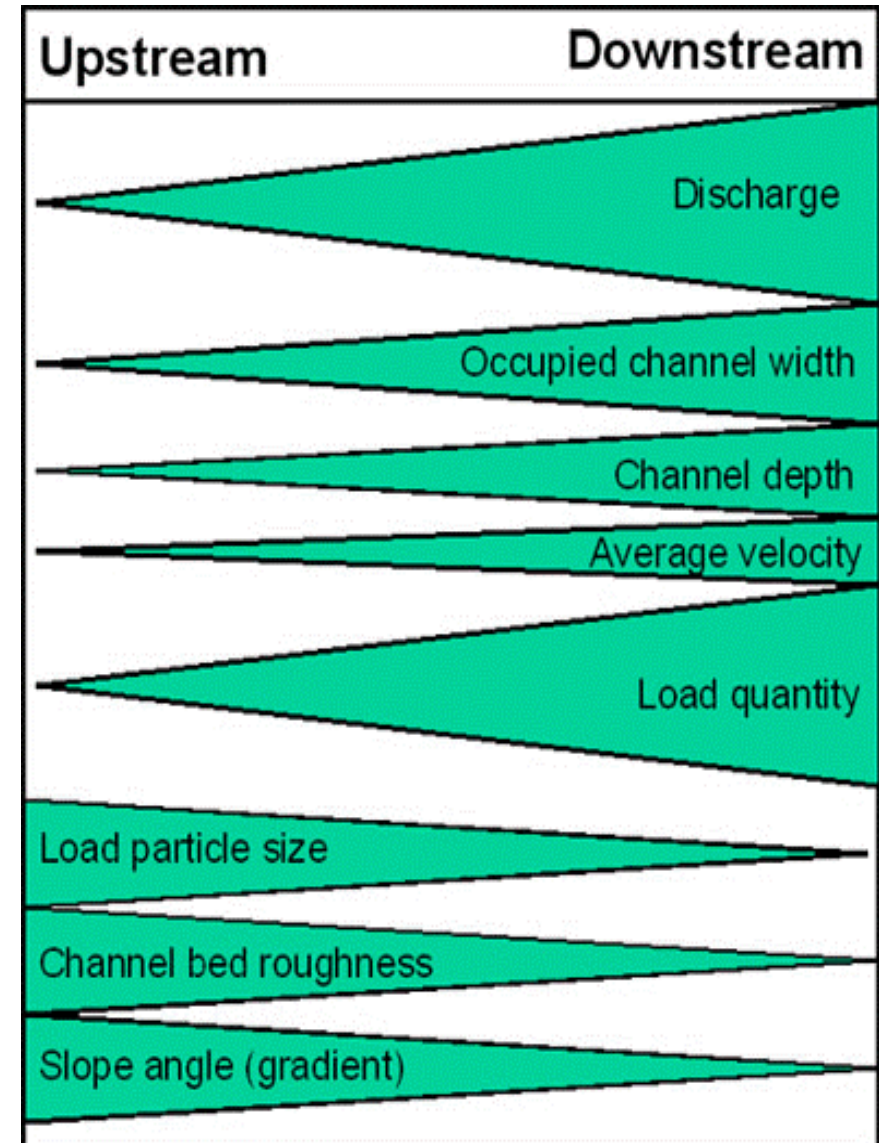
Refers to the speed at which water moves through its channel

#### **Load**

Particles of eroded material, generally rocks, that the river transports until it deposits them

#### **Gradient**

Refers to the steepness of the land



## Rivers: Erosion Key Terms

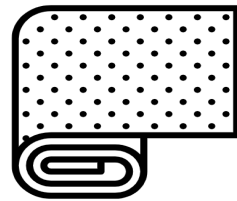
### **Hydraulic action**

Air becomes trapped in cracks in the rocks. This trapped air is compressed and breaks the rocks apart causing erosion.



### **Abrasion**

Rock and sand grind along the river bed, wearing away at the rocks surface like sandpaper.



### **Weathering**

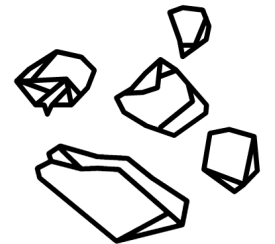
The breaking down of rocks at Earth's surface

### **Erosion**

The wearing away of rocks and their transportation elsewhere

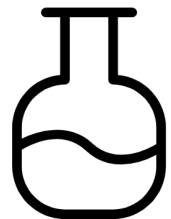
### **Attrition**

Rocks and pebbles suspended in the river crash into each other, and they break down, becoming smaller and smoother.



### **Solution**

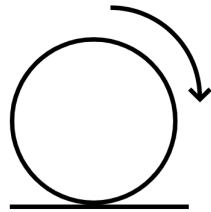
Acids contained in river water will dissolve some types of rock such as chalk or limestone.



## Rivers: Transportation Key Terms

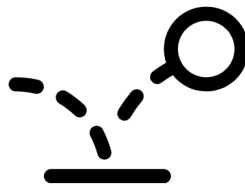
### **Traction**

Large pebbles and boulders are rolled along the riverbed.



### **Saltation**

Beach material is bounced along the riverbed



### **Transportation**

The movement of material/ sediment in the river channel.

### **Deposition**

The dropping of a rivers loads due to it losing velocity (speed)

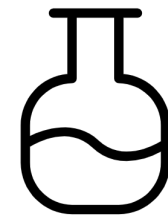
### **Suspension**

River material is suspended and carried by the flowing water

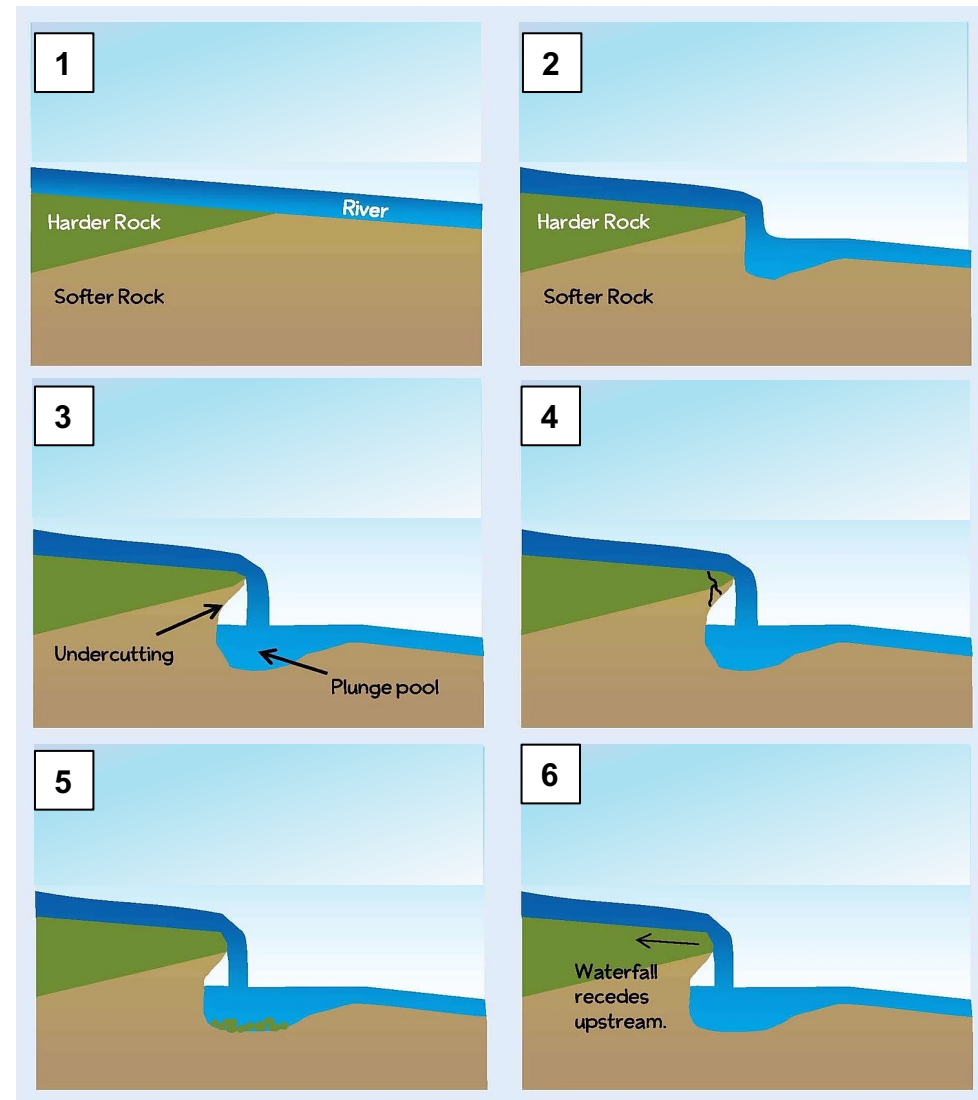
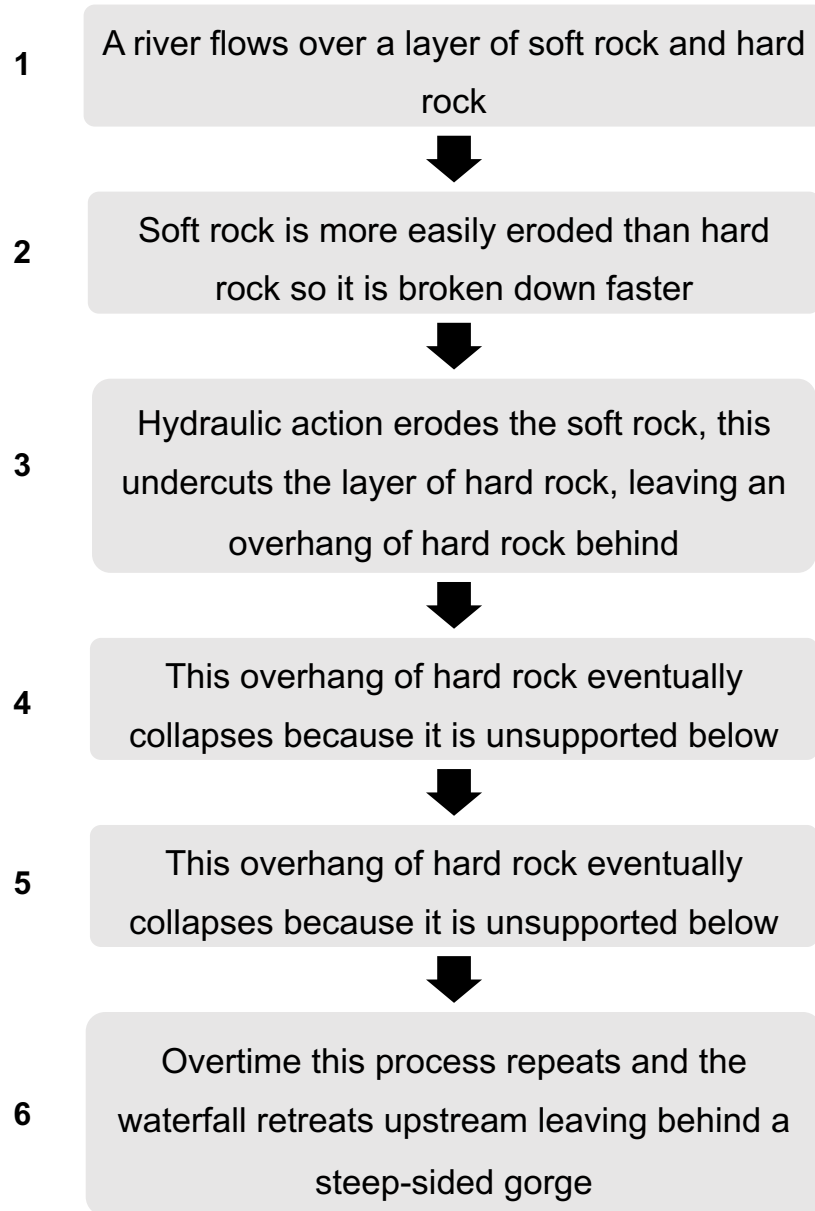


### **Solution**

Material is dissolved and carried by the flowing river water



## Rivers: Waterfall & Steep-sided Gorge Formation:



## Rivers: Interlocking Spurs

In the upper course there is more **vertical erosion**. The river cuts down into the valley



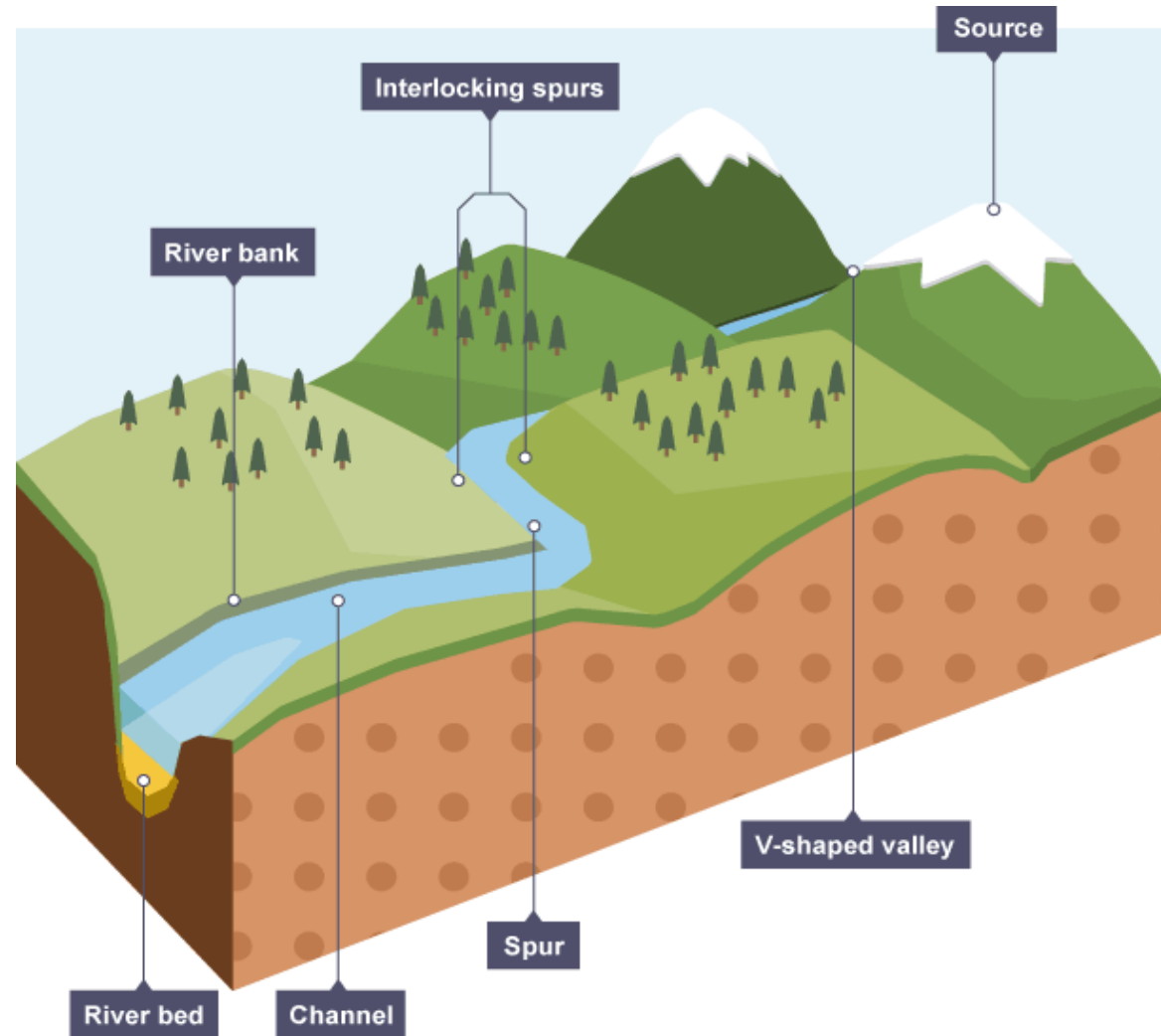
If there are areas of hard rock which are more difficult to erode, the river will bend around it



These outcrops of hard rock are called **spurs**



**Interlocking spurs** of land link together like the teeth of a zip and are formed by the river bending round multiple spurs



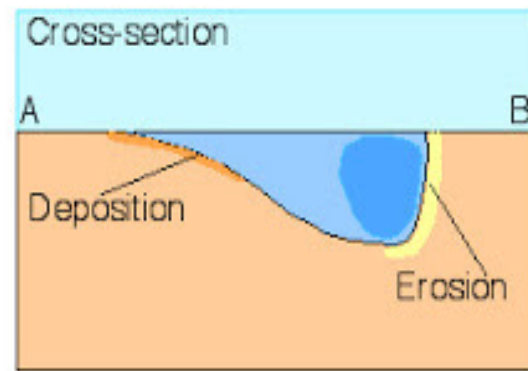
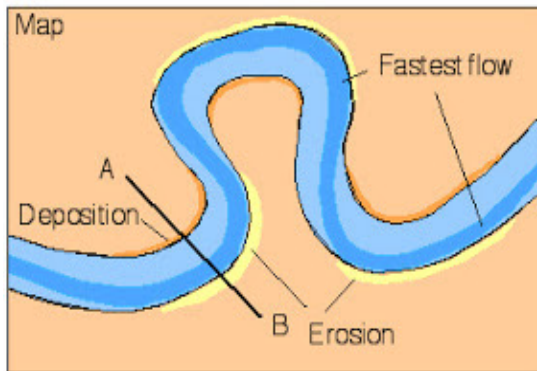


## Rivers: Landforms in the Lower Course

### **Meanders:**

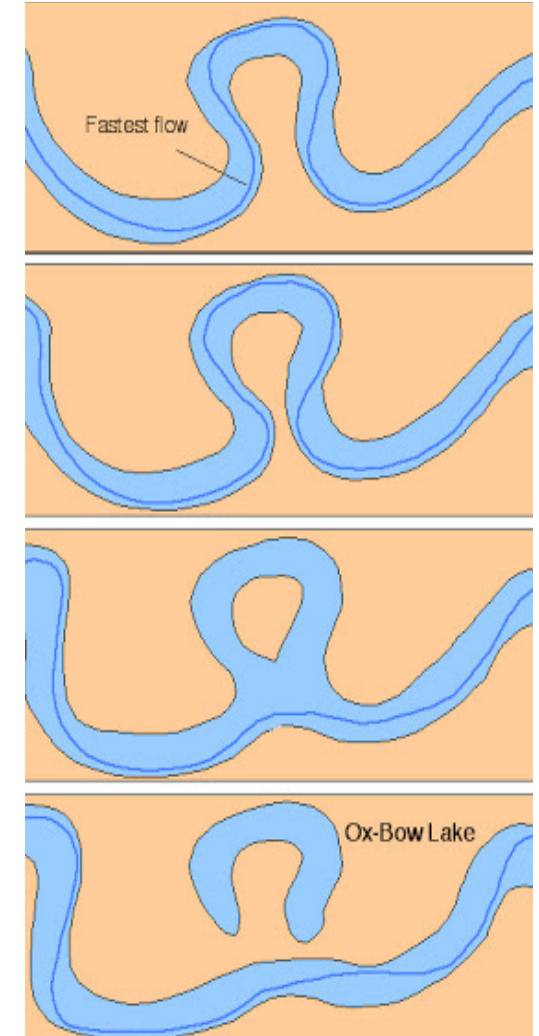
These are large bends that develop in the rivers middle and lower course

1. The **current (flow of water) is faster on the outside** of the bend because the river is deeper, so there is **less friction** to slow the water down
2. Therefore, more erosion takes place on the outside of the bend = forming steep sided **river cliffs**
3. The **current is slower on the inside** of the bend because the water is shallower, so there is **more friction** to slow the water down
4. Therefore, more deposition takes place on the inside of the bend = shallow gradient **slip-off slopes**



### **Oxbow Lakes:**

1. The outside of the meander is eroded more and more by abrasion and hydraulic action
2. The neck (land between 2 meanders), gets narrower and narrower
3. Eventually the river cuts across the neck, usually during a flood
4. The river always takes the shortest course, flowing across the neck and sealing off the loop
5. Finally, deposition occurs. This cuts off the meander completely and forms an oxbow lake

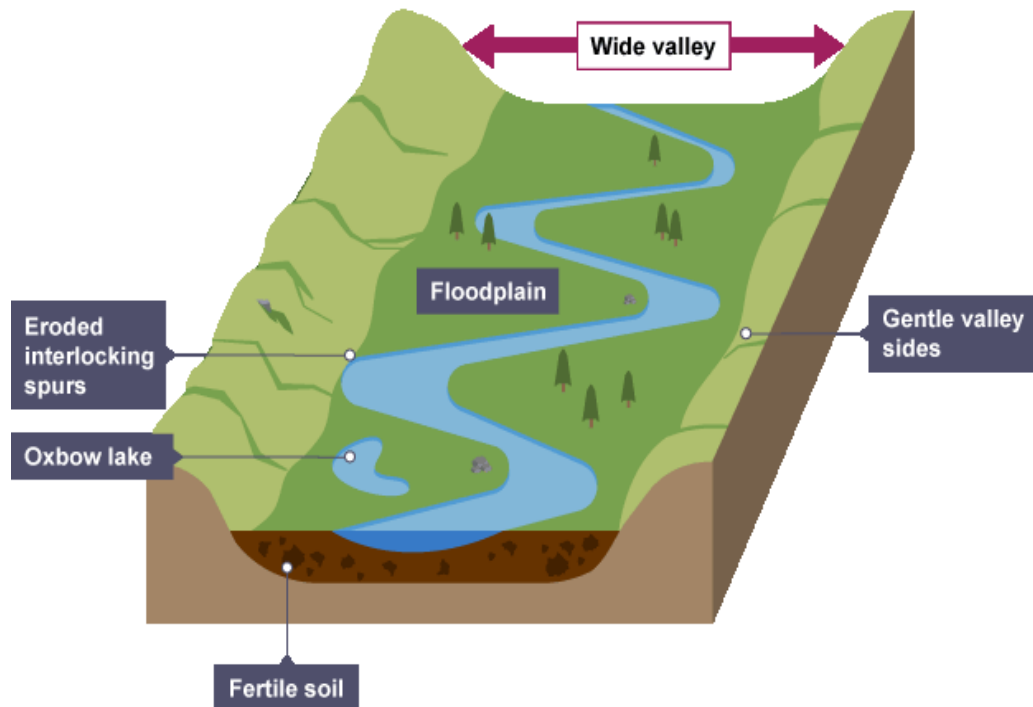


## Rivers: Landforms in the Lower Course

### Floodplains

This is the area of wide flat land either side of a river channel that is likely to flood

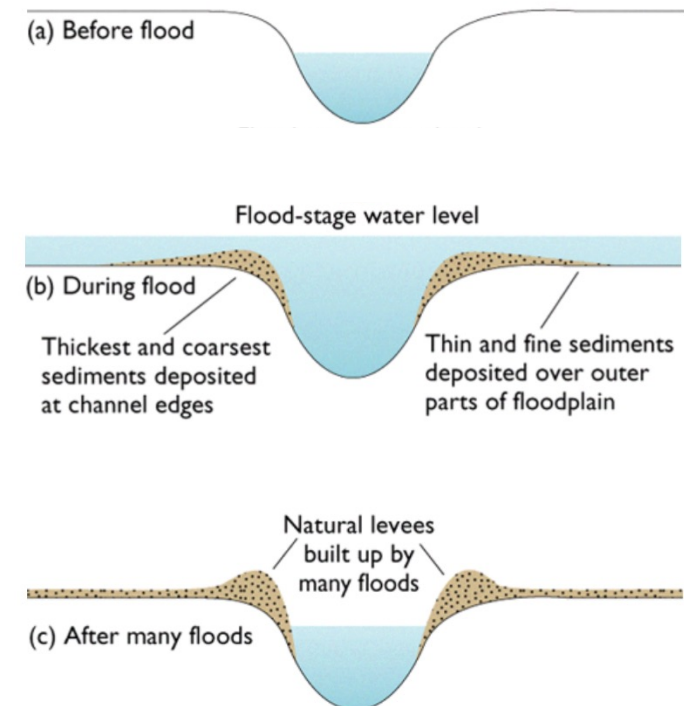
1. When a river floods onto a floodplain, the water slows down and deposits the eroded material it has been transporting
2. This deposition, builds up the floodplain making it higher
3. Meanders migrate (move) across the flood plain due to lateral erosion, making the floodplain wider and eroding away any interlocking spurs



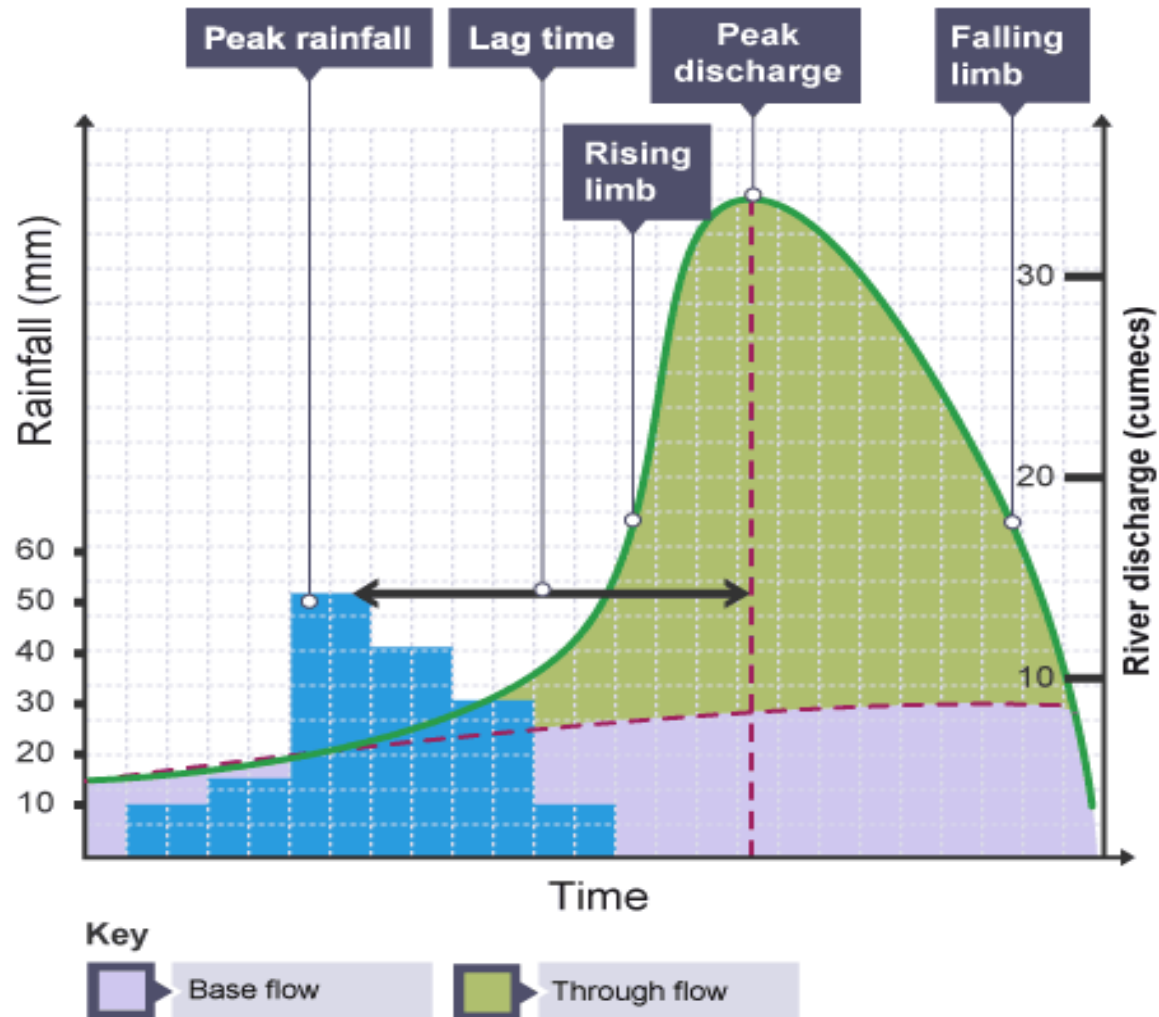
### Levees

Natural embankments (raised sections) along the edges of a river channel

1. During a flood, eroded material is deposited over the whole floodplain
2. Heaviest material is deposited closest to the river channel and the lightest material is deposited further away
3. Overtime deposited material builds up, forming levees



## Rivers: Discharge and Storm Hydrographs (1)



### Storm Hydrographs

Graphs which show the changes in river discharge (amount of water in a river), during a storm.

#### Key Terms:

##### Peak Discharge

Maximum amount of water held in the channel (cumecs)

##### Peak Rainfall

Maximum amount of rainfall (millimetres)

##### Lag time

The time taken between peak rainfall and peak discharge

##### Rising limb

Shows the increase in discharge on a hydrograph

##### Falling limb

Shows the return of discharge to normal/base flow on a hydrograph

##### Base flow

The normal discharge of the river

## Rivers: Discharge and Storm Hydrographs (2)

### River discharge is affected by different factors:

The more water that flows as surface runoff, the shorter the lag time will be.

Discharge will increase because more water is reaching the channel in less time.

### Factors influencing lag time and discharge:

#### Size of Drainage Basin

- Large basin will collect a lot of water so discharge increases, however lag time is decreased as the size means water takes longer to reach channel
- Small basin means decreased lag time

#### Vegetation Coverage

- Less vegetation = water flows quickly to channel as surface runoff
- More vegetation = more interception which increases lag time

#### Relief of the Land

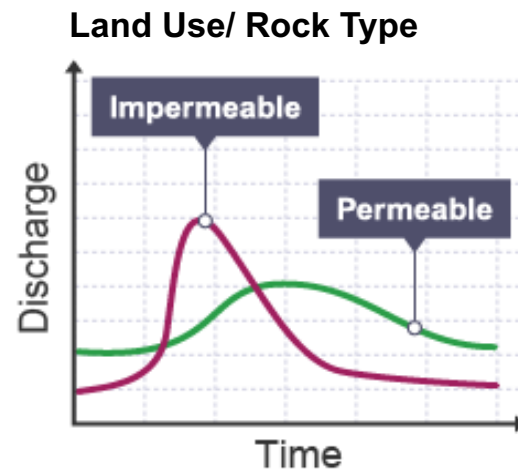
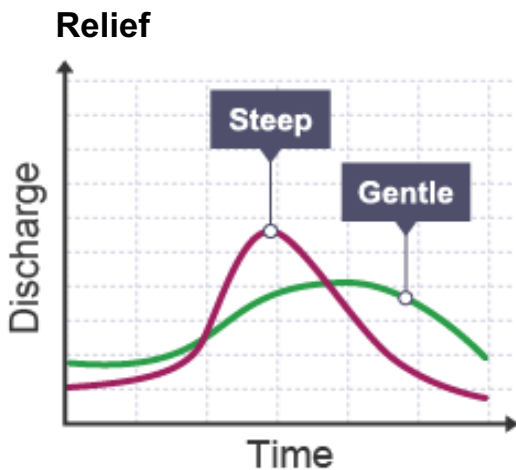
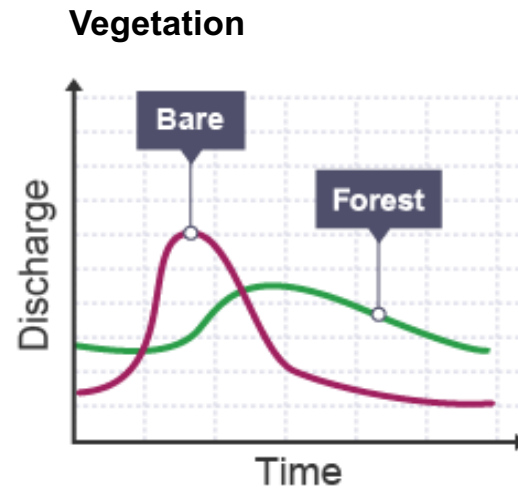
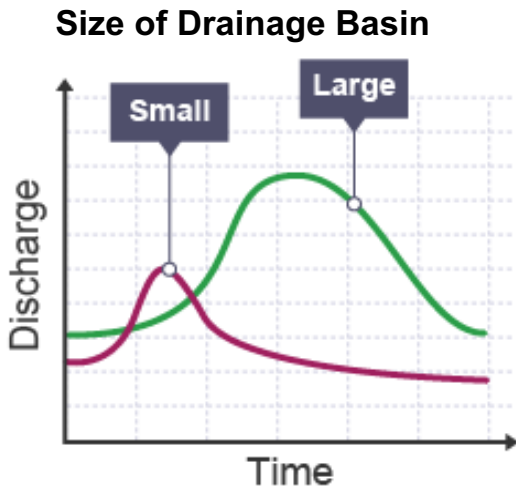
- More surface runoff occurs on steep slopes
- Lag time decreases as water reaches channel faster so discharge increases

#### Land Use and Rock Type

- Urban areas have drainage system/ covered in impermeable surfaces so surface runoff and throughflow increase = reduced lag time and increased discharge
- Impermeable rock types = more surface runoff, decreased lag time which increases discharge

#### Weather Conditions

- Hot, dry conditions and cold, freezing conditions both result in hard ground (this increases runoff which decreases lag time and increases discharge)
- Lots of rain in short, heavy periods will saturate the ground and cause more runoff which leads to shorter lag times and increased discharge



## Rivers: Flooding (Human Factors)

### Key Terms:

#### **Flooding**

When the discharge of a river increases so much that the level of a river gets high enough to spill over its banks.

#### **Saturated**

Holding as much water or moisture as can be absorbed



#### **Deforestation**

- Trees intercept precipitation, stopping it from reaching the ground
- Trees also take up water in their roots and store it
- Removing trees increases the volume of water that reaches the river channel, which increases the discharge and make flooding more likely



#### **Urban Areas**

- Buildings and infrastructure are made from impermeable materials
- Impermeable surfaces increase surface runoff
- Drainage systems take surface runoff directly to the river channel
- River discharge increases quickly which can lead to flooding



#### **Farming Practices**

- Tractors compact the soil making it harder for water to infiltrate = increases surface runoff to river channel
- Ploughing creates small channels in the soil which transport water directly to the river channel

## Rivers: Flooding (Physical Factors)



### **Prolonged and Heavy Rainfall**

- Long periods of heavy rainfall cause the soil to become saturated
- Any further rainfall can no longer infiltrate the soil, therefore surface runoff increases



### **Snowmelt**

- Large amounts of snow and ice melt means that large quantities of water enter the river channel in a very short space of time



### **Relief of the Land**

- If a river is in a steep sided valley, water will reach the river channel much faster because water flows more quickly down steeper slopes



### **Impermeable Rock Types**

- Impermeable rocks do not allow water to infiltrate them
- This increases surface runoff which means water will very quickly flow over land and into the river channel



### **Multiple Tributaries in one Area**

- Many smaller rivers joining a larger river in the same area means there is a large volume of water being added to the main river channel in a short space of time
- This rapidly increases the discharge and makes flooding very likely

## Rivers: River Management- Hard Engineering Strategies (1)

### Advantages:

1. Produces hydro-electric power
2. Water supply
3. Reservoir attracts tourists

### Dams and Reservoirs

Huge concrete walls which trap water behind it forming an artificial lake

### Disadvantages:

1. Very expensive
2. Areas near the reservoir may flood
3. Maintenance costs
4. Visual eyesore

1. Water moves out of an area more quickly, so flood risk decreases

### Channel Straightening

Removing meanders to straighten the river channel

1. Flooding more likely downstream
2. Faster flowing water = more erosion

1. More water can be held in the channel, less likely to flood

### Dredging

Removing sediment from riverbed to make the channel deeper

1. Needs to be done frequently to be effective (timely and expensive)

## Rivers: River Management- Hard Engineering Strategies (2)

### Advantages:

1. Relatively cheap to build
2. Floodwater is contained in river

**Embankments**  
Raising river banks so channel can hold more water

### Disadvantages:

1. Looks unnatural
2. Limit access to the river
3. Floodwaters can still breach the walls

1. Removes excess water from river channel, so flood risk decreases

**Flood Relief Channels**  
Floodwater flows into a relief channel and is taken to a different area

1. Expensive to build
2. If water levels still rise, the relief channel may also flood



## Rivers: River Management- Soft Engineering Strategies

### Advantages:

1. People have time to protect homes
2. Many possessions can be saved

**Flood Warnings**  
Environmental agency will monitor rivers and issue warning via media

### Disadvantages:

1. They don't stop floods happening
2. Not everyone will receive warnings

1. Impact of flooding is reduced
2. People will be less worried

**Preparation**  
Builds are modified and evacuation plans are created

1. Doesn't guarantee safety from flood
2. False sense of security

1. Less damage caused= fewer insurance claims
2. Key buildings are protected

**Floodplain Zoning**  
Restricting what can be built on floodplains, so to protect important buildings

1. Flood risk and impacts are not reduced
2. Flood will cause a lot of damage

1. Eroded material deposited on the land during a flood makes the land more fertile

**'Do Nothing'**  
Flooding is a natural process so no money is spent on river management

1. Flood risk and impacts are not reduced
2. Flood will cause a lot of damage

## **Rivers: Boscastle (Flash Flooding Case-Study)**

**Location:** Boscastle, North Cornwall, UK

**Date:** 16<sup>th</sup> August 2004

### **Causes:**

#### **Very Heavy Rainfall**

- A months worth of rain fell in just 2hrs
- Previous rainfall meant soil was already saturated, increasing surface runoff, throughflow and groundwater flow

#### **Impermeable Rock Types**

- Slate rock is impermeable
- Water flows across land as surface runoff, reaching river channel quicker = rapidly increases discharge

#### **Steep Sided Valleys**

- All 3 rivers flow through steep-sided valleys meaning water reached their channels very quickly from high land
- Small drainage basin = short lag time

#### **Three Rivers**

- The Valency, the Jordan and the Paradise all converge in close proximity to Boscastle
- Surplus of water from all 3 rivers meeting rapidly increased river discharge

### **Effects:**

- 84 cars were swept out to sea
- Bridges were destroyed and swept away
- 100 people rescued and evacuated by helicopter
- 58 properties flooded
- 6 buildings completely destroyed, including the visitors centre
- Village did not reopen to residents or visitors for 8 months, which meant a complete loss of business and tourism
- Damage to buildings, infrastructure and services cost the council £2million

### **Responses:**

**The Environmental Agency invested £10million into several flood defences, such as:**

- Widening and deepening the river channel- increased the rivers water carrying capacity
- Replaced low narrow bridges with taller wider bridges to allow large amounts of water to flow freely underneath (in the 2004 flood, vegetation and debris became blocked, creating a dam effect)
- Raised the level of the carpark and used a permeable surface so cars are above the flood risk level
- Tree management- dead trees removed and land owners encouraged to plant new trees and plants (increase interception)
- Flood defence walls built to protect homes and buildings

# 2.3 Weather and Climate

## GCSE Weather and Climate: Introduction

Key Term	Definition
<b>Weather</b>	The short term weather conditions of a place.
<b>Climate</b>	The average weather conditions over a long period of time (30 years)
<b>Atmosphere</b>	The layer of gases that surrounds the Earth
<b>Evaporation</b>	The process of turning from liquid into vapour (gas)
<b>Condensation</b>	The process of turning from vapour (gas) to a liquid
<b>Precipitation</b>	The collective term for 'water falling from clouds'. Can be: rain, sleet, hail or snow

### What Causes Weather?

1. The sun heats the Earth- **unevenly**
2. Earth also warms the air.  
Rising air leads to wind, because air from areas of high pressure rushes in to replace it
3. The sun's heat causes water to evaporate, giving us water vapour
4. Rising air cools.  
The water vapour condenses giving us clouds of water droplets
5. Droplets join to make larger drops, eventually falling as precipitation

---

### The 3 Types of Rainfall

#### Convection Rainfall

- Air rises in currents because the ground heats it (convection currents)
- Warm air cools and condenses. Clouds form and it rains

#### Frontal Rainfall

- Occurs where a warm air mass meets a cold air mass
- The warm air mass slides up over the colder air mass
- The warm rising air cools and condenses. Clouds form and it rains

#### Relief Rainfall

- When wind meets a line of hills the air is forced up, over the hills
- The rising air cools and condenses. Clouds form and it rains
- Rain falls on the windward side (side facing wind) but the leeward side (sheltered side) stays dry

## GCSE Weather and Climate: Air Masses

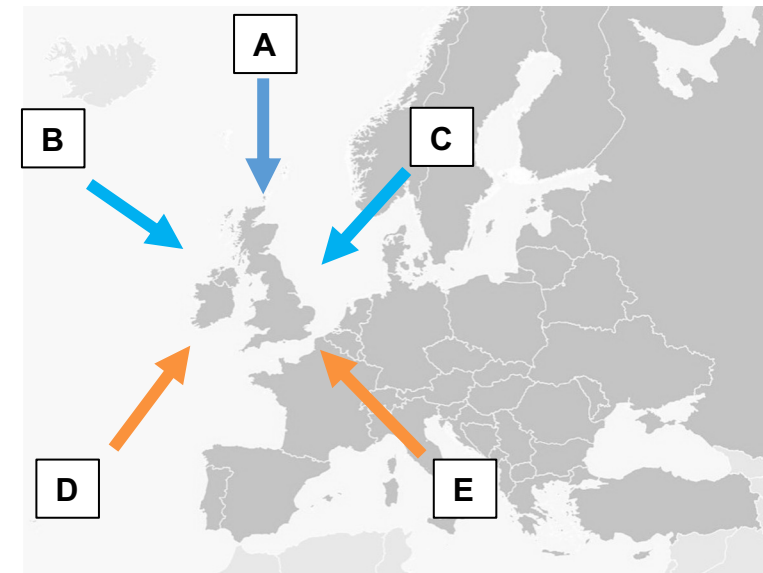
Key Term	Definition
<b>Air Pressure</b>	The force pressing down on us, due to the weight of the atmosphere. (Wind always blows from <b>high to low</b> pressure areas)
<b>Low Pressure</b>	Warm air rising causes low pressure.
<b>High Pressure</b>	Cool air sinking causes high pressure.
<b>Air Mass</b>	Huge blocks of air that create distinctive weather conditions across the globe.
<b>Source Region</b>	A large area of the Earth's surface where air masses remain for some time, to acquire temperature and moisture characteristics

### Air masses are classified according to:

- 1) Latitude-** in which they originate which determines their temperature –
  - Arctic
  - Polar
  - Tropical
- 2) Moisture-** nature of the surface over which they develop which affects moisture content –
  - Maritime (wet)
  - Continental (dry)

### Air Masses and the UK

- A) Arctic Maritime – Very cold and moist
- B) Polar Maritime- Cold and moist
- C) Polar Continental- Cold and dry
- D) Tropical Maritime- Warm and humid
- E) Tropical Continental- Warm and dry



## GCSE Weather and Climate: Factors Affecting Temperature

The Factor	How does it affect temperature?
<b>Altitude</b>	<ul style="list-style-type: none"><li>• This refers to height above sea level</li><li>• Temperature <b>decreases</b> as altitude <b>increases</b></li><li>• For every 100m increase in height, temperature drop by 1°C</li></ul>
<b>Latitude</b>	<ul style="list-style-type: none"><li>• This refers to the distance north and south of the equator</li><li>• Sun's rays are more <b>concentrated</b> at the <b>equator</b> = <b>hotter</b> temperature</li><li>• Sun's rays are more <b>dispersed</b> at the <b>poles</b> = <b>cooler</b> temperature</li></ul>
<b>Distance from the Sea</b>	<ul style="list-style-type: none"><li>• Oceans heat up and cool down more <b>slowly</b> than the land</li><li>• Coastal locations tend to be <b>cooler in the summer</b></li><li>• Coastal locations tend to be <b>warmer in the winter</b></li></ul>
<b>Ocean Currents</b>	<ul style="list-style-type: none"><li>• The effects of temperature from ocean currents depends if the current is hot or cold</li><li>• The <b>North Atlantic Drift</b> warms the west coast of the UK in winter by warming the wind</li></ul>
<b>Prevailing Wind</b>	<ul style="list-style-type: none"><li>• The <b>dominant wind</b> direction in an area</li><li>• In the <b>UK</b>, prevailing wind comes from the <b>South West</b> (tropical maritime)</li><li>• This contributes to frequent rainfall</li></ul>

## The World's Climatic Zones

### Polar

- Very cold (-25°C to 9°C) and dry
- Higher latitudes

### Temperate

- Mild and wet (no extreme temperatures)
- Mild summers and cool winters

### Hot Desert (Arid)

- Very hot and very dry (little/no rainfall)
- Occurs at areas of high pressure

### Tropical

- Hot and wet all year round
- Occurs along the equator (area of low pressure)

### Mediterranean

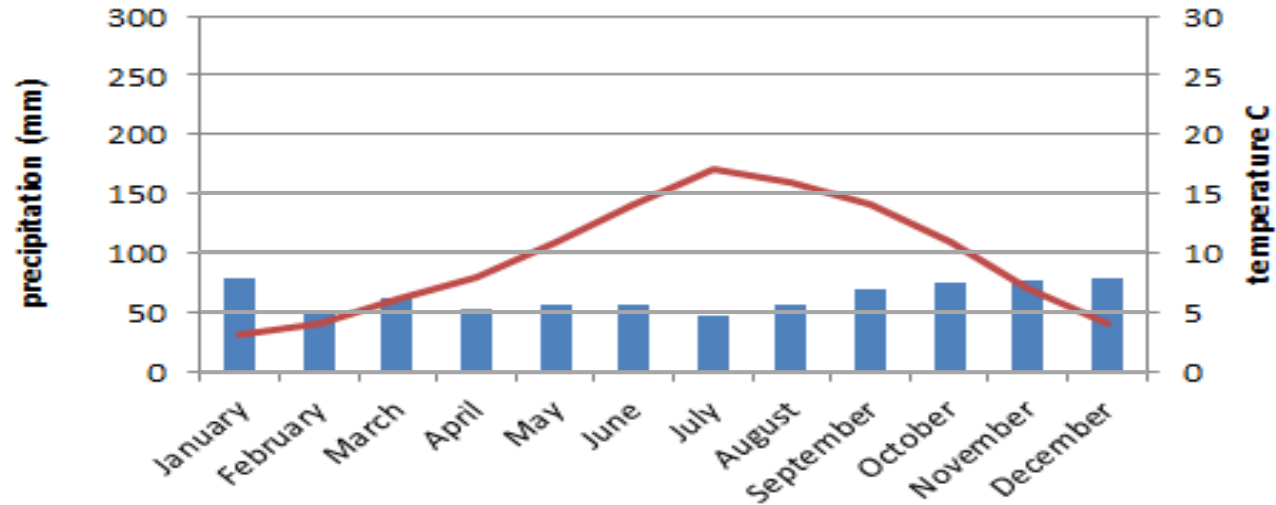
- Hot dry summers and mild winters

### Mountainous

- Can be found at many different latitudes
- Cold all year round due to altitude

## GCSE Weather and Climate: Climate Graphs

Climate Graph for London



Data table of information

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Average Temp (°C)	3°C	4°C	6°C	8°C	11°C	14°C	17°C	15°C	14°C	11°C	6°C	4°C
Average Rainfall (mm)	81 mm	50 mm	61 mm	52 mm	54 mm	54 mm	47 mm	54 mm	72 mm	78 mm	78 mm	80 mm

### Key Terms

#### Climate Graph

A climate graph displays yearly temperature and precipitation for a location

#### How to plot a Climate Graph

1. There are two 'Y axis' (rainfall, mm) and (temperature, °C)
2. The 'X axis' is the months of the year
3. Data information is given in a table
4. Rainfall (mm) is plotted as a bar graph
5. Temperature (°C) is plotted as a line graph

## GCSE Weather and Climate: Depressions and Anticyclones

### Low pressure systems = Depressions

Isobar numbers decrease as you move towards the centre of a depression

Winds blow from high to low pressure, therefore...

...winds blow inwards and anticlockwise around a depression

#### Key Terms:

##### Isobars

Lines on a weather map that join places that have the same atmospheric pressure

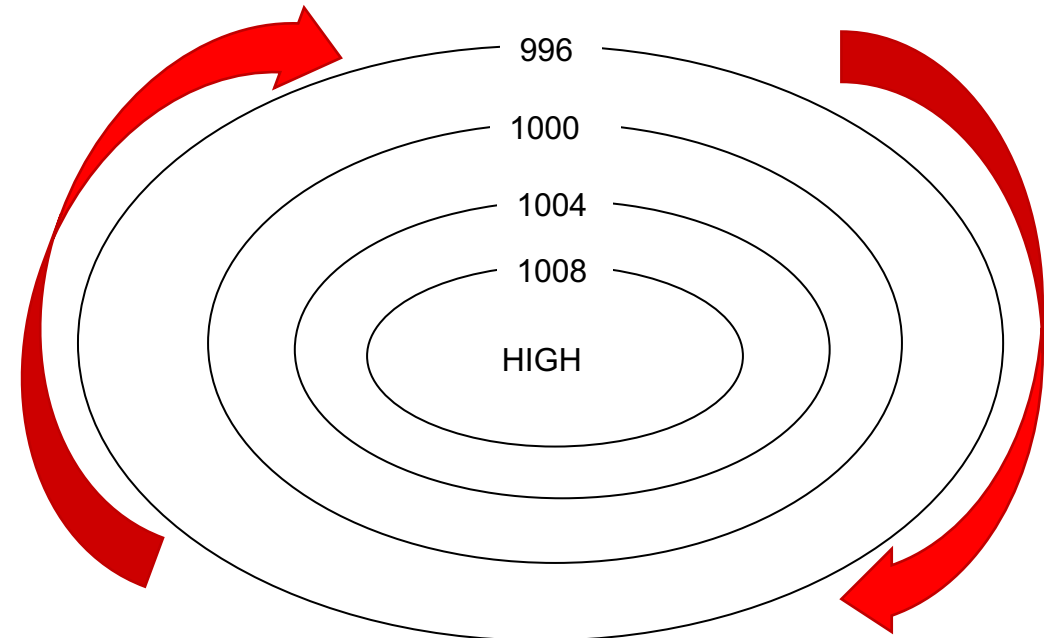
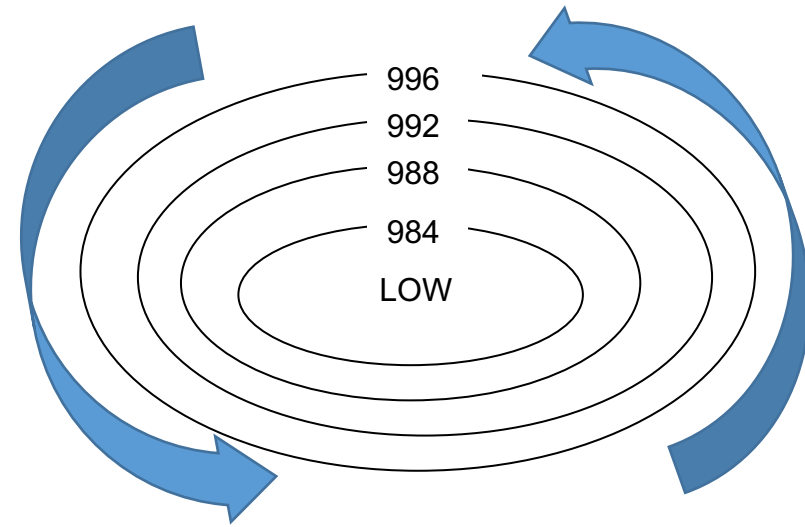
- The closer together the bars = stronger winds
- The further apart the bars = gentler winds

### High pressure systems = Anticyclones

Isobar numbers increase as you move towards the centre of an anticyclone

Winds blow from high to low pressure, therefore...

...winds blow outwards and clockwise around an anticyclone





## GCSE Weather and Climate: Cold Front, Warm Sector, Warm Front

1. When two air masses of different temperature meet; they do not mix well
2. This causes friction which causes the air to swirl
3. The boundary of the cold sector is called a 'cold front'
4. The boundary of the warm sector is called a 'warm front'



### Key Terms:

#### Front

The leading edge of an air mass

#### Cumulonimbus Clouds

Dense, vertically developed fluffy clouds with a flat base that tower to great heights. Formed by very fast rising air.

#### Cumulus Clouds

Fluffy clouds formed by fast rising, warm air

#### Stratus Clouds

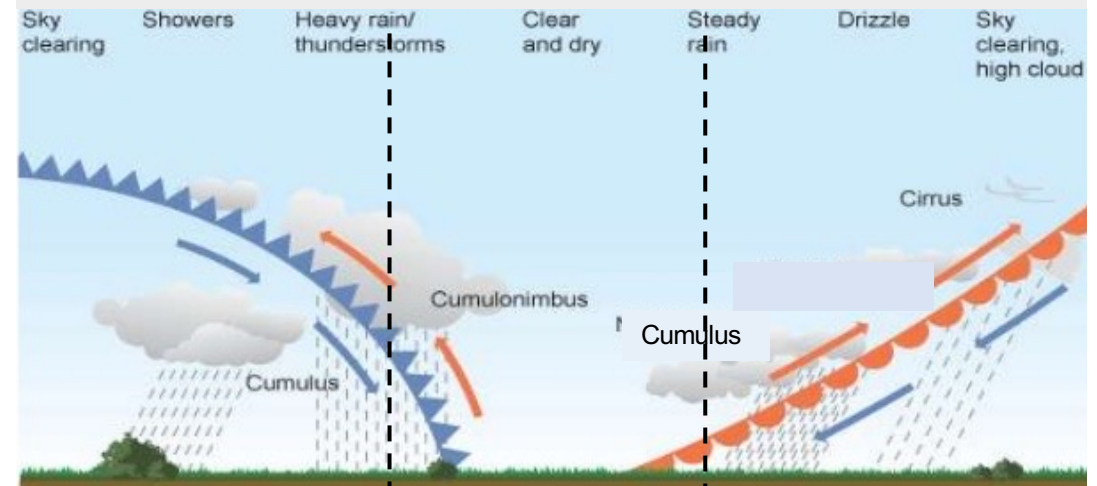
Blankets of dull cloud, formed by air rising more slowly

#### Cirrus Clouds

Thin, wispy clouds that form high in the atmosphere

### Cold Front → Warm Sector → Warm Front

- | Cold Front  | Warm Sector   | Warm Front   |
|---|---|--|
| 1. Cold air moves faster than warm air                          | 1. Warm moist air is forced to rise over cooler air | 1. Warm air rises over cooler air                      |
| 2. Cold air undercuts the warm air, forcing warm air to rise up | 2. Condensation occurs and stratus clouds form      | 2. Warm air cools and condenses to form cumulus clouds |
| 3. Very fast rising air condenses to form cumulonimbus clouds   | 3. Sky is grey and overcast                         | 3. Cirrus clouds lead the approaching warm front       |
|   | 4. Showers are common                               |  |



## GCSE Weather and Climate: Global Atmospheric Circulation (1)

<b>Key Term</b>	<b>Definition</b>
<b>Insolation</b>	The amount of solar radiation reaching a given area
<b>Solstice</b>	Is the point during the Earth's orbit around the sun at which the sun is at its greatest distance from the equator
<b>Equinox</b>	Is the point during the Earth's orbit around the sun at which the sun is the closest distance from the equator (12hr days and 12hr nights)
<b>Coriolis Effect</b>	The effect of the Earth's turning on the direction of the wind, which is (to the right in the northern hemisphere) and (to the left in the southern hemisphere)
<b>Trade Winds</b>	Surface winds that blow from the poles towards the equator
<b>Westerlies</b>	Surface winds that blow from the equator towards the poles
<b>Jet Stream</b>	Ribbons of very strong winds high in the atmosphere that can move weather systems around the world.
<b>Tropopause</b>	Is the upper boundary of the troposphere

## GCSE Weather and Climate: Global Atmospheric Circulation (2)

### Hadley Cell

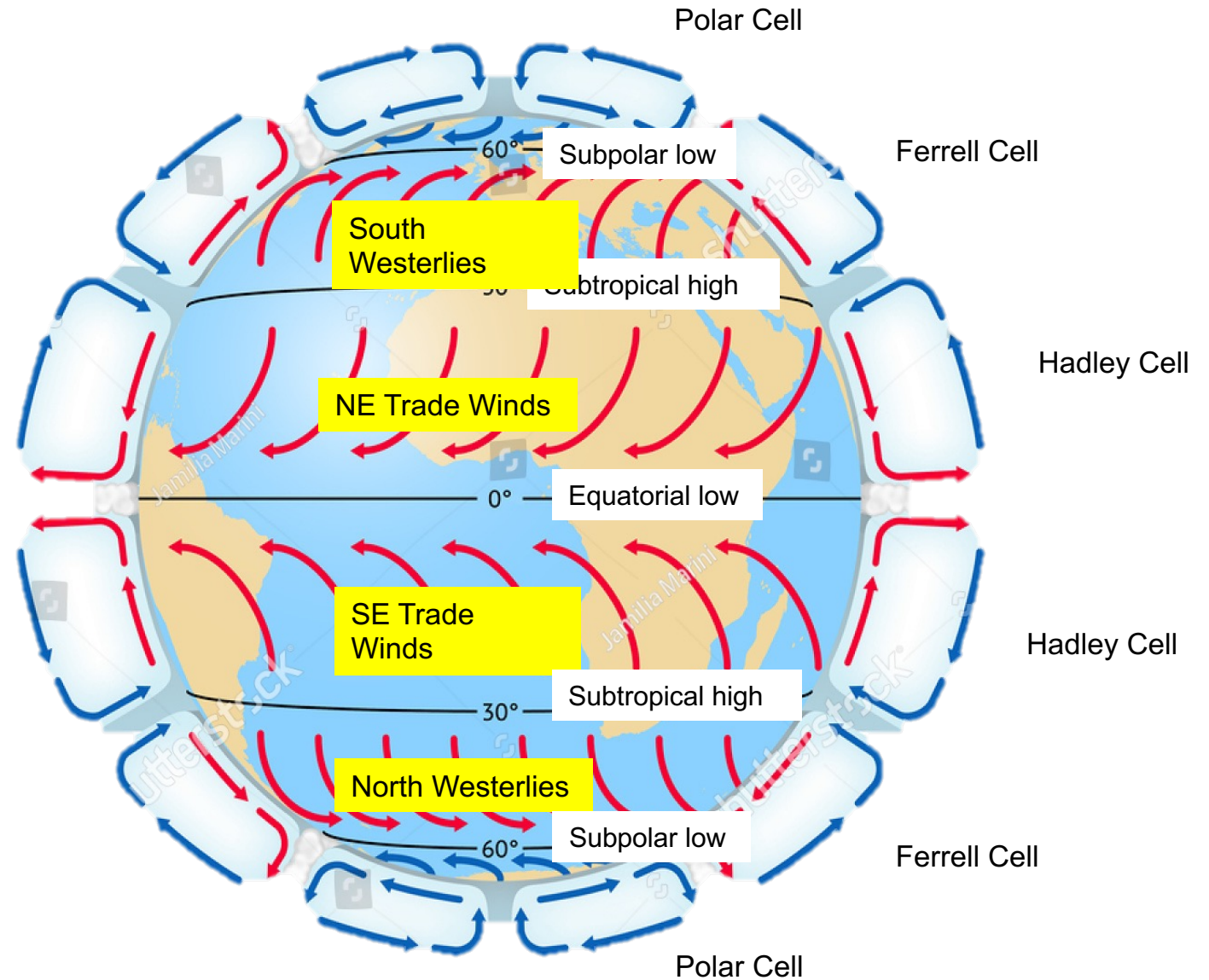
- At the equator the ground is heated intensely by the sun
- Warm air rises to the tropopause (low pressure) and cools
- Cool air sinks at 30°N and 30°S (high pressure)
- Trade winds then blow back towards the equator and the cell repeats

### Ferrell Cell

- Occurs between 30° and 60°
- Westerlies pull air across Earth's surface towards the poles
- At 60° the warmer air rises (low pressure) before cooling, sinking and repeating

### Polar Cell

- At the poles (90°) cold air sinks (high pressure)
- Trade winds blow air back towards 60° where it warms and rises (low pressure)
- The cell repeats



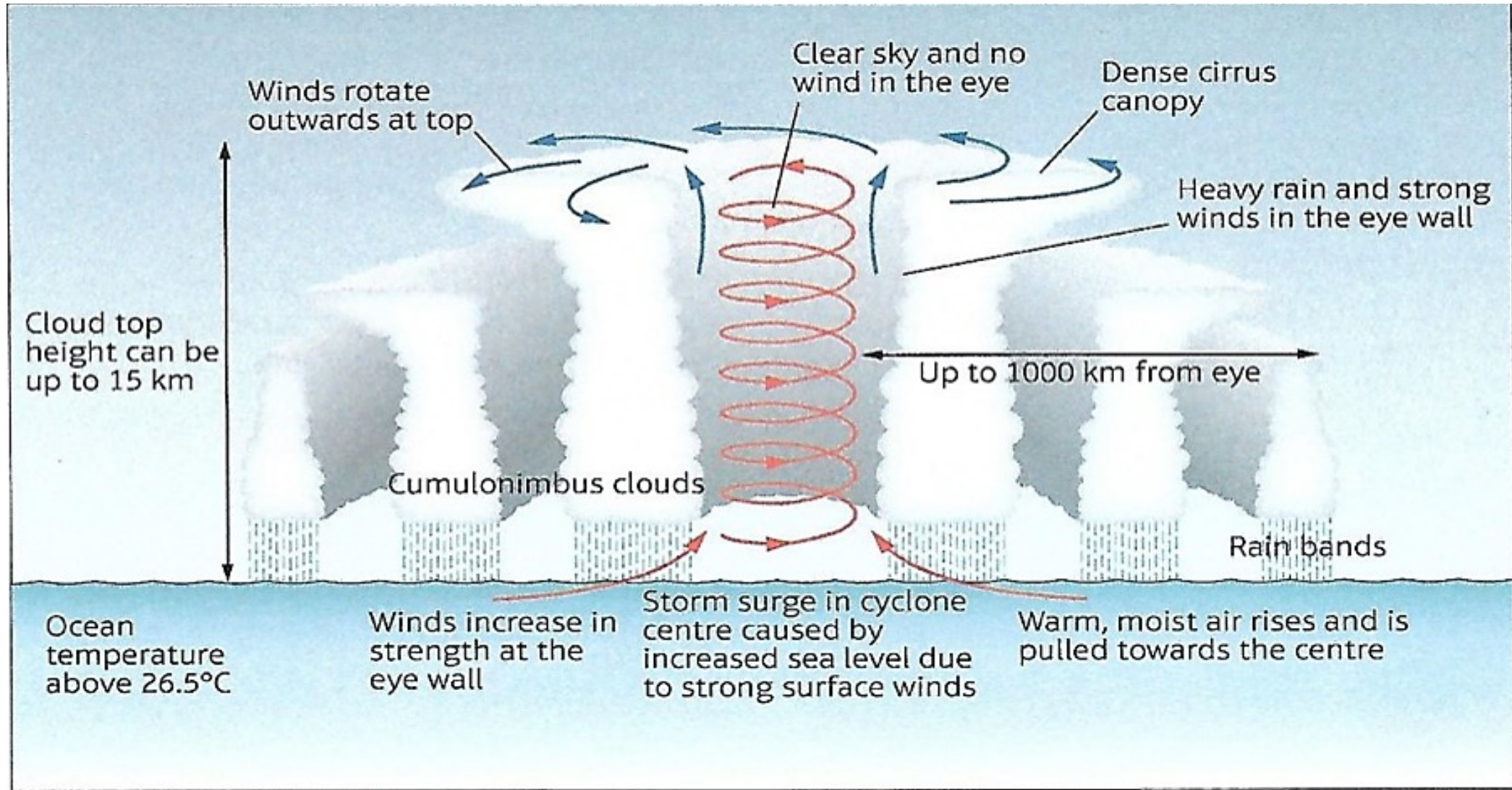
## GCSE Weather and Climate: Tropical Storms

### Requirements for Tropical Storms Formation:

1. Found between 5° and 15° either side of the equator
2. Ocean temperatures need to be above 27°C
3. Oceans need to be at least 60m in depth
4. Tropical storms move away from the equator and travel from East to West
5. Affect coastal areas but are not found inland

Key Term	Definition
<b>Global Atmospheric Circulation</b>	The worldwide circulation system of winds, which redistributes heat from the equator to the poles
<b>Tropical Storm</b>	An area of low pressure with strong winds spiralling around a calm central point (eye). Can be called: Hurricane, Cyclone, Typhoon
<b>Planning</b>	Actions taken to enable communities to respond to and recover from natural disasters
<b>Prediction</b>	Attempts to forecast when and where a tropical storm will strike
<b>Monitoring</b>	Tracking the path of a tropical storm using satellite, to help forecast when and where it will strike
<b>Protection</b>	Actions taken before a hazard strikes to reduce its impacts e.g. building design

## GCSE Weather and Climate: Formation of Tropical Storms



## GCSE Weather and Climate: Typhoon Haiyan (Case-Study)

**Location:** Philippines

**Date:** 3<sup>rd</sup> November- 11<sup>th</sup> November 2013

**Information:** Wind speed 170mph // Storm surge 15m

**Damage Cost:** \$2.98 billion (USD)

### Primary Effects

- 6300 killed (mainly drowned)
- 90% of Tacloban City destroyed
- Airport badly damaged
- Strong winds destroyed power lines
- Crops uprooted and flooded
- Widespread flooding caused by 400mm of rainfall

### Secondary Effects

- 1.9 million left homeless
- 6 million lost their source of income
- Landslides blocked roads, sabotaging rescue attempts
- Travel services disrupted for weeks
- Crime and violence broke out in Tacloban City

### Immediate Responses

- International government aid responded quickly with: food, water and temporary shelter
- US aircraft and helicopters assisted with search and rescue
- UK government sent shelter kits
- Field hospitals set up by the French

### Long-Term Responses

- UN donated financial aid to help with the rebuilding
- Cash for work programmes- people paid to help clear debris and rebuild city
- Rice farming and fishing quickly re-established
- Homes rebuilt on higher ground, away from flood risk areas

## GCSE Weather and Climate: Californian Drought (Case-Study)

**Location:** California, USA

**Date:** 2011- August 2015

Key Term	Definition
<b>Drought</b>	A prolonged period of no rainfall.
<b>Desertification</b>	The process of fertile land becoming a desert.
<b>Irrigate</b>	To supply water to land or crops to help growth.
<b>Soil Erosion</b>	The removal of the upper layer of soil, resulting in loss of soil nutrients.
<b>Consolidated/ Compacted</b>	Soil density increases when it is compressed. Plant roots help to give structure to soil.
<b>Vegetation</b>	A collective of plants found in a given area.

- Causes of the Drought**
- Winter rainfalls from 2011- 2015 were lower than usual
  - Drought and dry vegetation burns easily in the hot summer months
  - Jet stream position- dry air mass remained above California for a long time
  - Local residents depleting groundwater stores

- Effects of the Drought**
- Hydroelectric dams stopped producing electricity
  - Subsidence- fall in the level of the land causes damage to buildings and infrastructure
  - Food shortages meant that fruit and veg prices increased in the USA by 6%
  - 36% increase in wildfires
  - 17,100 farming jobs lost

- Responses to the Drought**
- Water restrictions and hose pipe bans
  - State government paid \$687m to compensate farmers and homeowners
  - Large scale desalination (cost \$1bn) to bring safe water to 300,000 people
  - Drought resistant crops

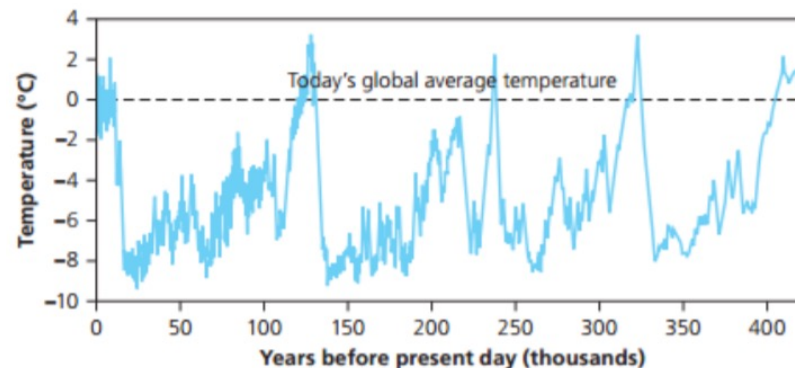
# 2.4 Climate Change



## GCSE: Climate Change and Global Warming

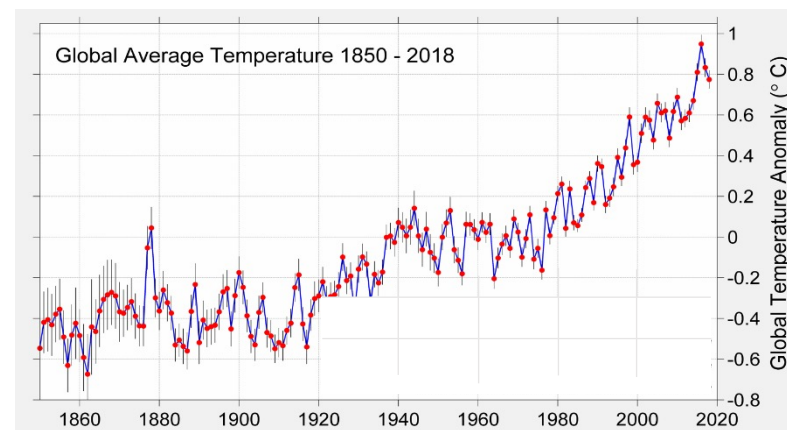
Key Term	Definition
<b>Climate</b>	The average weather conditions over a long period of time
<b>Climate Change</b>	A change in global or regional climate patterns
<b>Atmosphere</b>	The layer of gases that surrounds the earth
<b>Global Warming</b>	The gradual increase in the overall temperature of the earth's atmosphere
<b>Fossil Fuels</b>	A natural fuel such as coal or gas formed from the remains of organisms that lived long ago
<b>Greenhouse Gases</b>	Gases in the air that trap energy from the sun e.g. carbon dioxide, methane and nitrous oxide
<b>Greenhouse Effect</b>	Warming of the earth caused by the trapping of the sun's energy by greenhouse gases
<b>Quaternary Period</b>	The period of geological time from about 2.6 million years ago to the present day

## Long Term Climate Change



- Temperatures have fluctuated (gone up and down) during this time.
- It shows glacial periods (lows) and inter-glacial periods (peaks).

## Recent Global Warming



- Since 1860 the global temperature has increased rapidly
- The 20 warmest years on record have all come since 1995

## GCSE: Evidence of Climate Change

### Ice and Sediment Cores



- Ice sheets are made up of layers of ice – one layer is formed each year
- Scientists drill into ice sheets to get long **cores of ice**
- By analyzing the gases trapped in the layers of ice, they can tell what the temperature was each year
- The ice core below Antarctica shows the temperature change over the past 400,000 years

### Temperature Records

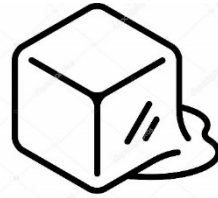


- Since the 1850's, global temperatures have been measured accurately using thermometers
- This gives a reliable but **short-term** record of temperature change
- Historical records like harvest dates or newspaper weather reports can extend the record of climate change further back

### Tree Rings



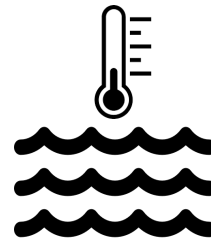
- As a tree grows it forms a new ring each year
- The tree rings are **thicker in warm, wet conditions**
- Scientists take cores and count the rings to find the age of the tree. The thickness of each ring shows what the climate is like
- Tree rings are a reliable source of evidence for climate change for the past **10,000 years**



### Retreating Ice Sheets

- There are 2 ice sheets remaining in the world today (one covering Greenland and the other Antarctica)
- Together these ice sheets account for 90% of the world's freshwater ice
- The world's glaciers are melting and **decreasing in size**
- Due to increasing temperatures, the ice sheets are decreasing, and huge amounts of fresh water are dumped into the oceans, increasing the sea level

### Warming Ocean Temperatures



- Ocean temperatures are increasing
- Oceans absorb the extra heat being added to the atmosphere
- Water expands when it warms, known as **Thermal Expansion**
- This expansion leads to rising sea level and increased coastal flooding worldwide

### Changing Weather Patterns



- As land and sea temperatures increase, **greater evaporation rates** occur
- Increasing evaporation = increasing humidity in the atmosphere
- This humidity leads to an **increase in global rainfall**
- In the UK, summer rainfall is decreasing (leading to drought)
- In the UK, winter rainfall is increasing (leading to flooding)

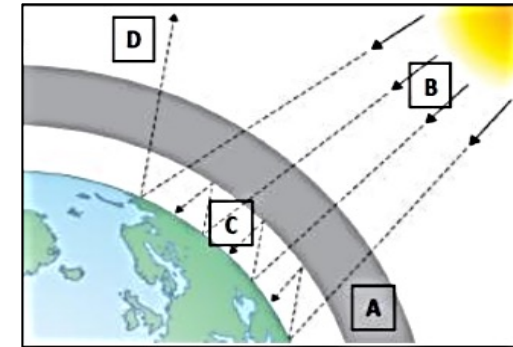
## GCSE: Causes of Climate Change

### Natural Causes of Climate Change

<b>Solar Output</b>	<ul style="list-style-type: none"><li>• Sunspots are dark patches that appear on the surface of the sun</li><li>• The more sunspots the greater the suns energy (warmer)</li><li>• The number of sunspots increase and decrease over a 11 year period</li></ul>
<b>Orbital Change</b>	<ul style="list-style-type: none"><li>• This is how the earth moves round the sun.</li><li>• It affects how close the earth is to the sun and therefore how much energy we get from the sun.</li><li>• When the earth is very close to the sun, it is warmer.</li><li>• When the earth is further away from the sun, it is cooler.</li></ul>
<b>Volcanic Activity</b>	<ul style="list-style-type: none"><li>• The ash and sulphur dioxide gas produced in large eruptions spreads around the world creating a blanket of ash</li><li>• This blanket of ash and gas will stop solar energy (sunlight) reaching the Earth</li><li>• Sunlight bounces off the sulphur and gas and is reflected back into space, cooling the planet and lowering the temperature</li></ul>

### Human Causes of Climate Change

- The greenhouse effect is a naturally occurring process
- However, human activity is causing more greenhouse gases to be produced
- This increase in greenhouse gases has caused a rapid increase in global temperature



- A. Humans produce greenhouse gases (CO<sub>2</sub>, methane, nitrous oxide) which create a blanket around the earth
- B. Sunlight travels to earth as shortwave radiation
- C. Sunlight is reflected off the Earth's surface as long-wave radiation. Some of this reflected sunlight is trapped in the Earth's atmosphere by the greenhouse gases = **Earth heats up**
- D. Some heat does manage to escape

## GCSE: Effects of Climate Change

### Social, Environmental and Economic Impacts of Climate Change

Social Effects	Environmental Effects	Economic Effects
<ul style="list-style-type: none"><li>• Diseases such as malaria would spread (mosquitos prefer hot climate)</li><li>• People who lose their homes to floods would be forced to migrate elsewhere</li><li>• Droughts would increase, causing severe water and food shortages</li><li>• Thousands of people would be left without clean water, causing diseases such as cholera</li><li>• A lack of clean water may lead to war or conflicts</li><li>• Deaths due to extremes in temperature</li></ul>	<ul style="list-style-type: none"><li>• Sea level rise due to melting ice sheets = flooding in low lying countries such as the Maldives</li><li>• Extreme weather (drought) causes land to dry and crops to die</li><li>• Prolonged drought will lead to desertification</li><li>• Extreme weather (tropical storms) become more frequent as ocean temperatures increase</li><li>• Habitats lost due to extreme weather = decrease in biodiversity</li></ul>	<ul style="list-style-type: none"><li>• Governments will forced to purchase and maintain flood defences on coasts and in coastal cities</li><li>• Failing crop yields due to climate and extreme weather will damage the economy</li><li>• Alpine ski resorts may close down due to lack of snow and ice</li><li>• Due to melting ice and sea level rise- ocean passages may become open for commercial shipping use</li></ul>

### Key Terms:

#### **Drought**

A long period without rainfall

#### **Desertification**

The process where fertile land becomes desert

#### **Migration**

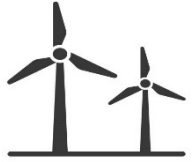
The movement of people or animals from one area to another

## GCSE: The Responses to Climate Change

### Managing Climate Change: Mitigation and Adaptation Key Terms

Key Term	Definition
<b>Mitigation</b>	The action of reducing the severity/seriousness of something
<b>Adaptation</b>	The process of change/ adjustment to climate change and its effects.
<b>Local</b>	Actions that can be taken within our homes and communities
<b>National</b>	Actions which are taken across an entire country, usually by a government
<b>International</b>	Actions which are taken by more than one country working together (global)

### Mitigation:



#### Renewable Energy Sources

- Energy sources that can quickly replenish themselves and can be used again and again
- 7 key types of renewable energy: solar, wind, tidal, thermal, hydroelectric power, biomass and nuclear.



#### Carbon Capture

- Scientists are developing ways to capture CO<sub>2</sub> from factories and safely store it underground so it can't go into the atmosphere.



#### Afforestation

- Deforestation contributes to global warming through the release of CO<sub>2</sub>
- Planting trees mitigates effects by removing CO<sub>2</sub> from the atmosphere
- Carbon is stored within trees until being returned back to the atmosphere through the natural process



#### International Agreements

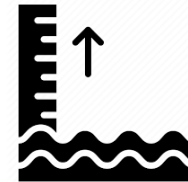
- **COP26** was the most recent climate meeting held in Glasgow, Scotland 2021
- COP26 is a **legally binding** international treaty, so pledges must be followed and carried out. COP26 agreed to
  1. **Reduce the usage of fossil fuels and invest in renewable energy sources**
  2. **Prevent global temperatures from warming by more than 1.5°C**
  3. **Help low-income countries become more environmentally friendly, by supporting them financially.**
  4. **Halt deforestation by 2030**
- However, many countries have **failed** to stick to past pledges, and there has been **no punishments** for this

### Adaptation:



#### Change in Agriculture

- Plant new crop types suitable to the new climate of an area (e.g. growing grapes in southern England)
- Technology can be used to create new crops that are more resistant to extreme weather
- Plant shade trees to protect seedlings and soil from strong sunlight



#### Coping with Rising Sea Levels

- Prepare for flooding by building flood defences (e.g. the Thames Barrier)
- For LIC's that cannot afford defences, people can build their homes on top of embankments or build raised flood shelters



#### Managing Water Supply

- Unreliable rainfall and periods of water shortage mean people need to use water resources more efficiently.
- Water meters can be installed in people's homes to discourage them from using lots of water
- Rainwater can be collected and waste water can be recycled to make more water available.

## Climate Change: Sea Level Rise

### Sea levels are rising due to Global Warming

- Global sea levels are rising at a rate of approx. 2mm per year
- Predictions estimate that by the year 2100, sea levels could have risen between 30cm-1m

#### Key Terms:

##### Global Warming

The gradual increase in the overall temperature of the Earth's atmosphere

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### Global Warming has two effects that causes Sea Levels to rise:

#### Melting Ice

- Increased temperatures melt glacial ice caps
- This melted ice water returns to the oceans
- This increases the volume of water in the oceans and causes the sea levels to rise

#### Thermal Expansion

- Increased global temperature causes oceans to get warmer
- Heated water particles expand
- This expansion increases the volume of water, causing sea levels to rise

Rising sea levels mean that low-lying parts of the world are at increased risk of coastal flooding.

**E.g.** Bangladesh and the Maldives

## GCSE Climate Change: The Maldives Case-Study

**Location:** The Maldives, Group of Islands in the Indian Ocean

**Number of Islands:** Approx. 1200- of which 200 are inhabited

**Average Island Height:** 80% of land is below 1m

**Population:** Approx. 440,000 people

**The Problem:** Due to rising sea levels, scientist predict The Maldives will be completely submerged within 50- 100 years

### Key Terms:

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#### **Submerged**

To be completely covered by the sea/ocean

#### **Desalination**

The expensive process of removing salt from sea water, making it drinkable

#### **Carbon Neutral**

Action to remove as much carbon dioxide from the atmosphere as each put into it

## The Impacts of Coastal Flooding on the Maldives

### **Economic**

1. Loss of tourism- largest industry in the Maldives. If main airport cannot operate then international tourism will be lost
2. Disrupt fishing industry- fish are the Maldives largest export. Coastal flooding may damage fish processing plants

### **Social**

1. Severe flooding causes housing damage, leaving whole communities homeless
2. Less fresh water available- saltwater contaminates freshwater supplies so locals have to rely on rainwater or build expensive desalination plants

### **Environmental**

1. Loss of beaches- flooding erodes beaches which destroys animal habitats
2. Loss of soil- soil on the island is shallow and easily washed away, leaving the land infertile so crops cannot grow

### **Political**

1. Maldivian government has asked the Japanese government to give them \$60 million to build the 3m high sea wall that protects the capital city, Malé
2. The Maldives has pledged to become carbon neutral so as not to contribute to global warming
3. Government is considering buying land in countries like India and Australia and moving Maldivians there (environmental refugees)



## GCSE: Climate Change in the UK (Case-Study)

### Why should the UK care about climate change?

- Sea levels around the UK coasts are rising by approx. 3mm per year  
Coastal areas are at increased significant risk of flooding
- Emerging evidence of changing rainfall patterns  
Drier summers leading to drought  
Wetter winters leading to more frequent and severe flooding
- In 2003, the UK and Europe experienced one of the most significant heat waves in recorded history (Kent, UK recorded a record temperature of 38.5°C)  
Over 2000+ people died in the UK alone
- Increase risk of vector-borne diseases  
Warmer temperatures will attract insects out of their native habitats and with them they will bring diseases such as:  
malaria, yellow fever and zika virus etc...
- In 2017, 37 out of 43 zones in the UK were considered to have illegal levels of air pollution (nitrogen dioxide), according to the European Commission
- London air pollution causes at least 4300 early deaths each year
- There are economic costs that the government will have to pay due to climate change. For example, building sea walls to prevent coastal flooding or paying our insurance claims.

### What is the UK doing to combat climate change?

- UK legislation: 2008 Climate Change Act commits government to cut national greenhouse gas emissions by at least 80% by 2050
- WWF UK campaigned to ensure that the UK government committed to end the use of coal in the UK by 2025 (the government have committed to this goal)
- The UK government has set a target of ending the sale of petrol and diesel cars by 2040
- Over one third of the UK's total energy now comes from renewable sources
- There are plans to make London the world's first ultra-low emission zone
- Promoting at home methods such as: turning off electrical appliances when not in use, recycling, insulating homes, not wasting water, using public transport, cycling or walking

# **3.1 How ecosystems function**



## How ecosystems function keywords

Keyword	Definition
<b>Ecosystem</b>	A community of plants and animals and the environment in which they live. Ecosystems include both living ( biotic ) and non-living ( abiotic ) parts.
<b>Biome</b>	Very large ecosystems
<b>Climate</b>	Long term weather pattern in a particular region.
<b>Semi-arid climate</b>	A climate of hot temperatures and rainfall for only half of the year
<b>Adapt / adaptation</b>	Adjust or change
<b>Transpiration</b>	Evaporation from leaves, trees and vegetation
<b>Photosynthesis</b>	The process of converting light energy from the sun into chemical energy
<b>Producer</b>	Plants that create chemical energy from the sun's light. Producers are at the bottom of the food chain.
<b>Primary consumers</b>	Animals that eat vegetation ( producers ) in the food chain. These are herbivores. These animals may be eaten by secondary consumers.
<b>Secondary consumers</b>	Animals that are higher up the food chain and that eat primary consumers

Keyword	Definition
<b>Tertiary consumer</b>	Tertiary consumers eat primary and secondary consumers as their main source of food.
<b>Decomposers</b>	An organism such as fungus, worms, slugs that breaks down ( decomposes ) dead animals.
<b>Xerophytic</b>	A type of plant that has adapted to survive in an environment with little water.
<b>Biomass</b>	The measure of all the plant or animal material in an area
<b>Leaf litter</b>	Leaves that have fallen to the ground and are decomposing
<b>Stakeholder</b>	A group of people who have an interest or concern in something

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## Global Biomes

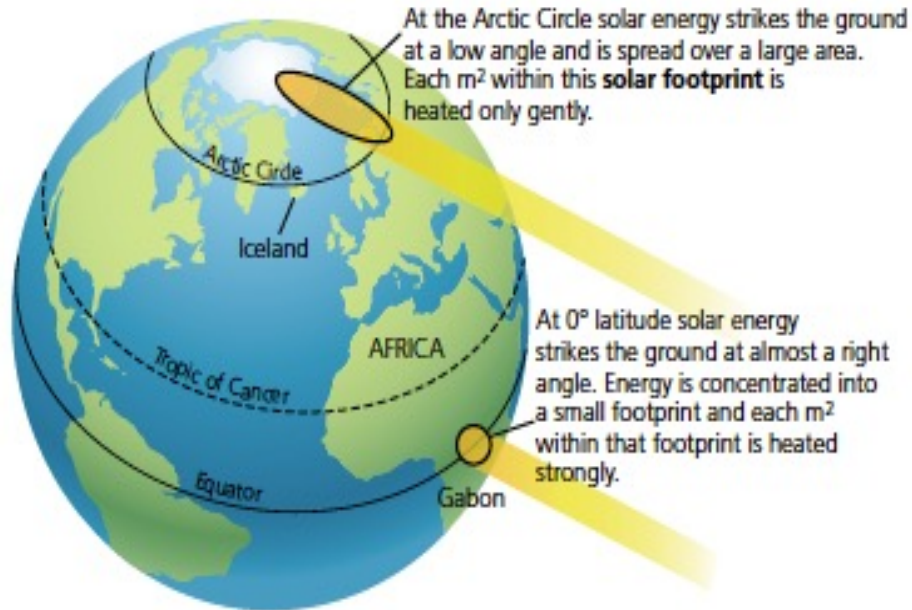


A **Biome** is a very large ecosystem



A **Ecosystem** is A community of plants and animals and the environment in which they live. Ecosystems include both living ( biotic ) and non-living ( abiotic ) parts.

The intensity of the sun's rays at the equator compared to the Poles creates differences in climate



Climate is such an important factor in influencing the natural vegetation and wildlife of a region that **biomes** broadly match the world's climate zones.

**Tropical rainforests** grow in a band around the Equator where the equatorial climate is hot and wet

The **Semi arid grassland** is found in places that have hot summers and mild or warm winters,

# Global Biomes

**Savannah:** a response to a summer wet season and winter dry season. For your exam, the savannah includes areas with a hot semi-arid climate

**Tropical rainforest:** a response to areas that are hot all year round and have no dry season. Monthly precipitation is at least 6 cm

**Temperate rainforest:** a response to areas having a mean annual temperature between 4 and 12 °C and an annual precipitation of over 140 cm

**Taiga:** a response to a sub-arctic climate. It has a long, very cold winter and a short, cool summer. Much precipitation is as snow

**Temperate deciduous forest:** a response to areas of warm, moist summers and mild winters

**Subtropical desert:** a response to temperatures that are hot all year and have too little precipitation to sustain life

**Tundra:** a response to very cold (average -28 °C), dark winters and cool (+12 °C) summers. The ground is permanently frozen in winter

**Mediterranean:** a response to hot, dry summers and wet, cool to warm winters

**Alpine:** a response to climatic change resulting from altitude. With increased height the vegetation will change from trees to grassland to shrubs

**Temperate grassland/desert:** a response to a warm to hot summer and a cold, often freezing winter. Precipitation ranges from semi-arid to semi-humid

**Key**

 Savannah	 Temperate rainforest	 Taiga	 Subtropical desert	 Alpine
 Tropical rainforest	 Temperate deciduous forest	 Temperate grassland/desert	 Mediterranean	 Tundra



# **Biome 1 : The Tropical Rainforest**

## Equatorial climate

Tropical rainforests are located in a band around the equator (Zero degrees latitude), mostly in the area between the Tropic of Cancer and the Tropic of Capricorn.

They are generally found in the West of continents, notably the Congo Basin in Africa, the Amazon in South America and also in Malaysia.

The equatorial climate is hot and wet all year,.

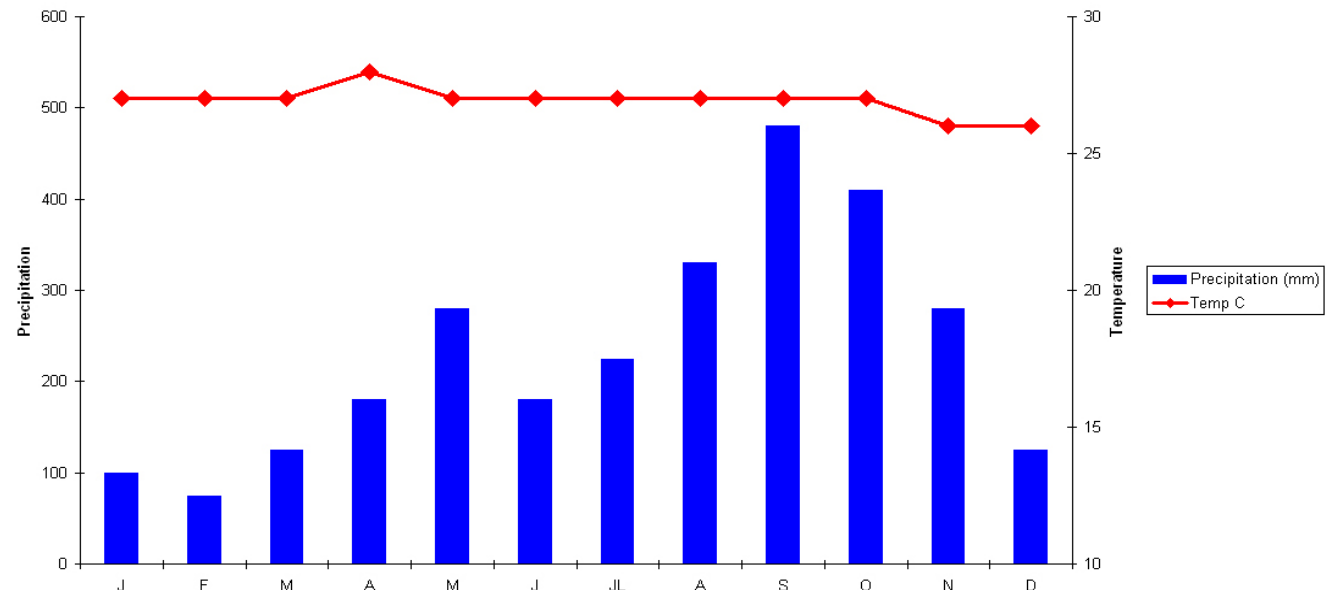
Temperatures are constant at 28°C, with very little variation.

Rainfall is also constant , with between 1500 mm and 2000 mm of rainfall a year. The rainfall is created by the heat creating massive zones of **low pressure**

Any vegetation living in this Biome will have to **adapt** ( *adapt means to adjust or change* ) to this lack of rainfall for half of the year .

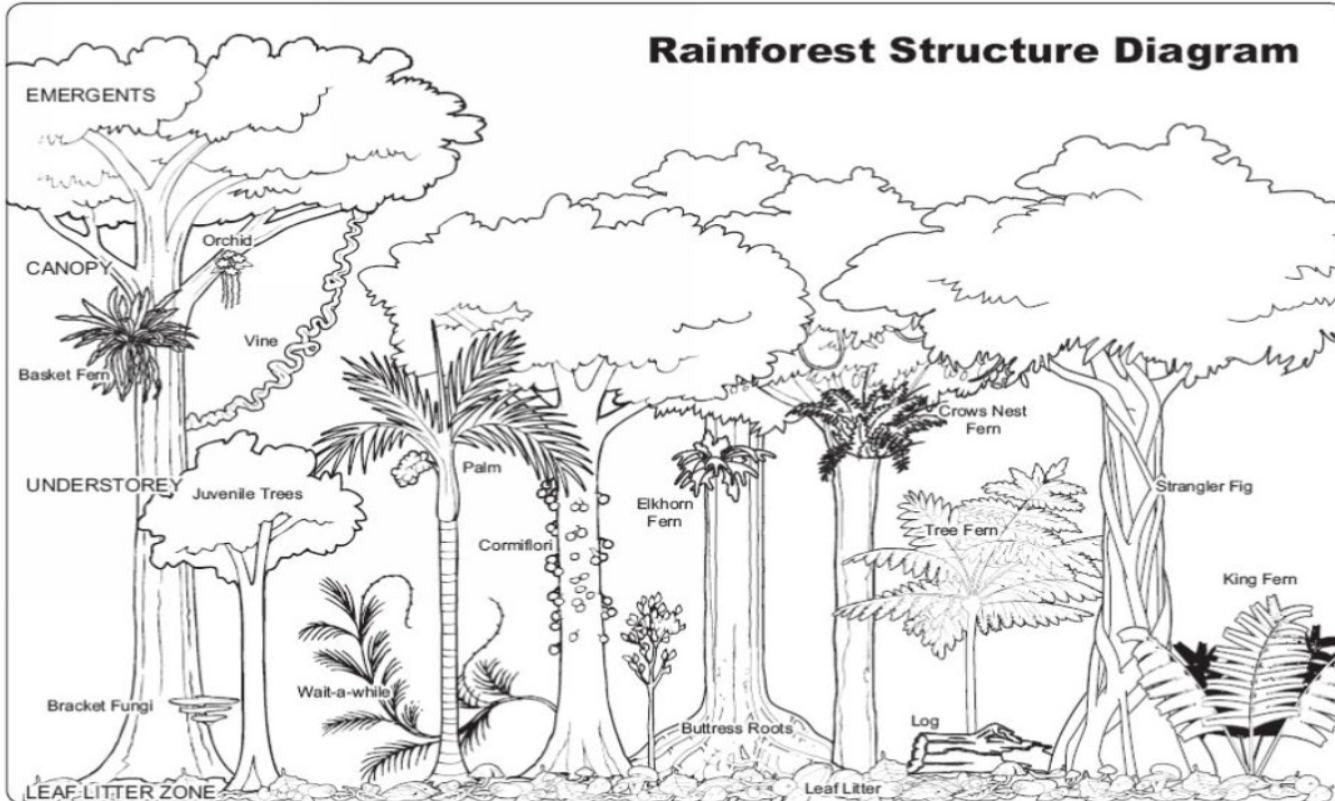


Rainforest Climate Graph For Penang, Malaysia



# Vegetation in the Tropical Rainforest

Unit 1 - Activity 7 Rainforest Structure Diagram



Wet Tropics Management Authority - Rainforest Explorer

## Tropical Rainforest Structure

Plants are constantly competing for sunlight. They aim to grow as tall as possible to get as much light as possible

This has led to distinct layers in the Rainforest

The canopy layer blocks out up to 90% of the light to the layers below

The soil is very poor in the rainforest

Because the trees grow so tall, Buttress roots are needed to help the trees stand up



## Vegetation in the Tropical Rainforest



### Plant adaptations in the Rainforest

Because the trees grow so tall, Buttress roots are needed to help the trees stand up

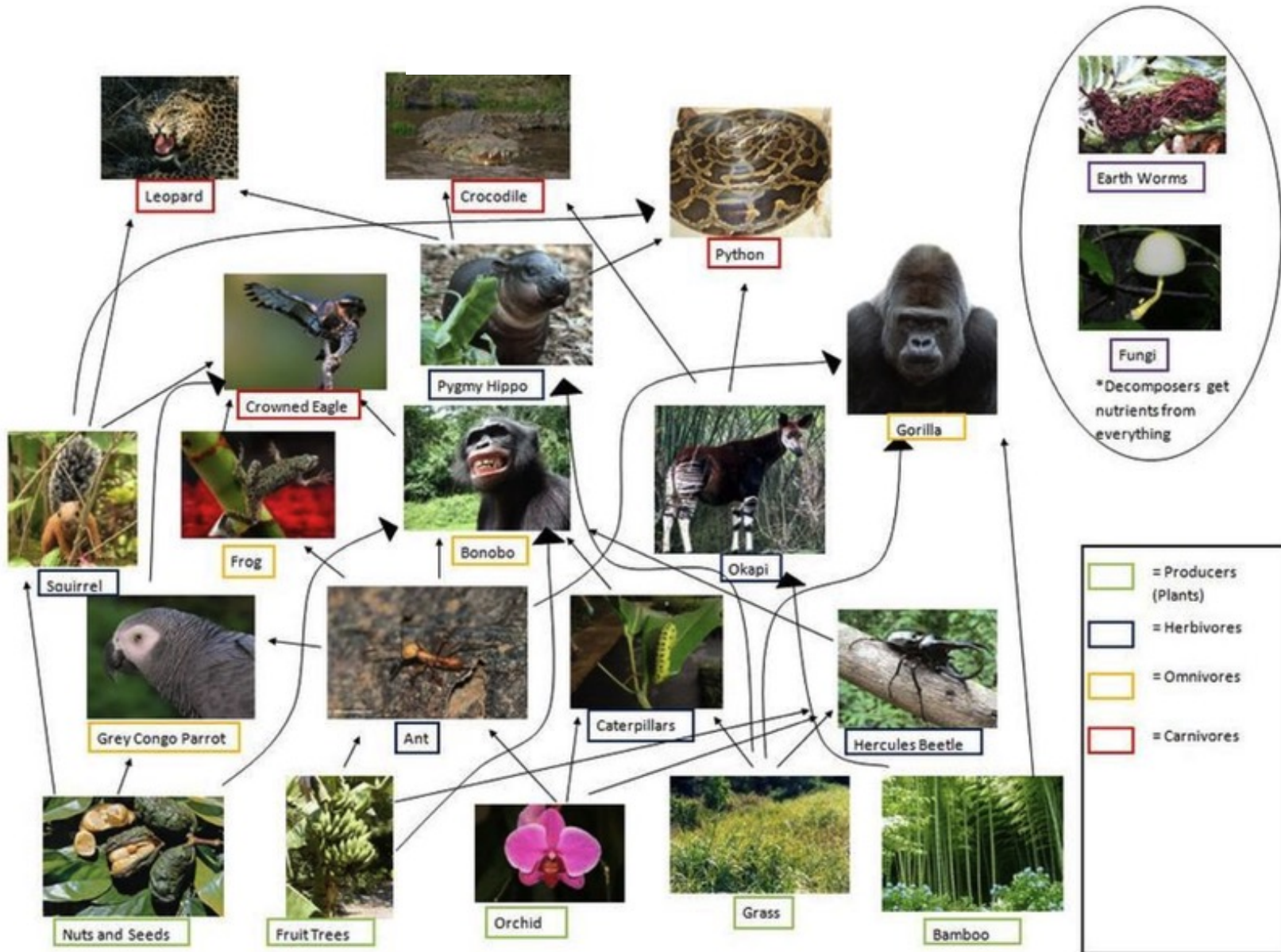
Drip tip leaves make sure that the rainfall runs off

Shallow roots because although the soil is poor, due to the constant heat and humidity, biomass decomposes quickly and nutrients recycled.

Some leaves are waxy to repel rainwater, or have holes in them to let the rain go through

Climbing plants such as lianas, use the tree trunks to climb up to the sunlight

# The Rainforest food web



## Energy flows

The main source of energy for all living things is sunlight. This is absorbed by producers such as plants. They convert the light energy from the sun into chemical energy by the process of **photosynthesis**.

This energy is passed on to animals when they eat the plants.

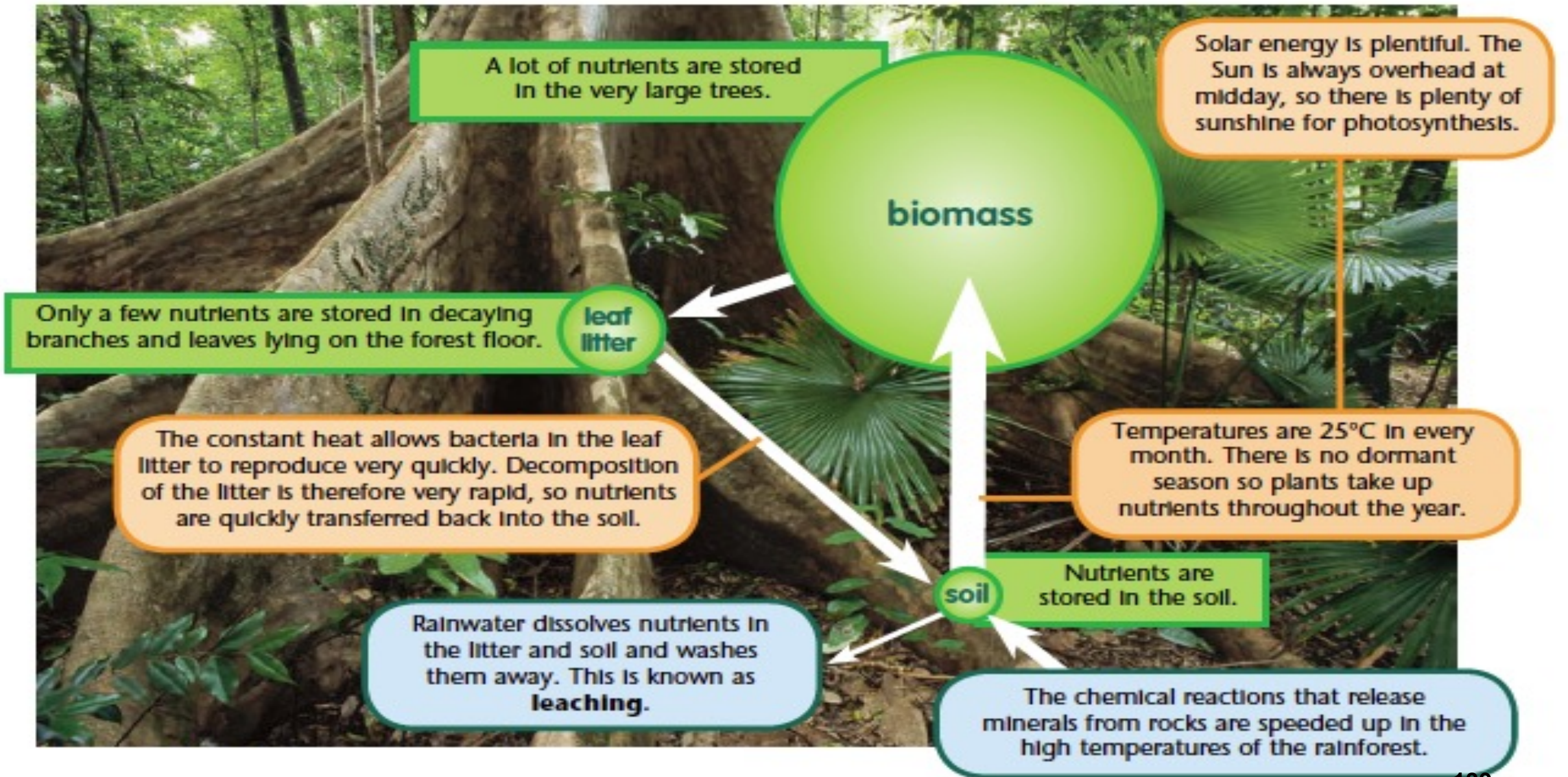
These animals are called herbivores or **primary consumers**.

In turn, these are eaten by other animals called carnivores or **secondary consumers**.

An omnivore eats both vegetation and animals

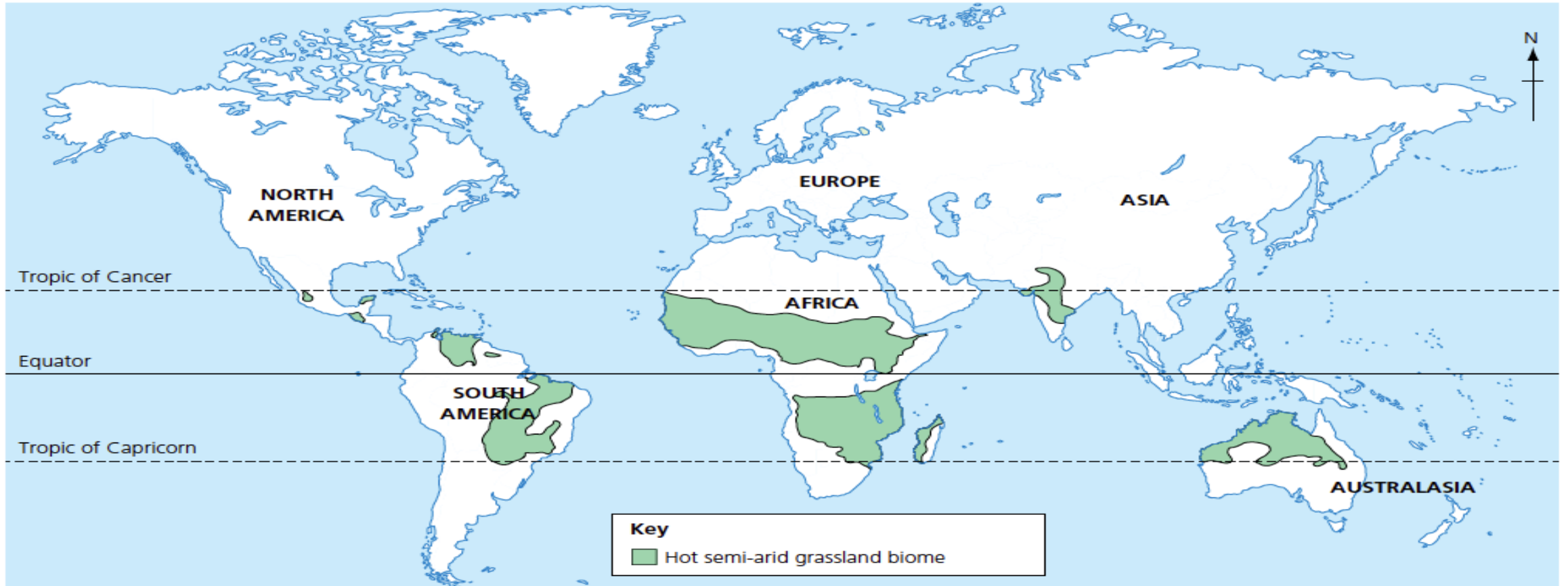
This is called a food chain. Energy flows up the food chain .

# The Nutrient cycle in the Tropical Rainforest



# **Biome 2 : The Semi-Arid Grasslands**

## Semi-Arid Grassland Location



The **Semi-Arid grassland** climate is found between the tropics of Cancer and Capricorn in South America, Africa and Oceania.

There is none in Europe or North America.

They are found in zones between hot deserts and areas having a tropical climate

## Semi-Arid Grassland Climate

The climate is hot all year due to the sun remaining high in the sky throughout the year. Mean temperature is 18°C .

Precipitation totals are lower than 600mm per year.

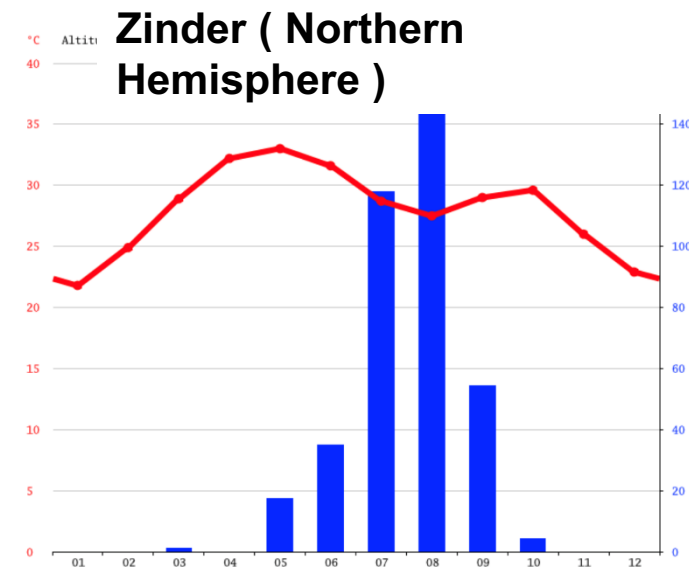
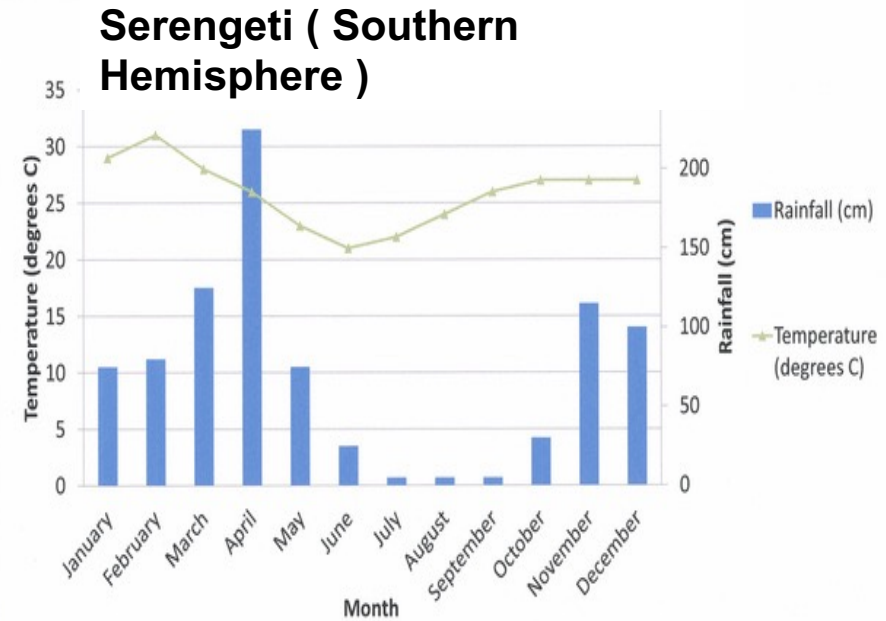
However, It is called a **semi-Arid climate** ( 'Semi' means half )

This is because it only has rainfall for half of the year ( in heavy storms and high humidity ) and then little or no rain for the other half of the year.

This means that it has 2 seasons – a wet season and a dry season.

When the rain falls will depend on whether it is in the northern or southern hemisphere, but the key point is that it will only fall for half of the year.

Any vegetation living in this Biome will have to **adapt** ( *adapt means to adjust or change* ) to this lack of rainfall for half of the year .



## Vegetation in the Semi-Arid Grassland Climate



### Baobab Tree

Grows over 30m in height and 7m in diameter. It can live for thousands of years

Lots of shallow roots spread out from the tree. They collect water as soon as it rains

The thick bark is fire resistant

Few leaves reduce water lost by transpiration

Its large barrel-like trunk stores up to 500 litres of water



# Vegetation in the Semi-Arid Grassland Climate



## Acacia Tree

Broad flat canopy reduces water loss. It provides shade for animals

Thorns on branches deter animals from eating them

Long roots reach ground water deep underground

Small leaves with waxy skin reduce the amount of water lost through transpiration

Grows up to 20m in height and 2m in diameter



The baobab and acacia are examples of xerophytic ( drought-resistant ) trees found in this biome .

This means they can survive long periods with very little rainfall during the dry season of the year.

It is difficult for trees to grow so thick forests are not present.

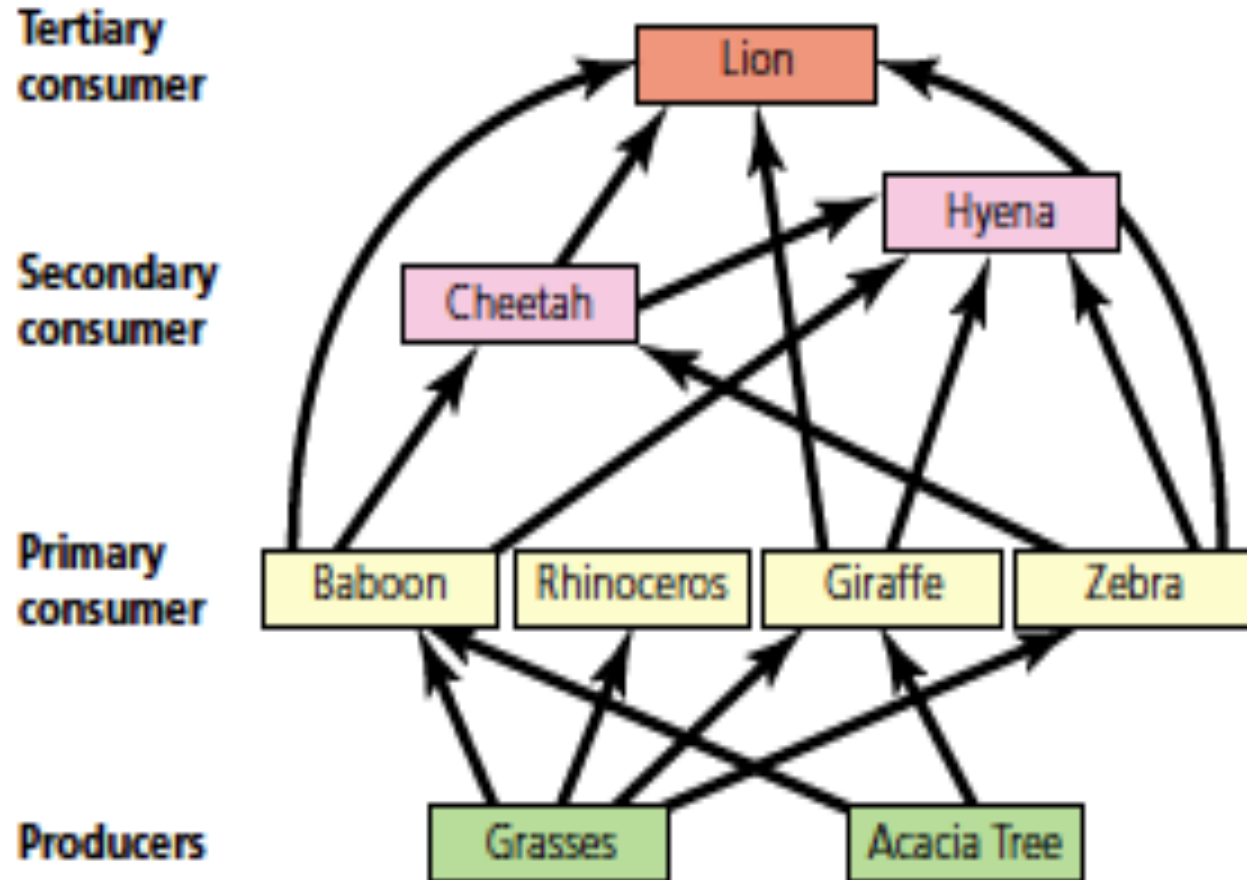
Between the widely spaced trees and bushes there are also grasses that grow rapidly to 3-4m in height in the wet season.

In the dry season they turn yellow and die back.





## The grassland food web



### Energy flows

The main source of energy for all living things is sunlight. This is absorbed by producers such as plants. They convert the light energy from the sun into chemical energy by the process of **photosynthesis**.

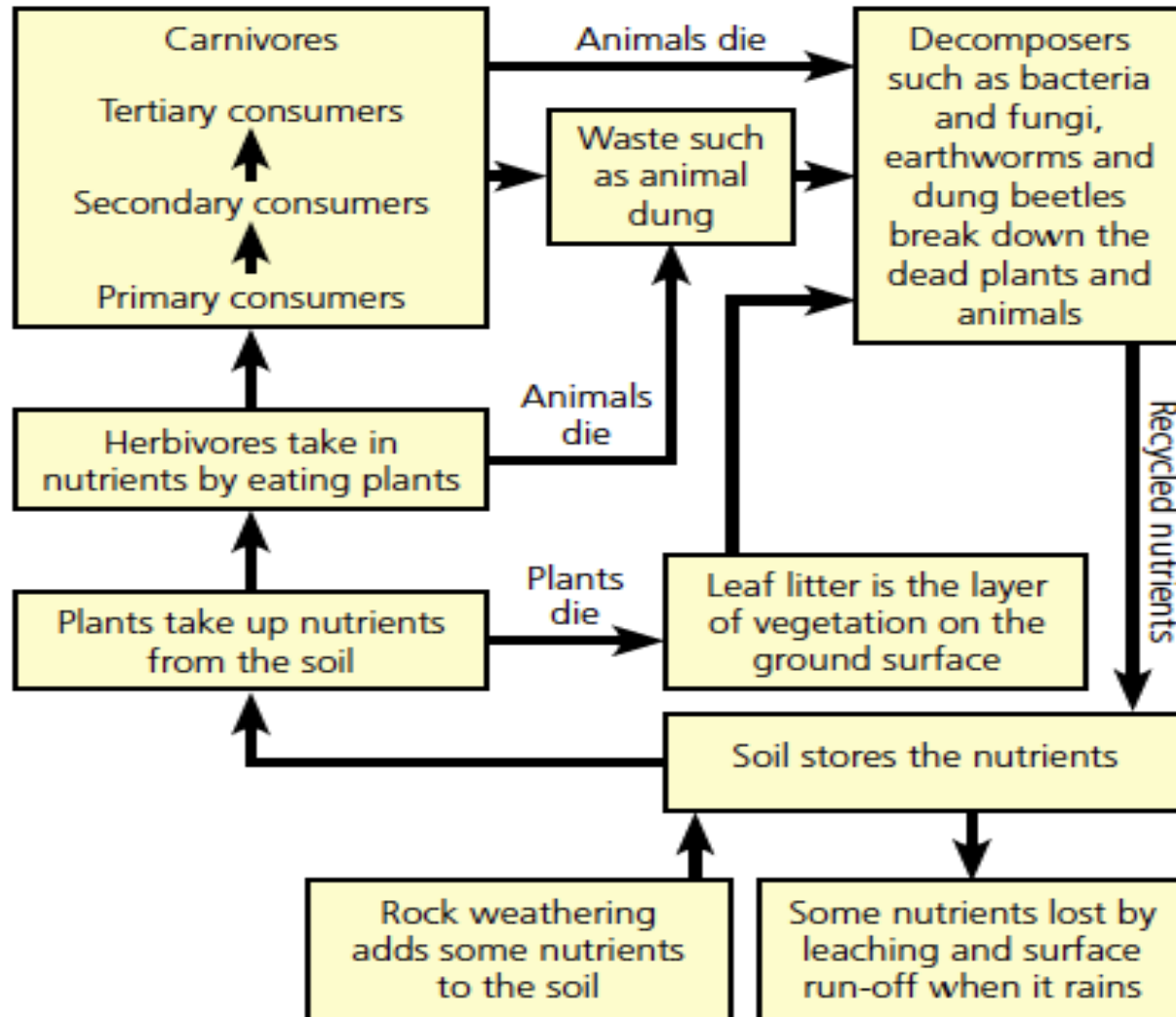
This energy is passed on to animals when they eat the plants.

These animals are called herbivores or **primary consumers**.

In turn, these are eaten by other animals called carnivores or **secondary consumers**.

This is called a food chain. Energy flows up the food chain .

## The Nutrient cycle in the semi-arid grassland



As well as energy , plants need essential chemicals such as iron and nitrogen

These nutrients are recycled though the ecosystem between the soil, biomass and leaf litter

When pants and animals di, they decompose and the nutrients are released and returned to the soil

This process is called the nutrient cycle

# A small scale ecosystem

## Attenborough Nature Reserve

Attenborough Nature Reserve is 6 miles South West of Nottingham.

At Attenborough there are both standing and moving water ecosystems .

The moving water is the River Trent and the standing water is flooded old gravel works.

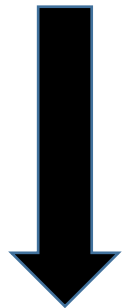
A food web for this ecosystem is shown below.

The Attenborough Nature Reserve was opened in 1965 by Sir David Attenborough. He returned in 2005 to open the nature centre which later won a gold ecotourism award.

Management of the reserve has to balance the needs and demands of a variety of people. Because the nature reserve is close to an urban area ( Nottingham ), it attracts large numbers of visitors.

These visitors come for different leisure and educational purposes. They place different demands on the ecosystem and are sometimes in conflict with each other.

These stakeholders will often have different viewpoints about the ways in which the ecosystem is being managed, agreeing with some strategies and disagreeing with others.



Producers: alder, birch, willow.

Primary consumers: crane fly, soldier fly, netted carpet moth.

Secondary consumers: frogs, toads, small birds.

Tertiary consumers: ducks, geese, foxes.

Quaternary consumers: hawks, owls, foxes, weasels.

### Possible influences on stakeholder views

Stakeholder	Positive influences	Negative influences
Wildlife Trusts member	Attracts a greater variety of birds Protected breeding for rare species	Very popular with non-birdwatchers Nature Centre ruins natural 'feel'
Teacher	Provides activities for students Has indoor study facilities	Visitor centre and paths can be busy
Attenborough resident	Recreational facilities next to home Raises house prices Stores floodwaters	Visitors parking on narrow village roads Visitors intrude on peace of village
Jogger	Pleasant surroundings Paths well maintained Choice of signposted routes	Share paths with other users Car park charges

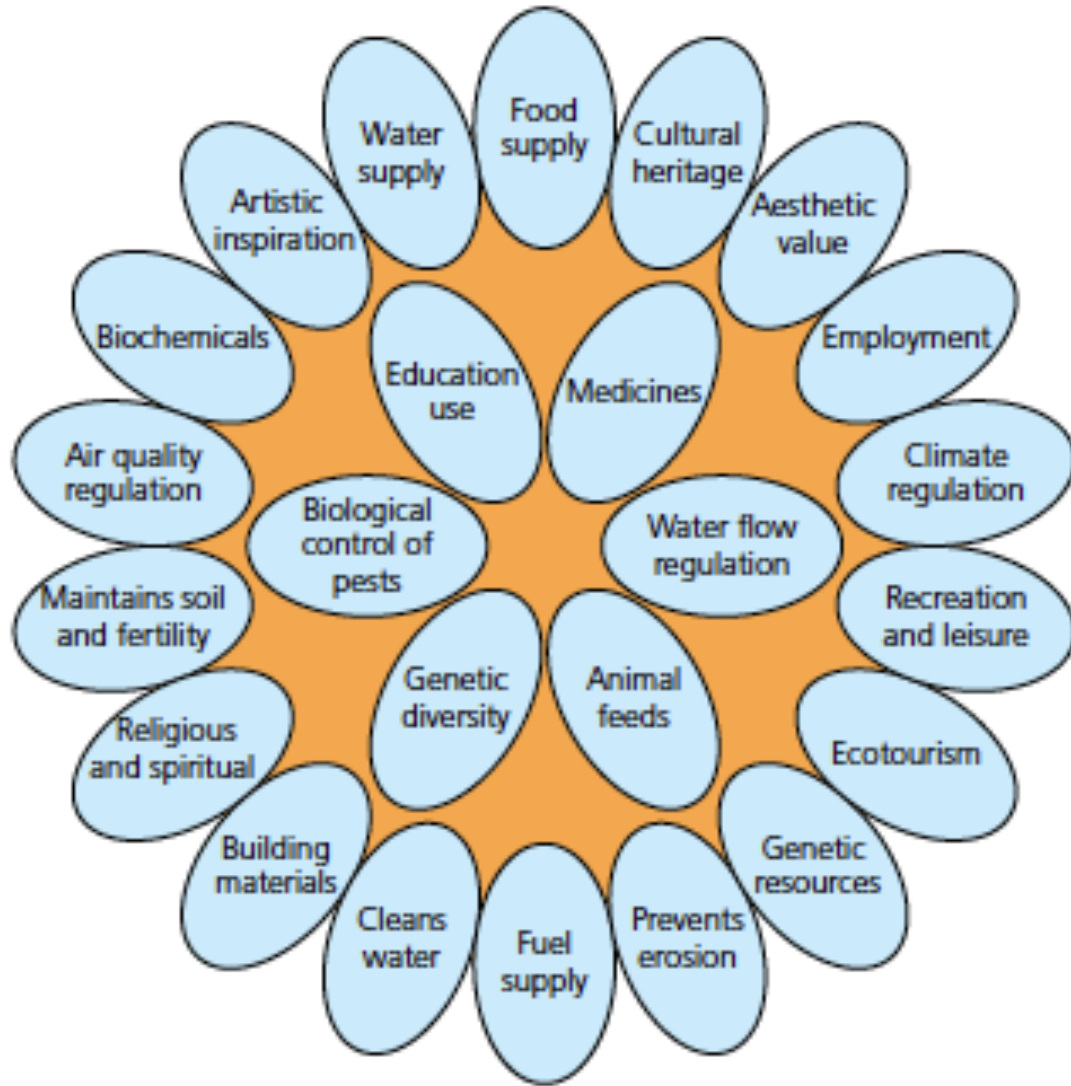
## **3.2 Ecosystems under threat**



## Ecosystems under threat' keywords

Keyword	Definition
<b>Ecosystem</b>	A community of plants and animals and the environment in which they live. Ecosystems include both living ( biotic ) and non-living ( abiotic ) parts.
<b>Biome</b>	Very large ecosystems
<b>Climate</b>	Long term weather pattern in a particular region.
<b>Semi-arid climate</b>	A climate of hot temperatures and rainfall for only half of the year
<b>Adapt / adaptation</b>	Adjust or change
<b>Deforestation</b>	The permanent removal of trees to make room for something besides forest
<b>Monoculture</b>	A type of agriculture ( farming ) in which only one crop is grown over large areas of land.
<b>Palm oil</b>	A vegetable oil grown. It is found in nearly 50% of all the packaged products we find in supermarkets

Keyword	
<b>Ecotourism</b>	Tourism that minimises damage to the rainforest and benefits local people.
<b>Sustainability</b>	'Meeting the needs of the present without compromising the ability of future generations to meet their own needs'
<b>Urbanisation</b>	The physical growth of towns and cities
<b>Mahogany</b>	A valuable hard wood
<b>Biodiversity</b>	The variety of plants and animals in an area
<b>Transpiration</b>	Evaporation from leaves, trees and vegetation
<b>Stakeholder</b>	A group of people who have an interest or concern in something



## Benefits provided by ecosystems

When Ecosystems are destroyed, these benefits are destroyed with them

# Threats to Tropical Rainforests

# Causes of deforestation

Deforestation is happening at a rate of more than 15 acres every minute of every day.  
An acre is about 1 football pitch or 16 tennis courts ) and 78 million acres lost every year!



Deforestation is the permanent removal of trees to make room for something besides forest

## Causes

**Logging** Logging is a major cause of deforestation. Woods such as Mahogany can bring in large amounts of money to companies and the government

**Cattle Ranching** In central America, 2/3<sup>rd</sup> of lowland tropical forests have been burned into pasture land since 1950

**Hydroelectric Power** An unlimited supply of water and ideal river conditions have led to the development of hydroelectric power stations (HEP Stations).

**Farming** There are nearly 3 million landless people in Brazil. The government has cleared large areas of the Amazon Rainforest and encouraged people to move there.

**Mining** The mining of iron ore, bauxite, gold, oil and other minerals have benefited many LICs. However, it has also devastated large areas of rainforest e.g. The Amazon.

## Causes

**Settlements** New settlements are needed for the millions of poorer people in LIC countries. Roads are built to allow access to people and companies

**Palm Oil** Palm oil is used by virtually every one of us in one form or another.

It is used in foods such s bread, cakes, cereals and ready meals and as well as ice cream and crisps.

Palm oil is cheaper than other types of oil and is easier to grow.

Most of the worlds palm oil comes from Malaysia and Indonesia where millions of acres of rainforest have been destroyed. This deforestation is said to be far greater than the rate of deforestation due to logging in the Amazon rainforest.

Ending Palm oil production is not an option as it brings in 5% of Malaysia's exports ( worth \$20 million ) , employs 600,000 otherwise destitute ( poor ) people. Children can also go to school on the income made from Palm oil.



# Effects of deforestation

## Local effects

**Soil** About 80% of the rainforests nutrients comes from trees and plants. That leaves 20% of the nutrients in the soil.

The nutrients from the leaves that fall are instantly recycled back up into the plants and trees.

When a rainforest is cut, conditions change very quickly.

The soil dries up in the sun. When it rains, it washes the soil away.

The rainforest never fully recovers. Wildlife and plant life is reduced.

**Local Tribes** Estimates suggest that 80% of forest Amazonian Indians have died since the arrival of Europeans in the sixteenth century.

Most have died from western diseases such as malaria to which they have no immunity. Those remaining have been forced away by the construction of roads, ranches, mines and reservoirs

## National and Global effects

**Income** Deforestation can consume a country's only natural resource. If deforestation is not managed in a sustainable manner a country's only natural resource could be lost forever.

**Global Warming** Rainforest canopies absorb carbon dioxide which is a gas in the atmosphere. When the rainforests are burned and cleared, the carbon is released.

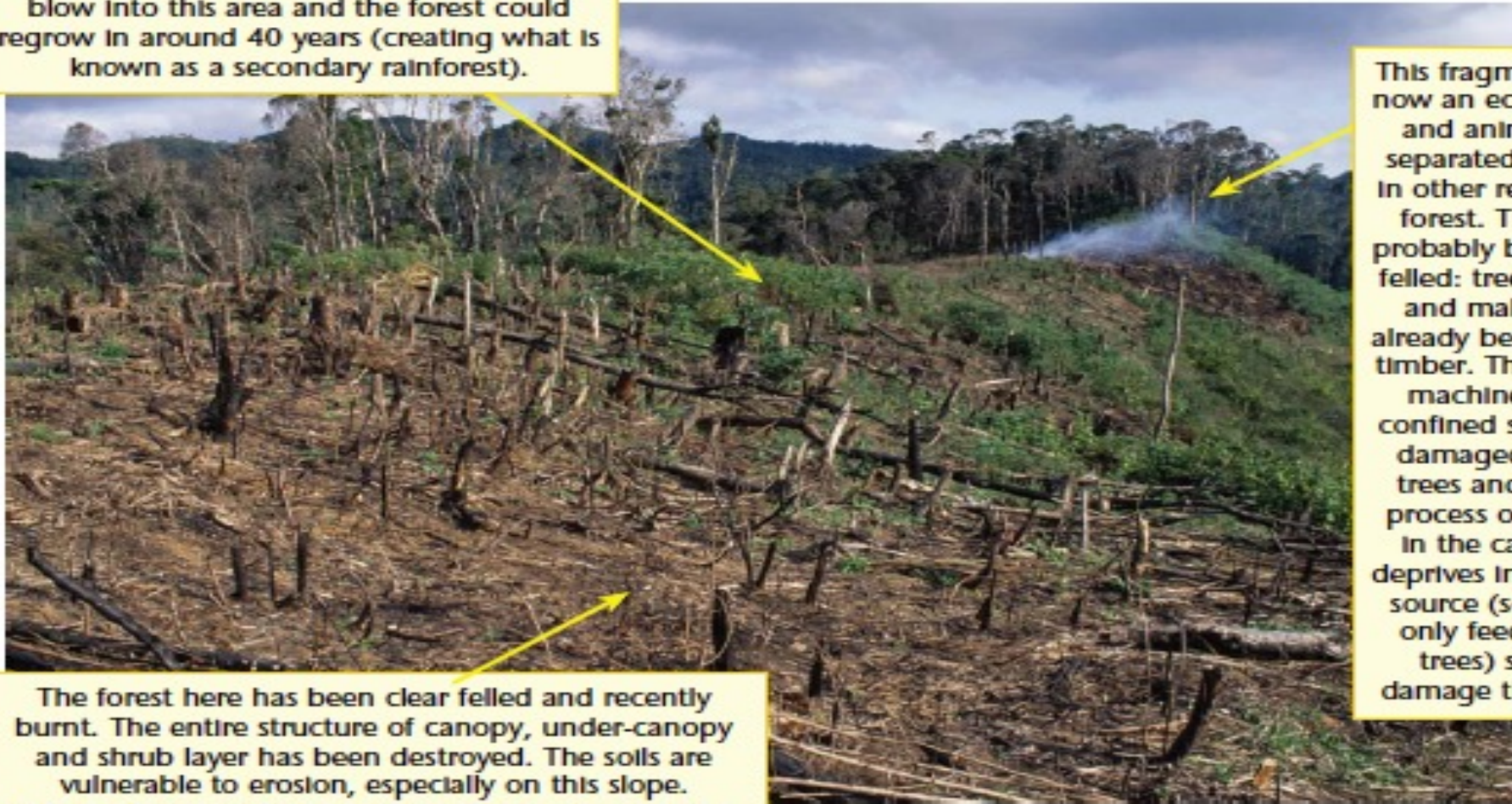
Also, when trees are cut down they can no longer absorb carbon dioxide. This means more carbon dioxide is in the atmosphere

Carbon dioxide allows heat through the atmosphere (suns rays). However, it will not allow reflected energy to escape from the atmosphere. This is called the greenhouse effect and causes global warming.

**Loss of Biodiversity** Millions of species have died and some species have become extinct. These animals may have contained cures for diseases

**Loss of Biodiversity** Millions of species have died and some species have become extinct. These animals may have contained cures for diseases

The forest in the foreground was burnt a few months ago. The stumps and roots of larger trees have helped to retain soil. What was once the forest floor (and therefore starved of direct sunlight) is now open to sunlight and weeds have quickly colonised. Seeds from trees in the background could blow into this area and the forest could regrow in around 40 years (creating what is known as a secondary rainforest).



The forest here has been clear felled and recently burnt. The entire structure of canopy, under-canopy and shrub layer has been destroyed. The soils are vulnerable to erosion, especially on this slope. Obviously, since the canopy has been removed, the nutrient cycle has been broken.

This fragment of forest is now an ecological island, and animals here are separated from animals in other remnants of the forest. This forest has probably been selectively felled: trees such as teak and mahogany have already been cut for their timber. The use of heavy machinery in such a confined space will have damaged many other trees and shrubs. This process opens up holes in the canopy. It also deprives insects of a food source (some of which only feed on selected trees) so begins to damage the food chain.

▲ **Figure 21** Tropical rainforest cleared in Madagascar.

# Sustainable Management of the Tropical Rainforest



**Sustainable** is *'Meeting the needs of the present without compromising the ability of future generations to meet their own needs'*



**Ecotourism** is tourism that minimises damage to the rainforest and benefits local people.

Management strategies	
<b>National Parks</b>	In these areas, damaging activities such as logging and mining are restricted. However, it can be hard to monitor and police these restrictions.
<b>Wildlife corridors</b>	Wildlife corridors link up National Parks or Nature reserves so that species can travel between them safely. This keeps genetic diversity and keeps the species healthy.
<b>Sustainable Logging</b>	Only certain trees ( the older or inferior ) are felled ( chopped down ). New trees can be replanted to replace the ones that are cut down. Logos such as 'FSC' Forestry Stewardship Council ) are added to trees that have been sustainable logged so that people know.
<b>Conservation and education</b>	Education about the impacts of deforestation will encourage people to buy products that are certified from sustainably managed sources such as the FSC.
<b>Ecotourism</b>	Only a small number of people are allowed into the rainforest area at any time to minimise damage. Income is created for the local people ( who act as guides, provide accommodation and transport ) and for the government ( taxes ) If local people are employed in tourism they don't have to farm or mine to make money, meaning fewer trees are cut down.
<b>International agreements</b>	International agreements try to reduce illegal logging and promote buying hardwoods such as Mahogany from sustainably managed forests
<b>'Debt for nature' swap</b>	If a country owes money to other countries in the form of Debts, they can write off some of this debt in return for protecting areas of rainforest.

# Sustainable Management of the Tropical Rainforest

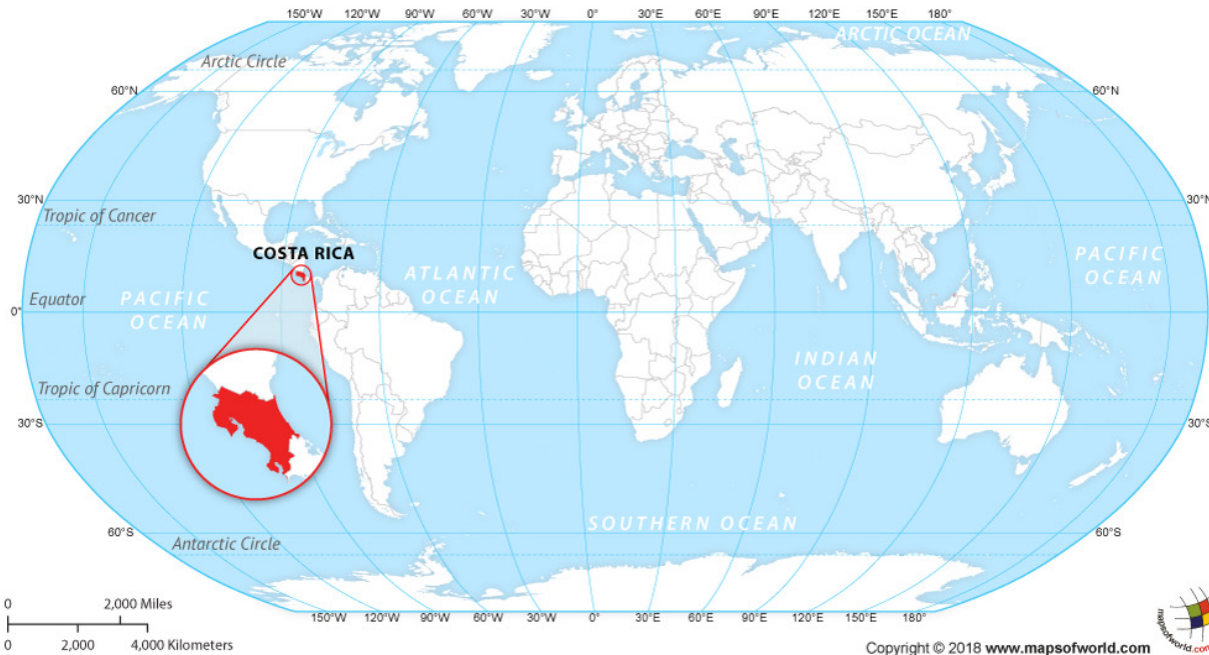


**Sustainable** is 'Meeting the needs of the present without compromising the ability of future generations to meet their own needs'



**Ecotourism** is tourism that minimises damage to the rainforest and benefits local people.

## COSTA RICA LOCATION MAP



### Case –study : Costa Rica

**Ecotourism** By 2024 it is estimated that Costa Rica will earn \$6.2 billion from ecotourism

This is the largest source of income for Costa Rica

**Wild life corridors** The countries are looking to create a wildlife corridor throughout the whole of Central America

**'Debt for nature' swap** A swap was made between Costa Rica and the USA in 2010 when Costa Rica agreed to spend \$27 million on conservation projects.

**Protected land** 23.4% of land is protected in Costa Rica

# Threats to Semi Arid grasslands

## Threats

<b>Fires</b>	During the dry season, fires are caused both by lightning strikes and by local farmers burning the grass to encourage new growth when the rains arrive. Grass can survive these fires, but young trees are destroyed
<b>Monoculture</b>	Only growing one crop reduces biodiversity and it can use toxic chemicals that leak into the natural grassland.
<b>Tourism</b>	People come to see endangered species such as elephant, cheetah, lion and rhino. However, the tourist buses and jeeps can get too close to the animals and stop them from hunting and mating.
<b>Hunting and poaching</b>	<p>One of the greatest threats is hunting and poaching which has led to the illegal killing of over 40,000 animals each year in Kenya's Serengeti National Park.</p> <p>There were once over 100,000 black rhinos in Africa, there are now less than 2,700. They are killed for their horns which are used in traditional Asian medicines and sell for over 5 times the price of gold.</p> <p>Over 100,000 elephants were killed between 2013 and 2015 for the ivory in their tusks</p>
<b>Urbanisation</b>	The growth of cities pushes built up areas further into grassland each year.



## Management

<b>Sustainably manage horn</b>	Remove horns and sell them in a controlled manner to reduce prices making illegal horn less lucrative for poachers
<b>Dehorning rhino</b>	No horn = nothing to poach!
<b>National Parks</b>	Keeping all of the Rhino in a National park would ensure protection but the parks are too big to police properly.

# **3.3 Water resources and management**



## 'Water resource and management' keywords

Keyword	Definition
<b>Consumption</b>	Using up a resource
<b>Abstraction</b>	When water is taken from a river , reservoir or underground source to be used.
<b>Water footprint</b>	A measure of human use of water and our impact on natural water resources
<b>Embedded water</b>	The amount of water that has been used to produce and transport any product
<b>Irrigation</b>	The supply of water to land or crops to help them grow.
<b>Fast fashion</b>	Clothes being used for a short period of time and then thrown away
<b>Dyeing</b>	The use of dyes and other chemicals to colour clothes
<b>Water security</b>	When there is enough water to ensure everyone has clean water, sanitation and good health. Also, the economy has enough water to grow food and manufacture things that are needed
<b>Sanitation</b>	The provision of clean drinking water and adequate sewage disposal
<b>Water stress</b>	A lack of water causing significant issues for the population

Keyword	
<b>Relief rainfall</b>	Rainfall is formed when air cools as it rises over hills and mountains. As it rises it cools, condenses and forms rain
<b>Groundwater store</b>	Water in the ground below the water table
<b>Over abstraction</b>	When water is taken from the ground faster than it can be recharged by natural processes
<b>Recharge</b>	When water soaks into the rocks to replace water that has been used from the groundwater store
<b>Salinisation</b>	The deposition of harmful minerals in the soil caused by over-irrigation
<b>Rainwater harvesting</b>	The collection and storage of rainwater, for example from the roof of a house
<b>Transboundary cooperation</b>	Governments co-operate with each other where rivers cross national boundaries
<b>Sahel</b>	The semi-arid region of North Africa to the south of the Sahara desert. Sahel means 'shore' in Arabic.



## Trends in water consumption

Everyone needs water. It is essential for healthy life. We also use vast amounts of water to grow food and in many industrial processes.

However, the total amount of water varies from one country to another. For example the average American family uses 1300 litres of water a day, whereas the average African family uses only 22 litres a day

Generally, much more water is used per person in the richer nations than the poorer nations. This is because

- Water abstraction is expensive. It involved huge investments to build dams and water-transfer schemes.
- Wealthier people tend to use water in non-essential ways such as watering gardens, washing cars or filling swimming pools
- People buy consumer products such as clothes and cars. These all use water when they are produced
- As economies grow, money is invested in modern farming techniques

Some countries are lucky enough to have higher rainfall totals than others and many countries have major rivers which bring water into their territory.

However, only 0.3% of the worlds water is accessible and useable by humans

Between 2000 and 2050, global water demand is expected to increase by up to 1/3.

### Where water is found

#### Water Stores:

**Oceans: 97.2%**

**Glaciers & Ice:**  
2.15%

**Groundwater: 0.61%**

**Lakes: 0.009%**

**Inland seas: 0.008%**

**Soil Moisture:**  
0.005%

**Atmosphere: 0.001%**

**Rivers: 0.0001%**

## Water footprints

As consumers we all have a **water footprint**. This is a way of measuring how much water we use

The larger the footprint , the greater our impact on the planets water resources . For example through drink, washing , bathing and flushing the toilet. You use about 95 litres of water in a 5 minute shower.

However, farming and manufacturing use huge quantities of water, meaning that the food we eat and the product we buy have all used water to make the, We call this **embedded water**, and each of use uses 2000-50000 litres of embedded water every day

## The water footprint of the fashion industry

Half of all textiles are made from cotton. Cotton grows best in hot semi-arid climates

Many cotton farmers live in LIC countries such as Mali in West Africa or NIC's such as India.

Cotton is an important industry in these countries as it provides jobs and income. Cotton production employs over 250 million people worldwide.

However, cotton is a thirsty crop, but grown in areas that have low rainfall.

It takes 10,000 litres of water to produce 1Kg of cotton – enough to make a pair of jeans and a single T-shirt !

This means that environmental pressure groups such as WWF , argue that the way cotton is farmed is environmentally unsustainable.

The fashion industry also have to deal with 2 other issues.

1. Fast –fashion – clothes only being used for a short period of time and then thrown away
2. Dyeing – the use of dyes and other chemicals in the fashion industry creates a waste problem. The fashion industry is responsible for around 20% of eater pollution



Other footprints	Litres
Pizza	1,260
100 g chocolate	1,700
A dozen bananas	1,920
1 kg beef	13,500

## Over abstraction : Lake Chad

**Water Abstraction** is the process of taking water from a ground source, either temporarily or permanently. Most water is used for irrigation or treatment to produce drinking water

Lake Chad lies on the border of Niger, Nigeria, Chad and Cameroon.

Water is abstracted in the Chari-Logone river basin in Nigeria for domestic supply in Kano ( a Nigerian city ). It is also used for irrigation of crops which include Onions, Tomatoes, Chilli peppers and rice.

It is thought that only 5-10% of the water in the Chari-Logone river now flows into Lake Chad. The rest evaporates or is abstracted and used.

20 dams have been built in north-eastern Nigeria. This leaves only about 2% of the water in Komodougou-Yobe river basin to flow into Lake Chad

Between 1963 and 2013, Lake Chad lost 90% of its water. It shrank in size from 25,000km<sup>2</sup> to 2,500km<sup>2</sup>.

The reduction in the size of the lake has threatened the resources and livelihoods of the 50 million residents in that region.

There are 2.8 million refugees in the Lake Chad region, and estimates state that there are 9.2 million people in need of humanitarian assistance.



The drainage basin of Lake Chad is shown by the pale green area

## Over abstraction : Lake Chad

### Consequences of over abstraction

This is a very poor part of Africa. There are 40 million people living in the drainage basin of Lake Chad and 60% of them live on less than \$2 a day.

The lake water has become stagnant and a source of disease such as Cholera

Soils have suffered from salinisation. This process occurs when too much water is used to irrigate crops. Water evaporating from the soil leaves behind harmful chemicals. The soil is now too salty to grow crops.

Less fish stock has plunged many fishermen into unemployment and poverty.

Wetland bird populations have declined because the wetland ecosystem surrounding the lake has dried out.

Poverty has increased, leading to increased out migration to cities like Kano. Increased poverty has also led to people turning to extremist groups like Boko Haram.

### Can Lake Chad be saved – The Transaqua Solution

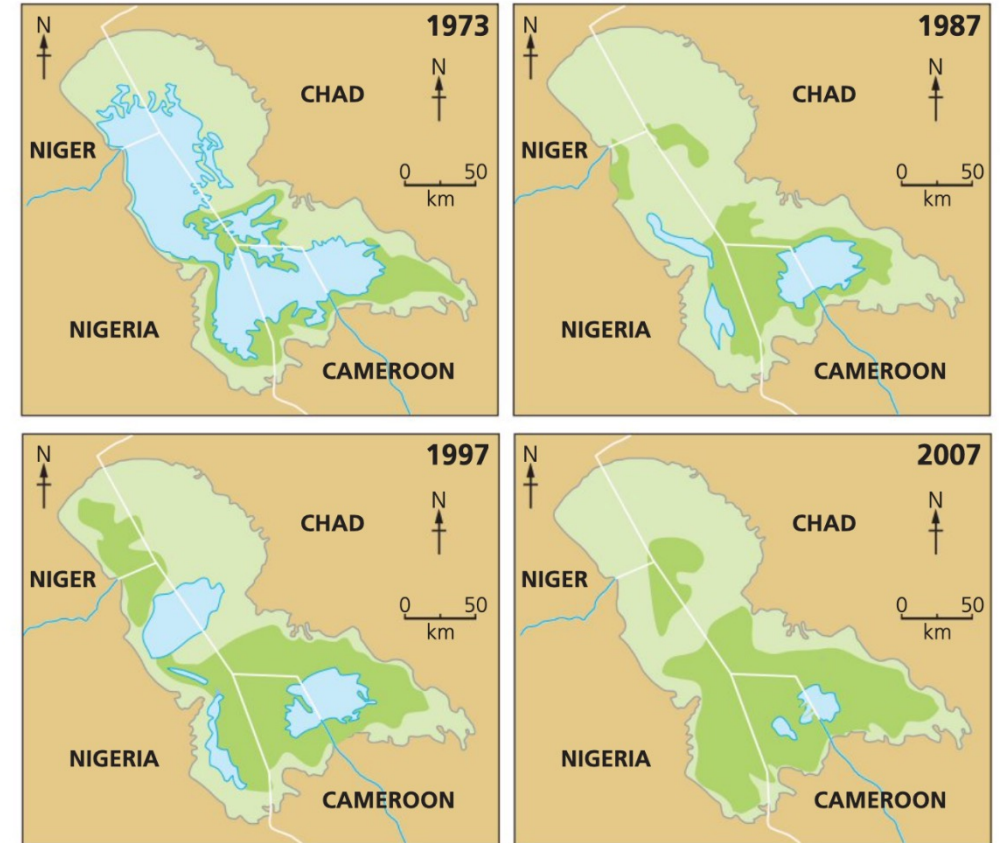
A proposed project would transfer water from the Democratic Republic of Congo.

A 2,400km canal would transfer 100 billion metres cubed of water every year from the River Congo to the River Charri.

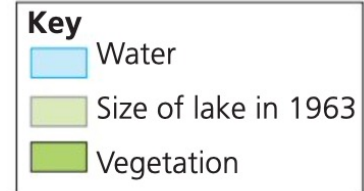
The governments of India, China and Brazil see this as an opportunity to invest in Africa – a continent that is rich in resources would help support the growth of rapidly growing NIC's.

The project would provide water for agriculture, industry and electricity as well as creating jobs and water security.

However, Congo says that the water is theirs. The cost of this project is estimated to be between \$50-\$70 billion and it will take 30 years to build.



Lake  
Chad



# Water Security

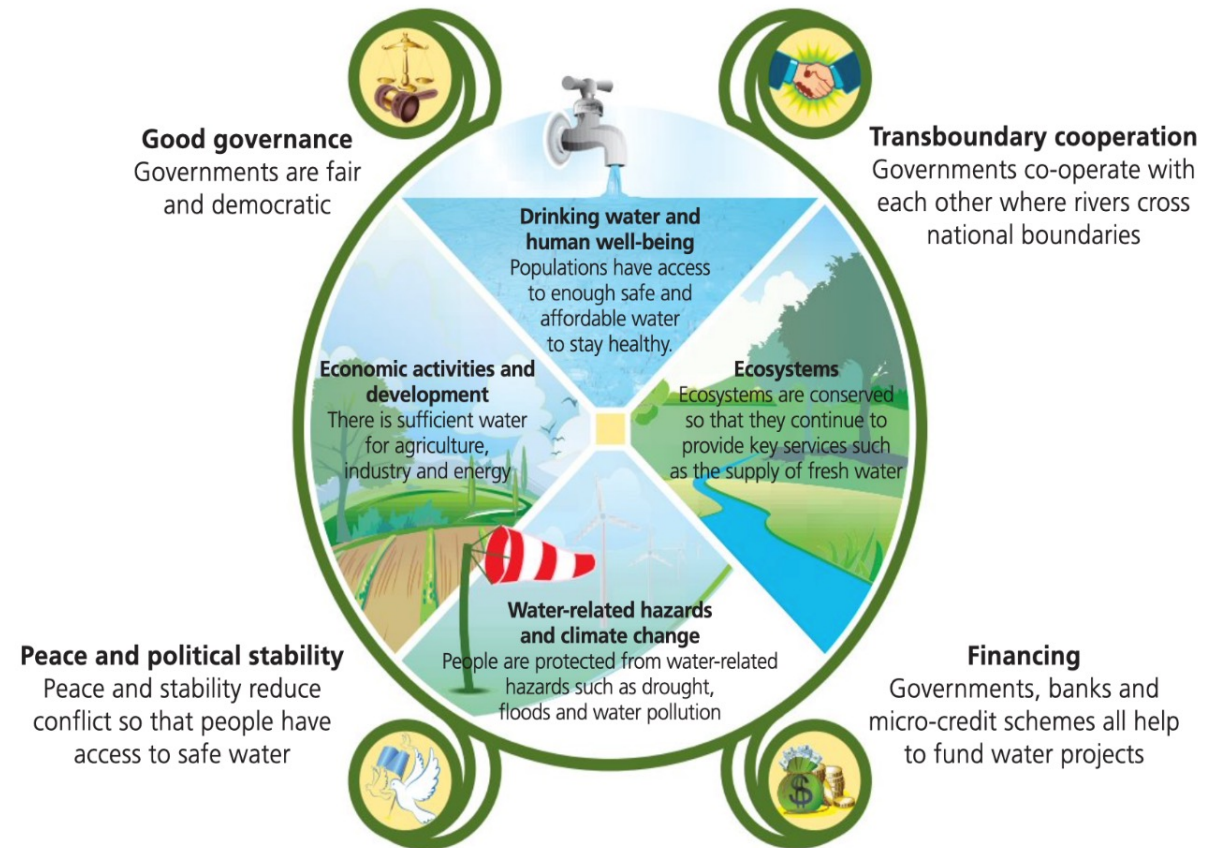
Water security is an important aim for any country. Drinking or bathing in unclean water can cause diarrhoea, cholera, dysentery, typhoid and polio.

WHO estimates that Diarrhoea causes the death of 485,000 people each year.

Clean water is essential to economic and social development

Safe water is needed to maintain water supplies, provide hygiene, grow food and supply industry

Without sufficient safe water, infant mortality and maternal mortality rates increase



The inside of the diagram represents what it means to have water security whilst the outer part of the diagram describes how water security can be achieved

## Water Security

### Water insecurity and health in Kano

Kano City is Nigeria's third-largest city. Its population is growing quickly because of rural to urban migration from the surrounding areas where low rainfall and poverty are push factors

Kano's water supply comes from the Tiga dam and the Challawa Dam. The Tiga Dam also supplies water to the Kano river irrigation project which uses water to grow food for Kano.

However, Kano has no sewage system or sewage treatment plants. People living in high density shanty towns in the city use pit latrines.

Poor sanitation means that people are at risk of diseases such as Cholera and Polio. Polio attacks the nervous system and can cripple its victims. But polio can be eradicated by immunising young children

Between 2003 and 2004 local Muslim religious leaders and the state government of Kano decided to oppose and future vaccinations of children in Kano state. The state government now supports the vaccination program, but some people remain violently opposed to it.

In February 2013, extremists opened fire on 2 polio clinics in Kano , killing 9 health workers

The state government and UNICEF have led a huge program to educate local people about the benefits of the polio vaccine.

At present Nigeria has virtually eradicated Polio

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## Case-study : South Africa

### South Africa : Water problems

In South Africa average water consumption was 172 litres in 2010. It is now 233 litres per person per day. This doesn't necessarily mean that people are using much more water in their homes. Only about 12% of South Africa's water is used domestically ( in homes ). About 60% is used by farmers to irrigate their crops.

The consumption of water in South Africa varies from one province to another. For example demand is highest in Gauteng, which is an urban province with lots of industry. Demand is lowest in Limpopo, which is South Africa's poorest and most rural province

In January 2018, the population of Cape Town, South Africa, was told it had three months before the city ran out of water. Demand had been exceeding supply since 2015 and water stores had nearly run out. There were many reasons for this

1. The population of the city had risen from 2.4 million in 1995 to 4.1 million in 2015, an increase of 71%. The amount of reservoir storage had only increased by 17% in the same period
2. Water consumption had grown in the farming and manufacturing sectors. Farmers use 30% of water in Western Cape. To avoid disaster in Cape Town, the supply to farmers was cut by half
3. water-thirsty plants, not native to this part of South Africa, had spread through the catchment area. It is estimated that these plants use 30 million cubic metres of water each year which would otherwise go into Cape Town's reservoirs
4. Climate change appears to be making the Western Cape drier. . There was lower than normal rainfall between 2015 and 2018
5. The Western Cape government says 37% of all water supplies are lost through leaking pipes.

## Case-Study : South Africa

### Solution 1 : Rainwater harvesting

Rainwater harvesting is the collection and storage of rain water ; for examples, from the roof of a house

South Africa has 53 large dams, which is almost half of all the dams in Africa. Despite this, there are many South Africans without access to clean drinking water.

Many of these people live in rural, remote parts of South Africa. They are too isolated to become part of the big projects such as the LHWP and they are too poor to drill boreholes to tap into groundwater supplies .

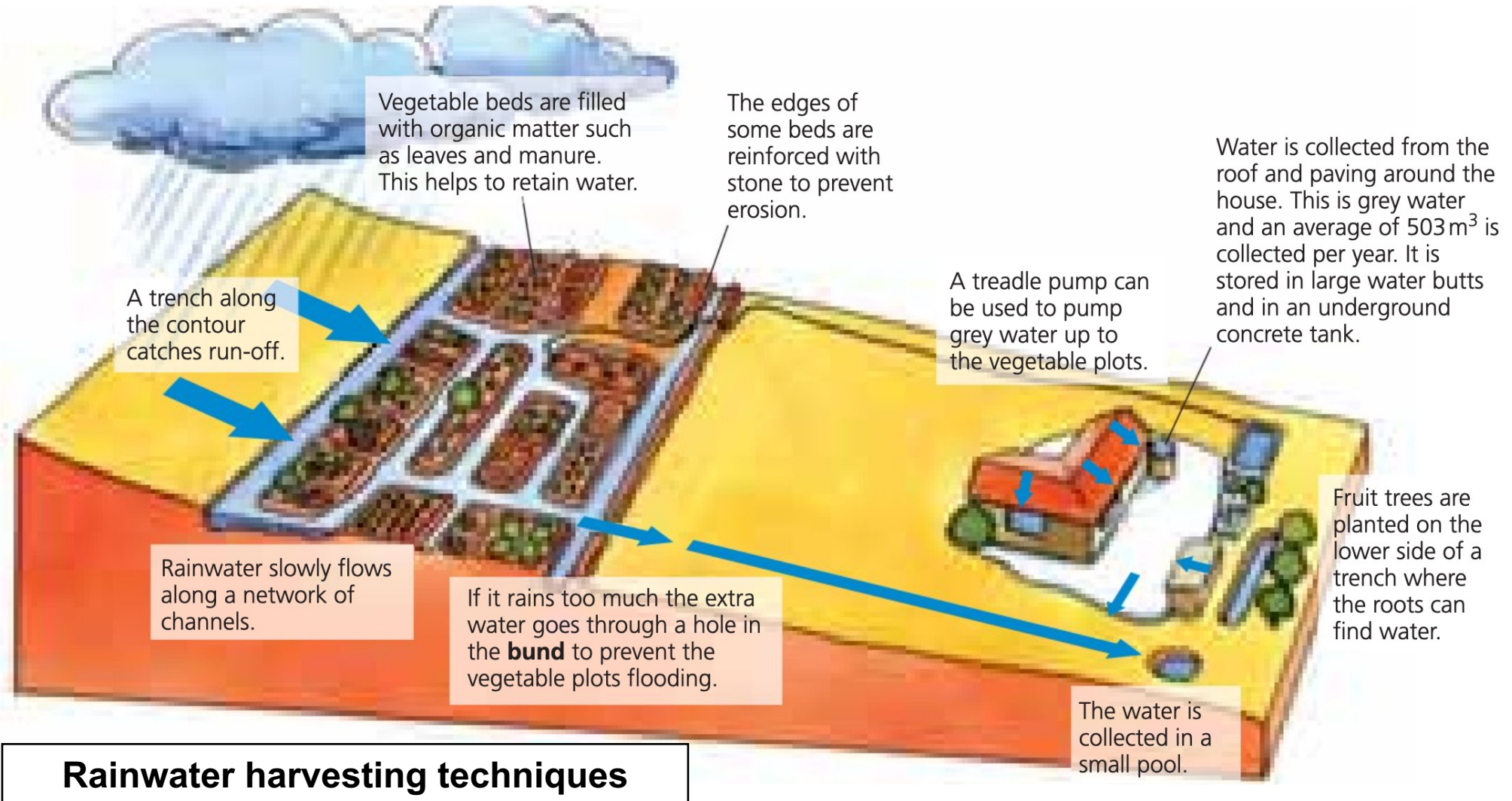
Instead they have to rely on cheap, small scale methods of rainwater harvesting as shown on the next page.

These strategies are affordable and practical for families, no matter how small the farm is or how little money they have.

They use ways that are cheap, practical and easy to maintain using appropriate technology

Rainwater harvesting techniques are examples of sustainable water development. They benefit people now, without doing any lasting damage to the environment or using up valuable resources. The methods are not usually big enough to have negative impacts on the surrounding drainage basin – unlike the big dam building schemes used by the government





## Case-study : South Africa

### Solution 2 :Water from Fog

Fog can be harvested to provide clean drinking water to isolated rural communities.

Schemes have been used successfully in Peru Ethiopia and Tenerife.

It is a form of appropriate technology because it is relatively cheap to install and maintain

To collect water from fog, a simple system of fine-mesh nylon nets are suspended vertically between tall poles. The fog condenses on the net and drips into a gutter below. It then passes through sand before being piped to where it is needed

Fog harvesting works best in upland regions ( at least 400m above sea level, that experience moist air being blown from the coast. As the air rises it condenses to form fog

Fog harvesting could work in Limpopo as it is over 1000. above sea level and moist air is blown inland by prevailing easterly winds

All 130 school children at Tshanowa primary school in Limpopo used to bring bottled water to school every day. Now they drink pur water collected from fog

It is not foggy every day.

The nets and poles are relatively cheap to buy.

Repairs are essential. Nets are easily torn in the wind.

Repairs are easy to make and require little training.

Ground water is contaminated.

Fog harvesting technology does not need any electrical energy.

Many rural areas do not have a piped supply from a reservoir.

Some of the foggiest sites are some distance from rural communities.

**Advantages and disadvantages of fog harvesting in Limpopo**

# Water Management

## Water Transfer schemes : Lesotho Highlands water project ( LHWP )

Lesotho is a small, mountainous country that is completely surrounded by South Africa.

Rainfall in Lesotho is mainly relief rainfall (caused by the mountains)

- Lesotho receives over 2000mm more rainfall per year than parts of South Africa
- Rainfall in South Africa is less than half that of Lesotho.

Lesotho Highlands Water project (LHWP) – designed to collect water in the mountainous regions of Lesotho and pipe it to the river Vaal catchment in South Africa.

Dams such as the Katse Dam and the Mofale Dam collect water in Lesotho. 40% of the water in the river basin is transferred to the Vaal River in South Africa via 200km of pipes.

It was begun in 1984 and can transfer  $26.4\text{m}^3$  per second. This will be doubled in 2020 when a \$1bn new dam will be finished.

Lesotho is a good location because it has high rainfall, Impermeable bedrock so little water is lost, a large available workforce and deep valleys that are easy to dam up



Lesotho

## Water Transfer Schemes: Lesotho Highlands water project ( LHWP )

### Advantages

The Lesotho government is receiving money from S Africa; this makes up 75% of the country's income.

20,000 new jobs created.

The percentage of people in South Africa with access to safe water rose from 83% to 87%

Dams provide HEP as well as water

Roads have been constructed to access the dam sites

Later dams created 1000 megawatts of electricity for Lesotho

### Disadvantages

The money from the project has not gone on poverty reduction – its main objective

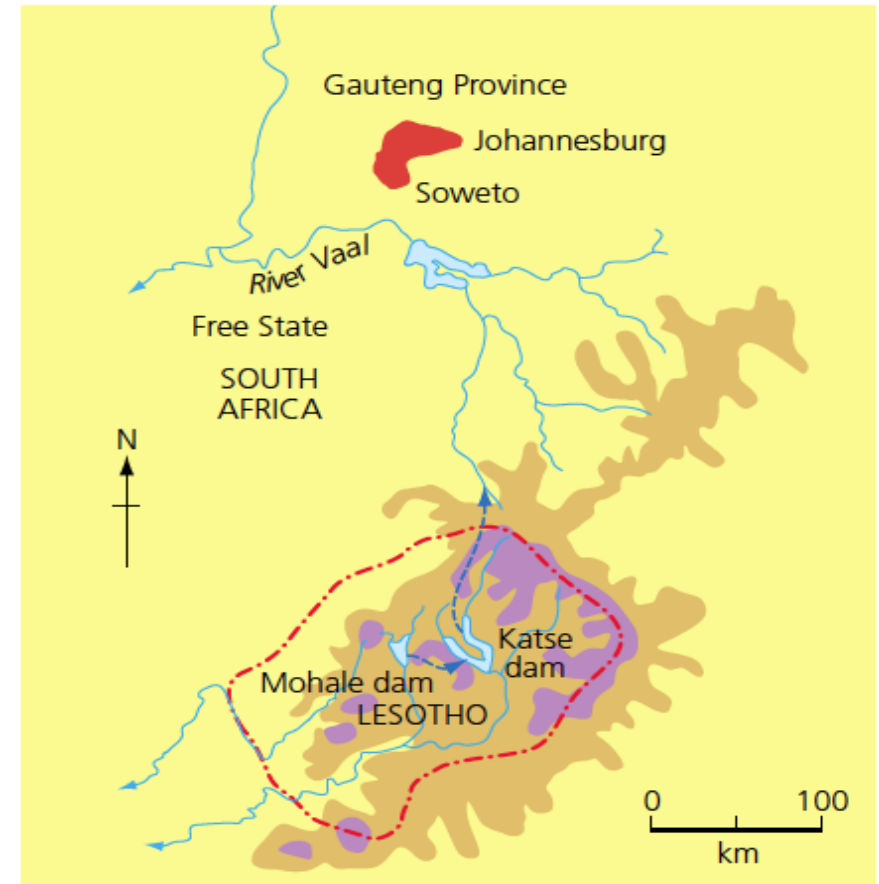
Which led to increase in AIDs and alcoholism as workers got bored in labour camps

However, many people in Lesotho still have poor access to water. (5% Urban Areas, 23% Rural Areas)




Farmland is flooded to create the reservoirs. 20,000 people were forced to move after the first dam was built.

Compensation was paid to the families who lost land during construction of the dams.

Many families have said that the compensation is too little and too late



#### Key

-  Pipe transferring water into the River Vaal catchment
-  Land over 3,000m
-  Land over 2,000m

## Trans-boundary water issue : Mekong River

### The problem

The River Mekong flows through six countries; China, Laos, Vietnam, Burma, Cambodia & Thailand.

Its source is in the Yunan province in China, and its mouth is The South China Sea.

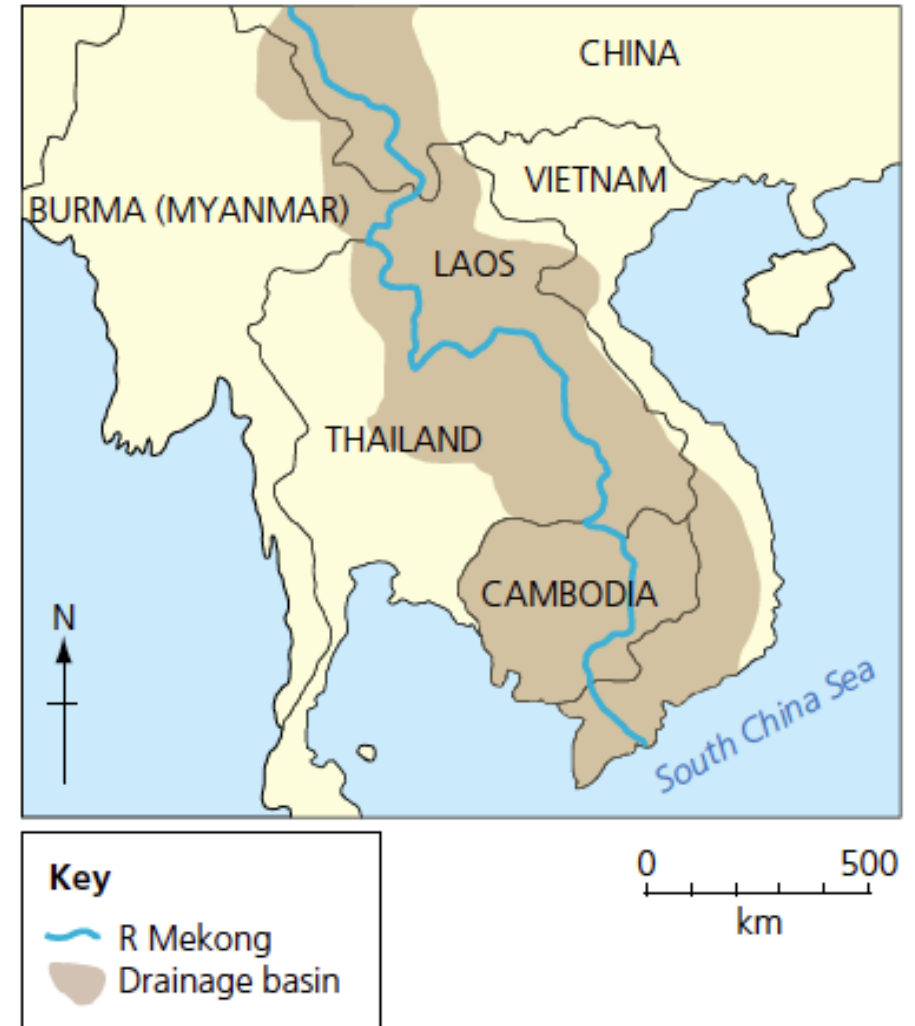
Each of the 6 countries rely on the river for water supply and for food.

Fishermen in Cambodia catch about 2 million tonnes of fish a year from the river - no other country on Earth relies so much on wild protein in its diet.

Since 1990 China has built a series of Dams to generate hydro-electric power ( HEP ) to feed China's fast growing economy

Dams on international rivers like the Mekong, can create conflict between the different countries that are dependent on the water

Building a dma in one country alters the flow of water, causing problems for people who live further downstream. So as ore water is used in China, less arrives in Cambodia.



## Trans-boundary water issue : Mekong River

### Advantages of Dams

The heavy monsoon rain regularly causes flooding on the River Mekong. Dams upstream in China have reduced this risk.

Jobs are created in dam construction

Electricity can be generated which can help businesses grow or children to study at home.

More people have a safe water supply

### Disadvantages of Dams

Seasonal floods deposit fertile silt onto the flood plain and many farmers rely on these floods to water their rice crops. 80% of rice production relies on this flood which dams prevent.

Dams mean less water for farmers downstream.

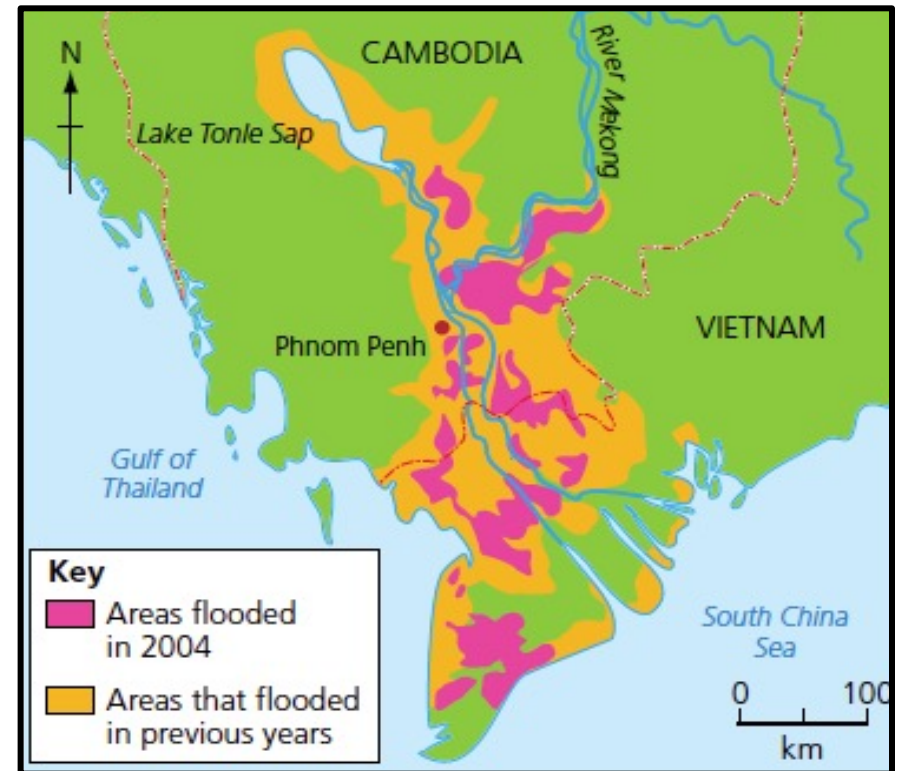
Water levels have dropped, creating sandbanks in the river which make navigation by boats more difficult.

Fish populations have shrunk and fish caught are much smaller.

Land is flooded and farmland lost.

Water can be suddenly released causing flash floods.

People have been displaced by reservoirs



## Trans-boundary water issue : Mekong River

### How should the river be managed in the future ?

The Cambodian government feels that, as the country furthest downstream, it is most vulnerable to changes made to the river by other countries.

It feels that river management upstream is affecting the frequency of floods, rates of sediment deposition and the fish population

The dams prevent fish migration.

Fishermen also need the seasonal rise and fall in the rivers flow because the fish spread out into the lakes and ponds of the flood plain during the flood season. The massive dams are evening out the seasonal ups and downs on the Mekong's pattern of discharge and reducing the overall size of the flood

The government of Cambodia is considering a range of options in order to reduce the risk of both drought and flood

a) Fund a flood control centre to collect data and issue forecasts

b) Assess flood risks in each community

c) Produce advice to householders on how to protect themselves

d) Build flood walls and embankments

e) Build small dams to hold back floodwater

f) Better land use planning so that homes are not built on flood plains

g) Start to talk to neighbouring governments about river management

h) Set up an annual flood conference where guests are invited from neighbouring countries

i) Assist neighbouring countries with aid during emergencies

Strategies used in Cambodia to reduce flood and drought risk

# **3.4 Desertification**





## 'Desertification' keywords

Keyword	Definition
<b>Desertification</b>	Desertification is the process by which dry environments become more like desert . Over a period of years the amount of natural vegetation decreases and the soil is exposed to the hot sun
<b>Sahel</b>	The semi-arid region that borders the southern edge of the Sahara Desert
<b>Intertropical convergence zone (ITCZ)</b>	A band of low pressure that circles around the globe. The ITCZ moves north of the Equator in July/August and south of the Equator in December / January. The ITCZ brings heavy rainfall for a few months .
<b>Semi-arid climate</b>	A climate of hot temperatures and rainfall for only half of the year
<b>Malnutrition</b>	Lack of proper nutrition, caused by not having enough to eat or not eating enough of the right things.
<b>Gulley erosion</b>	The removal of soil by rainwater to form a steep-sided V-shaped ditch
<b>Deforestation</b>	A farming term that refers to a period of time ( usually a year or more ) when the land is given a rest from growing crops. This period allows the soils to recover its fertility
<b>Monoculture</b>	A type of agriculture ( farming ) in which only one crop is grown over large areas of land.
<b>Jatropha oil</b>	A biofuel that grows in harsh and arid conditions

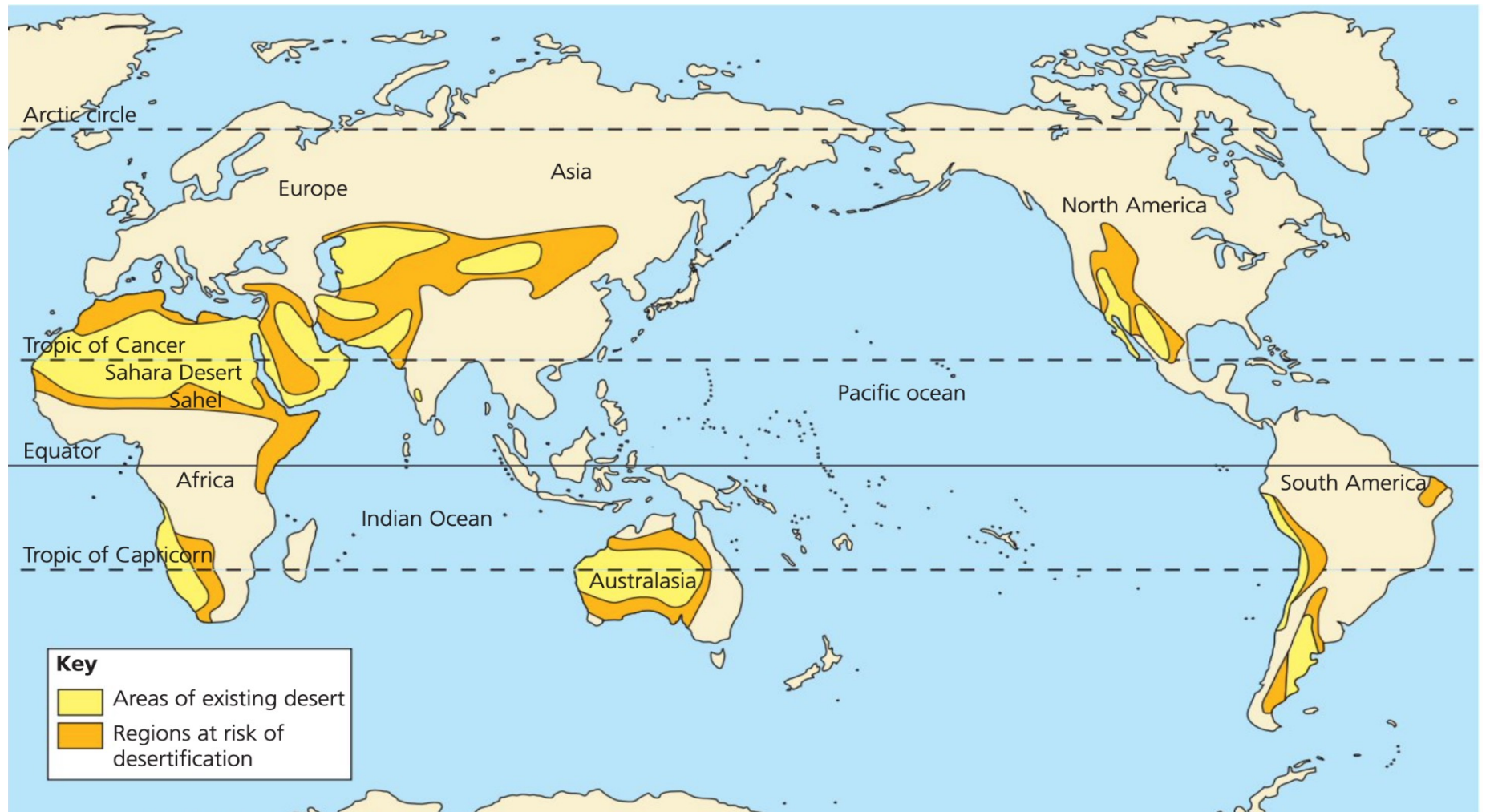
Keyword	Definition
<b>Infiltration</b>	The movement of rainwater into the soil
<b>Over-grazing</b>	To graze ( grassland ) so heavily that the vegetation is damaged and the ground becomes liable to erosion
<b>Vulnerable</b>	Very likely / more likely to be damaged or exposed
<b>The Great Green Wall</b>	An 8000km green wall of productive landscape across Africa to combat the problems of desertification.
<b>Drip irrigation</b>	Water drips slowly to the roots of the plants. The aim is to place water directly into the root zone and minimize evaporation
<b>Bunds / Magic stones</b>	Construction of stone walls prevent soil erosion and surface runoff during periods of heavy rain. This encourages <b>infiltration</b> and recharges soil moisture.
<b>Drought-Resistant Crops</b>	Crops which can still produce food in a region, even when rains are poor. These include: Chickpea, groundnut and millet.
<b>Rainwater Harvesting</b>	Construction of roofs that collect rainwater that can then be stored in large tanks until it is needed. This provides some water for survival as well as irrigation.

# Location of Desertification



Desertification is the process by which dry environments become more like desert. Over a period of years the amount of natural vegetation decreases and the soil is exposed to the hot sun

## Regions at risk of desertification

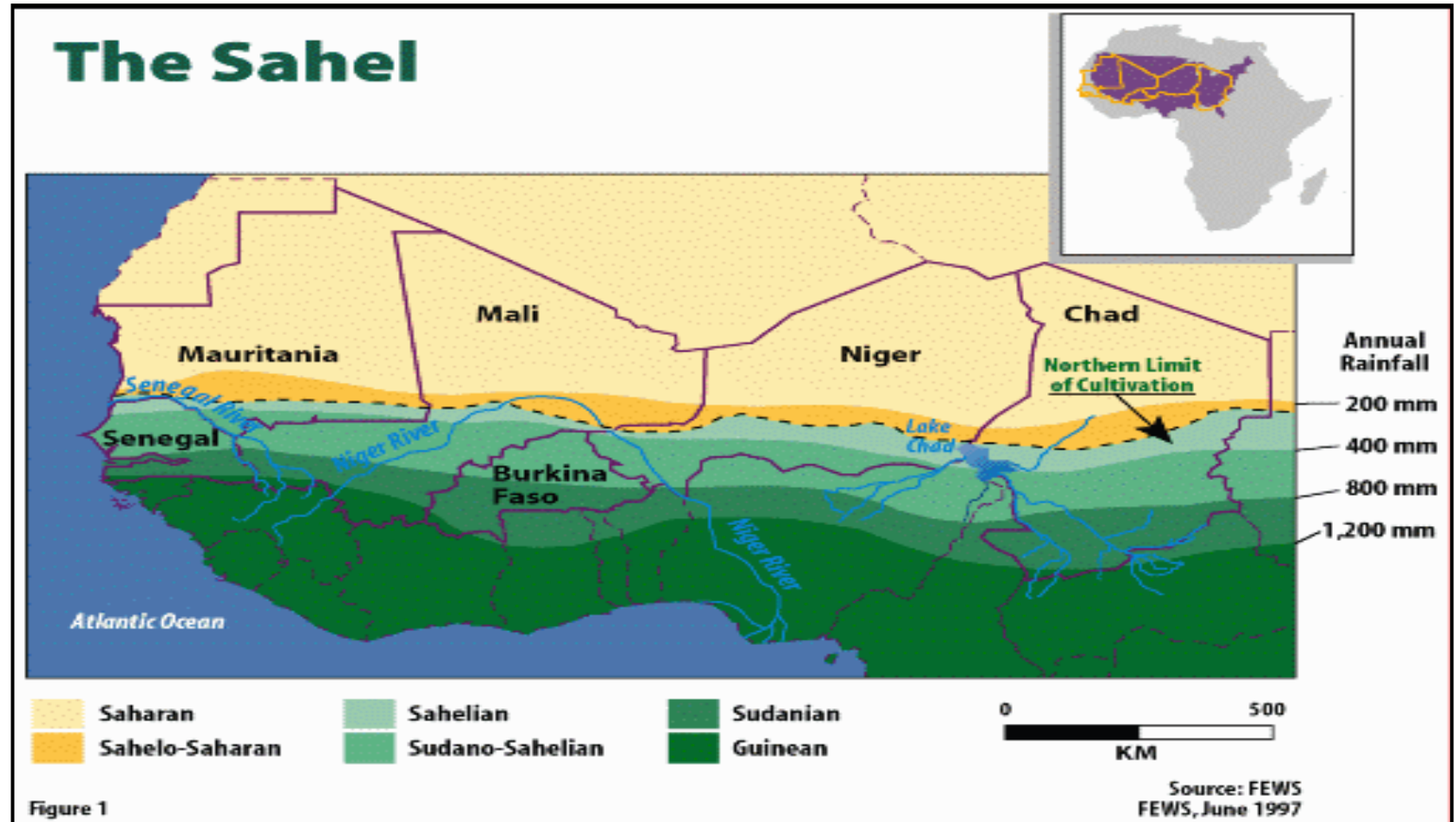


## Location of the Sahel

The **Sahel** is the area to the South of the **Sahara Desert** across the centre of Africa where drought and desertification are taking place.

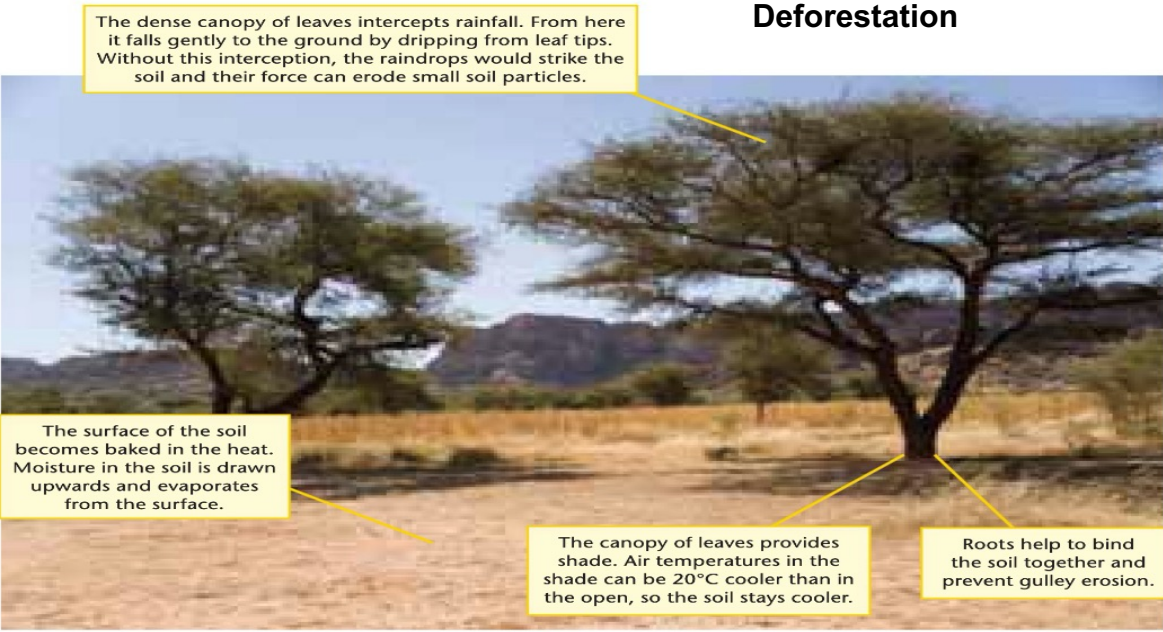
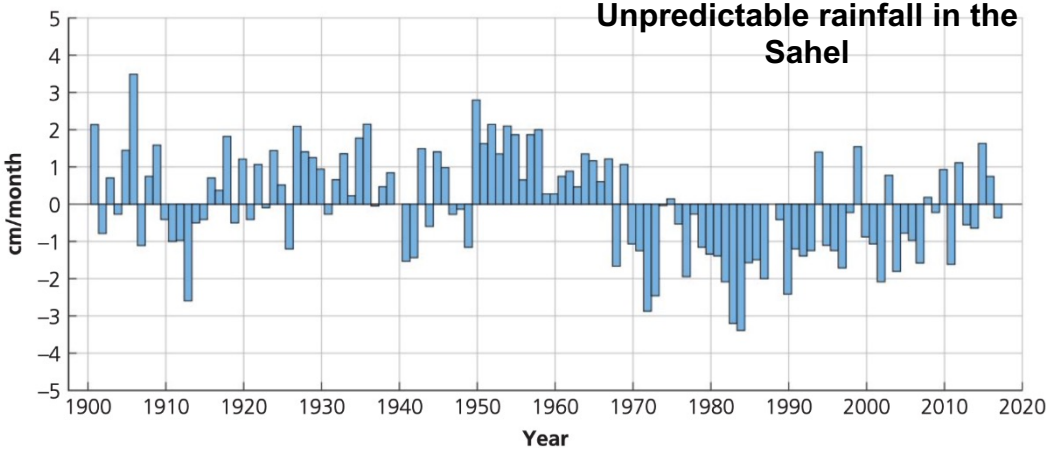
The countries affected are:

- Senegal
- Mauritania
- Mali
- Niger
- Chad
- Burkino Faso
- Somalia.

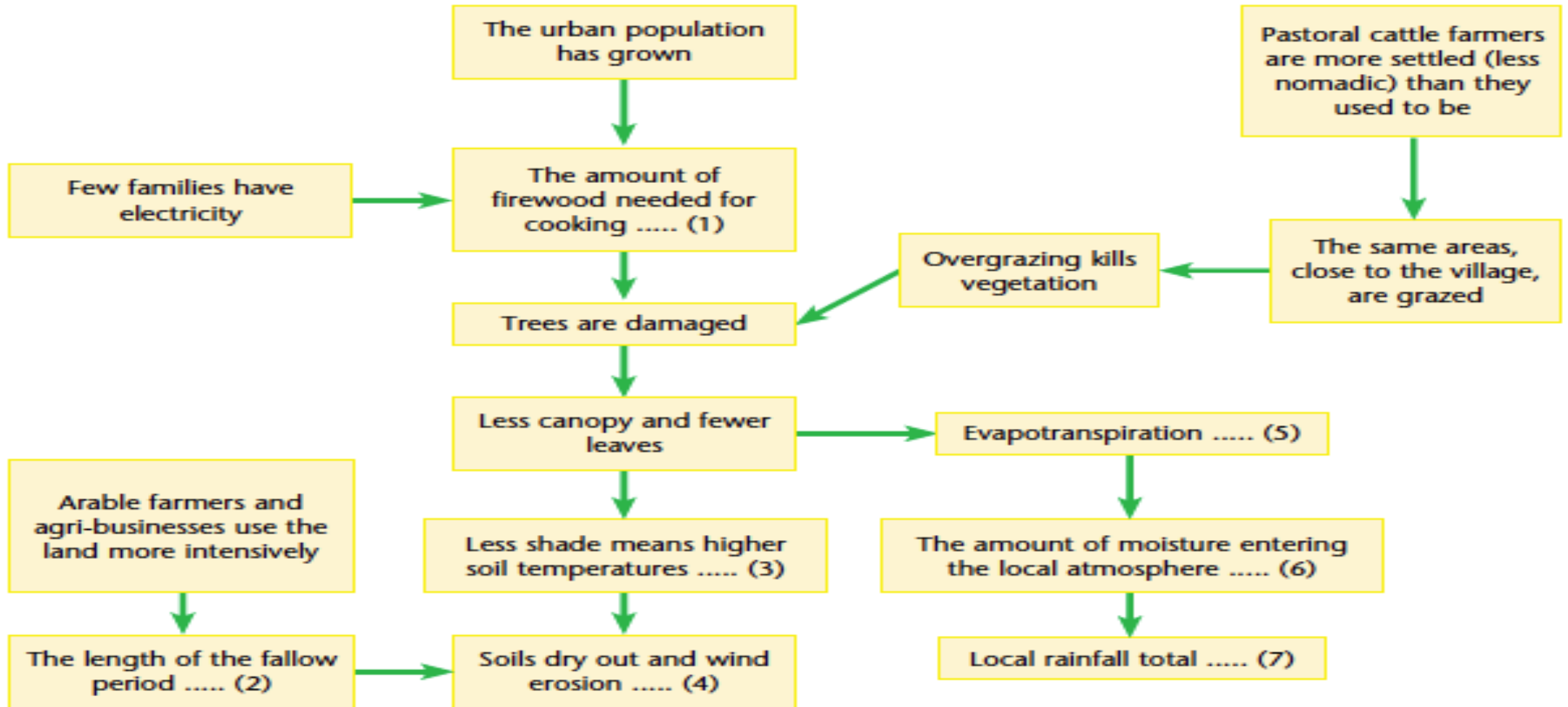


Cause	Reason
Unpredictable seasonal rainfall	Some areas such as the Sahel has a long dry season of 9 months followed by a wet season of 3 months. However these wet seasons have become unpredictable , with short periods of heavy rainfall running off the land and failing to soak down into the soil where it is needed to recharge the soil moisture
Climate change	Deserts are becoming warmer and drier
Migration	Poor quality soil will cause people to migrate, as they migrate they spread the problem.
Overgrazing by farmers	Too many animals grazing will make it difficult for plants to grow back.
Deforestation	Removing trees removes the roots that bind the soil. The soil is more easily eroded by the wind.
Commercial farms	Use the land so intensively the soil is quickly worn out
monoculture	Planting just one crop leads to a lack of nutrients in the soil which leads to soil infertility
Poor farming practices	Land could be stripped of everything that it has, removing its nutrients
Overpopulation	An increase in population leads to increased urbanisation

## Causes of desertification



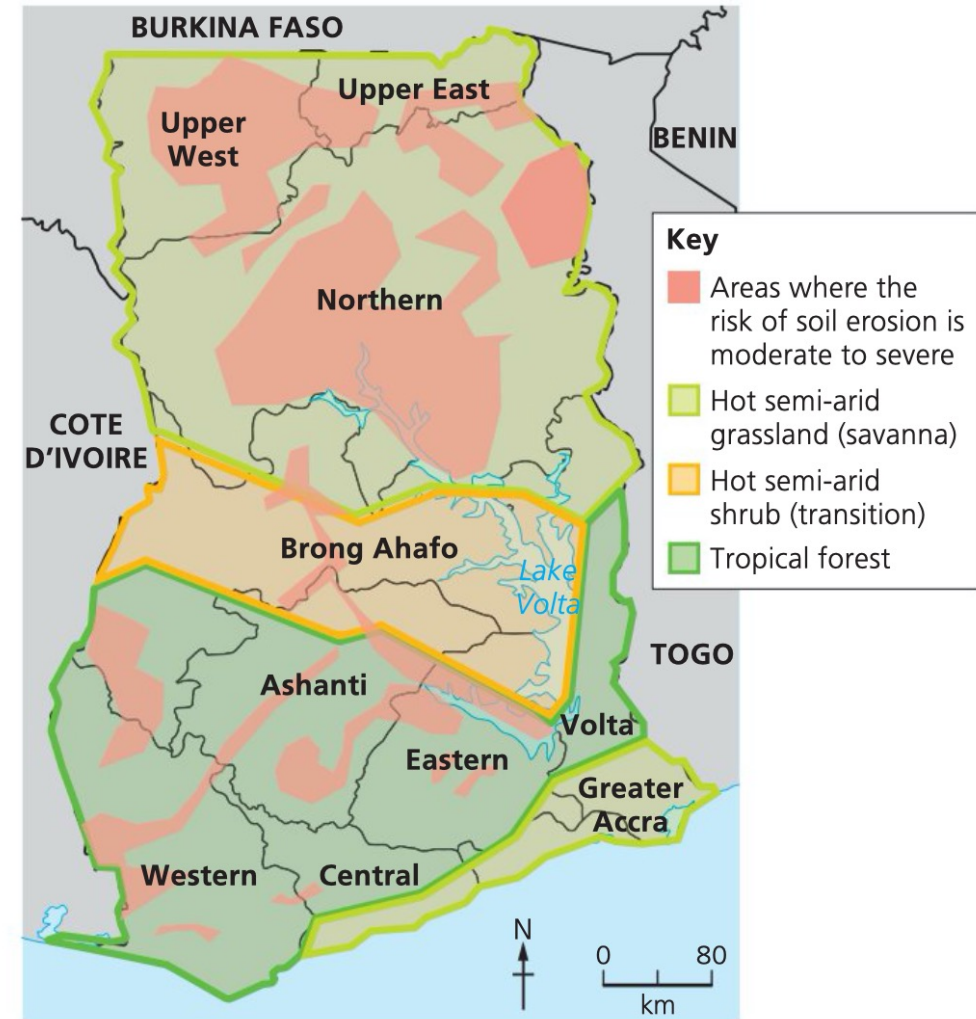
## How poor land management leads to desertification



# Ghana

Ghana is a tropical country in West Africa.

Northern Ghana has a hot semi-arid climate with a dry trees are used for firewood and shrubs are over-grazed so soil erosion has become a serious issue in the Northern, Upper West and Upper East regions, season that can last up to 8 months of the year Climate change is also affecting the semi arid regions of Ghana. Rainfall patterns seem to be increasingly unpredictable, Crop failures and the death of livestock lead to economic losses for farmers., food shortages and higher food prices. According to UNICEF, one in five children in Ghana ha stunted growth because they are suffering from chronic malnutrition



# Management of Desertification

Method	Advantages	Disadvantages
<b>1. Drought resistant crops</b>	Crops which can still produce food in a region, even when rains are poor. These include: Chickpea, groundnut and millet	<b>These new varieties are more expensive than traditional seeds (as they are developed by large companies in HICs) and farmers struggle to afford them.</b>
<b>2. Drip irrigation</b>	Water is delivered directly to the root of the plant, reducing loss by evaporation	Initial cost is high.
<b>3. Rainwater harvesting</b>	Construction of roofs that collect rainwater that can then be stored in large tanks until it is needed. This provides some water for survival as well as irrigation.	This requires rainfall and construction using techniques from foreign NGOs. This may not be available widely enough to be a viable option overall.



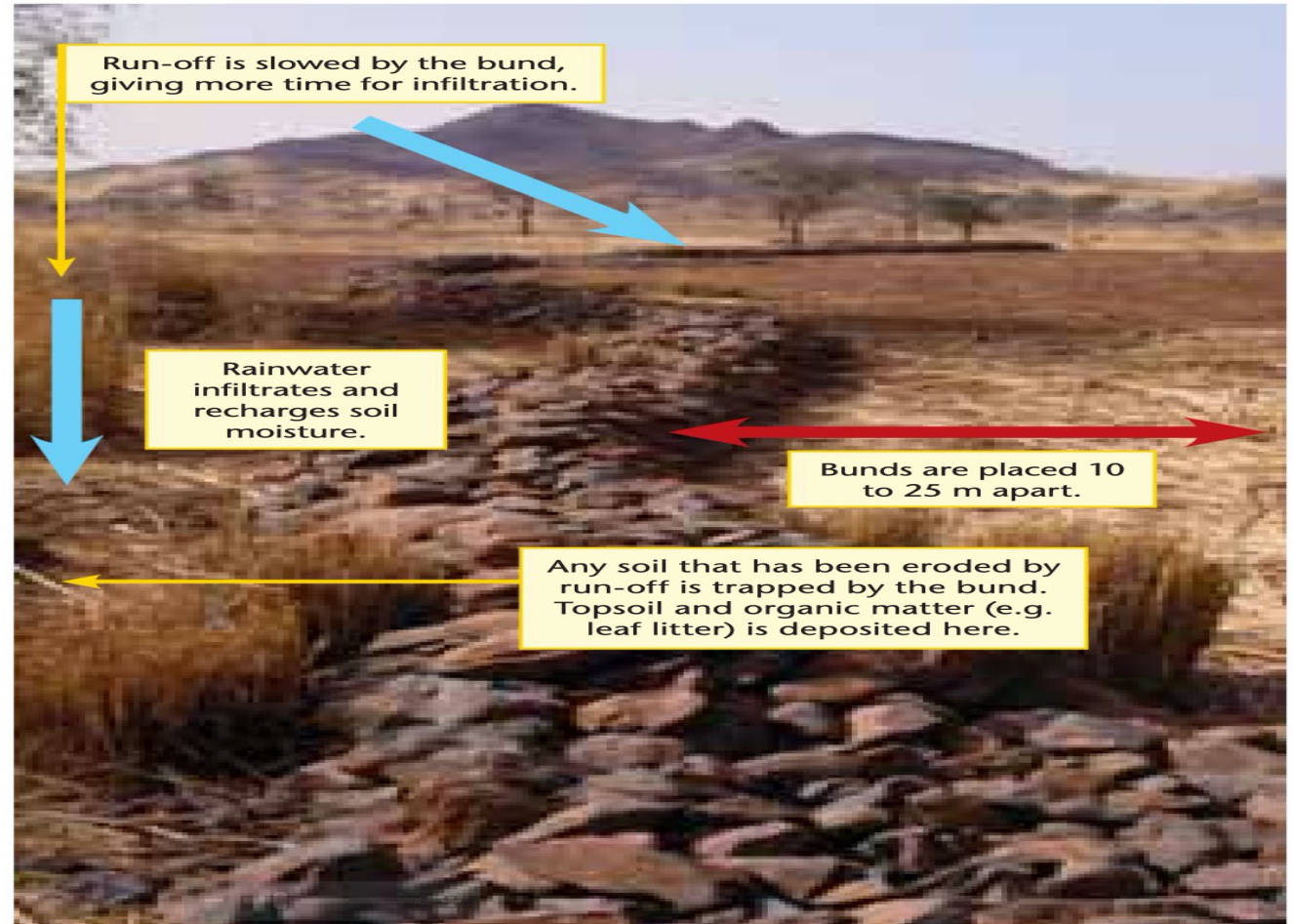
**Drip Irrigation**

## Bunds / Magic stones

### 4. Bunds / Magic Stones

Construction of stone walls prevent soil erosion and surface runoff during periods of heavy rain. This encourages **infiltration** and recharges soil moisture. These are a cheap, no technology sustainable solution .

However, You actually need rain to fall in the first place for these to work as intended.





# The Great Green Wall ( GGW )

## 5. The Great Green Wall

The GGW is an initiative where 11 countries are working in partnership with one another. The plan is to plant a 15km-wide strip of land with trees and shrubs across the width of Africa ( 8000km! ) It is hoped that this wall of vegetation will help prevent further soil erosion from the Sahel and improve incomes

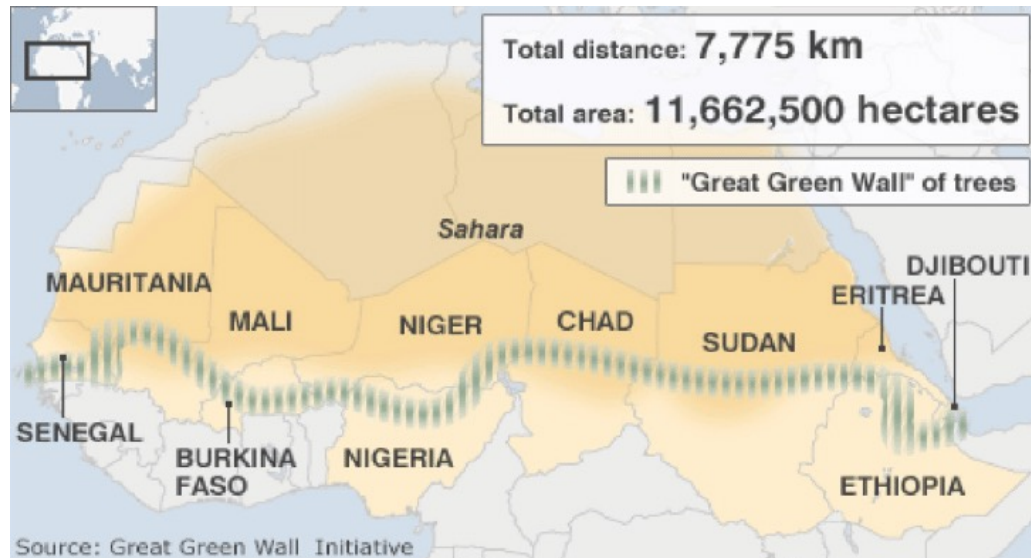


Successes	Problems
Reduces soil erosion during the rainy season	Huge progress made by some countries ( e.g. Niger and Senegal ) but poor progress made by the other 9 countries
Farm income diversified by growing fruit trees	Some local communities do not feel as though they have been involved in the decision making progress and they feel suspicious
Plant food can be used for livestock / cattle	Large areas of the wall are uninhabited, meaning there is no one there to plant and care for the trees
Reduces the amount of time women spend collecting firewood	One country in the chain might lose the will or not have the money to continue with the project
Increases the ability of communities to cope with climate change	Cost is \$8 billion
Fallen leaves improve soil fertility	
Trees will provide shade for crops and increase their yield	

## GCSE Weather and Climate: summary of Desertification in the Sahel

**Location:** The Sahel, Southern border of the Sahara Desert  
**Distance:** 3670 miles, from Senegal (West) to Eritrea (East)

**The Problem:** The Sahel is vulnerable to drought which has led to frequent famine and the death of millions of inhabitants. Prolonged drought and strain on the land are causing the Sahara Desert to spread southwards, a process known as desertification.



### Desertification in The Sahel:

#### Causes of Desertification

- Overgrazing AND over-farming
- Deforestation
- Climate change (erratic rainfall and drought)
- Population growth (more pressure to grow more crops)

#### Effects of Desertification

- Soil becomes less usable (nutrients lost)
- Vegetation damaged or lost (soil erosion occurs)
- Food loss leading to famine
- Fewer plant and animal species

#### Responses to Desertification

- Afforestation (Great Green Wall from Senegal to Djibouti)
- Terracing // use 'Magic Stones'
- Irrigation (water the land AND drip irrigation)
- Responsible farming (drought resistant crops)