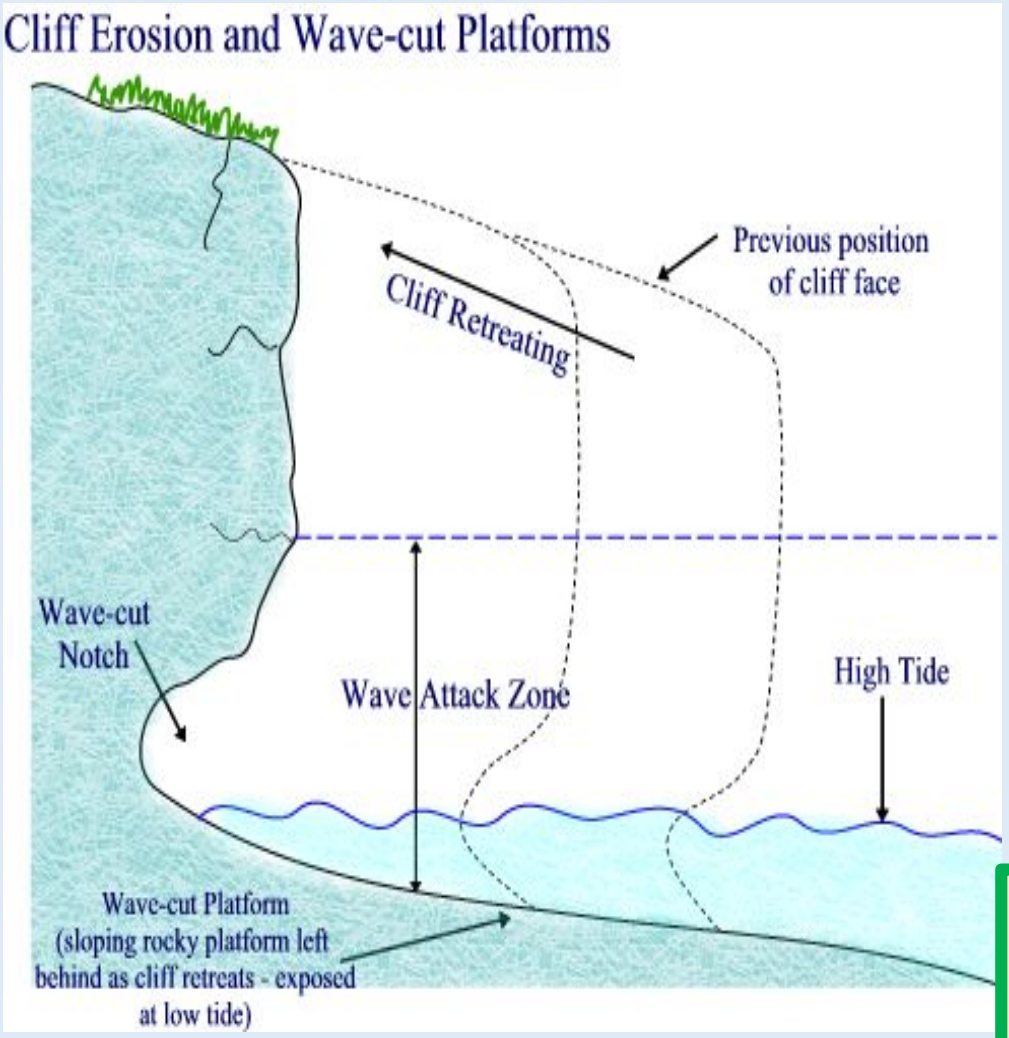
COASTAL LANDSCAPES AND PROCESSES

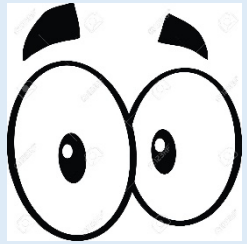
Landforms of Coastal Erosion

Wave Cut Platforms



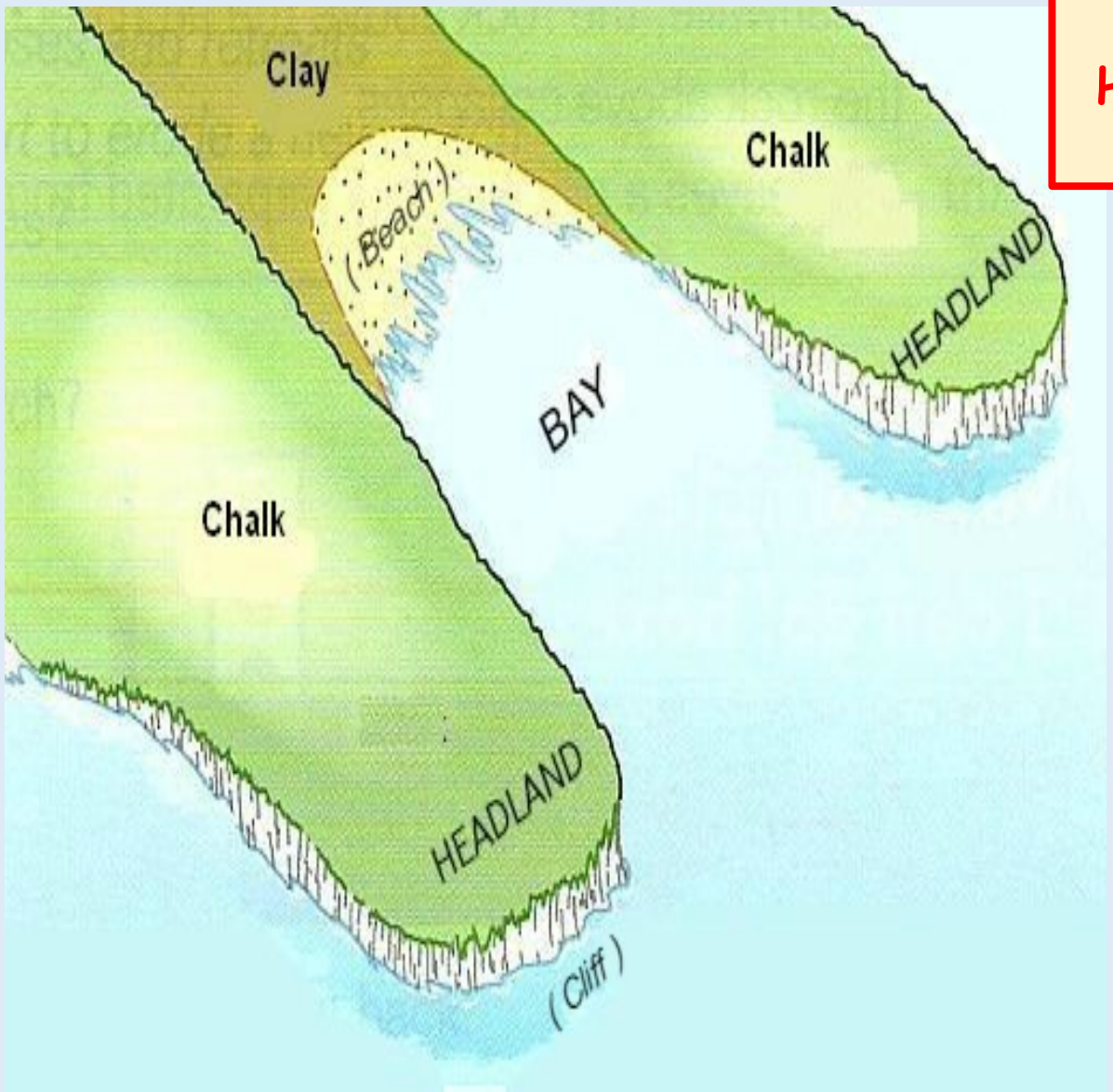
You MUST include HYDRAULIC ACTION & ABRASION

1) Destructive waves = high tide = erode base = **WAVE CUT NOTCH**
2) Cliff collapses = gravity
3) Cliff retreats = erosion = smooth platform = **WAVE CUT PLATFORM**



Say what you see:
Height of the WAVE CUT PLATFORM
Features on diagram e.g. beach, notch

Landforms of Coastal Erosion



You MUST include HYDRAULIC ACTION & ABRASION

Headland = hard rock

Bay = soft rock

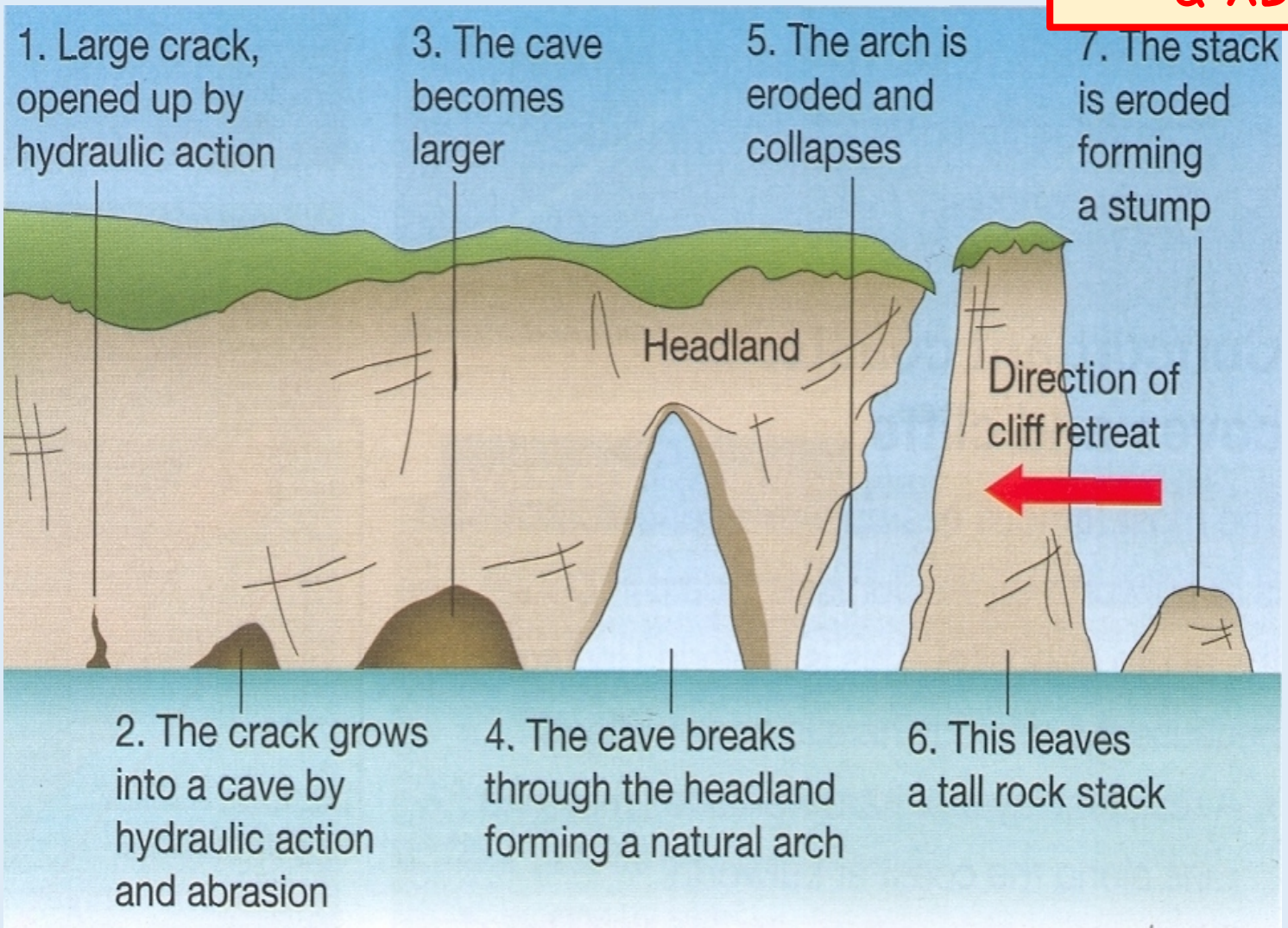
Soft rock = easily eroded

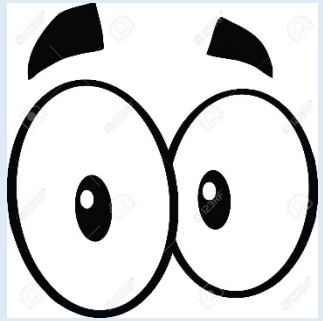
Hard rock = more resistant

Landforms of Coastal Erosion

Cave, Arch, Stack, Stump

You MUST include HYDRAULIC ACTION & ABRASION



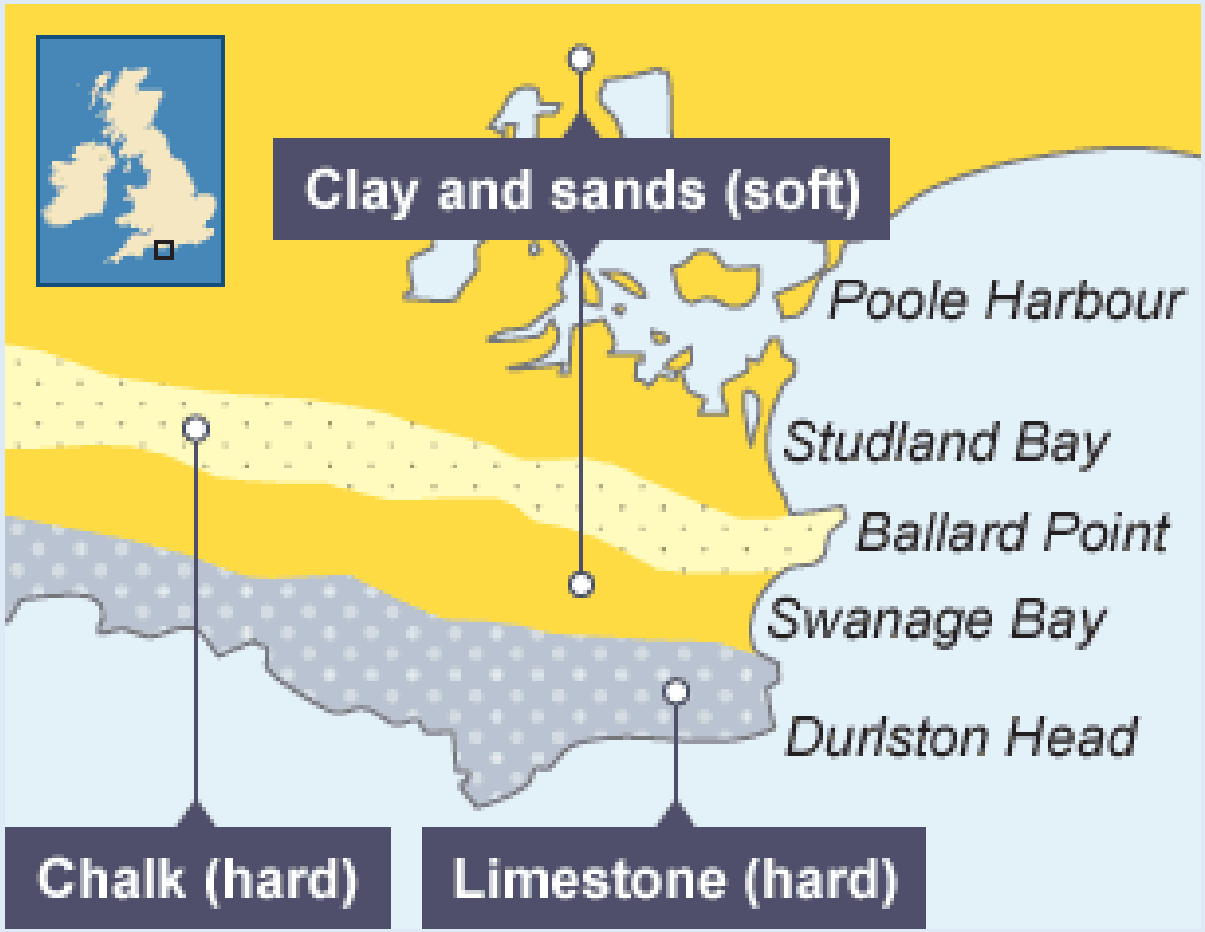


Say what you see:

Height of the WAVE CUT PLATFORM

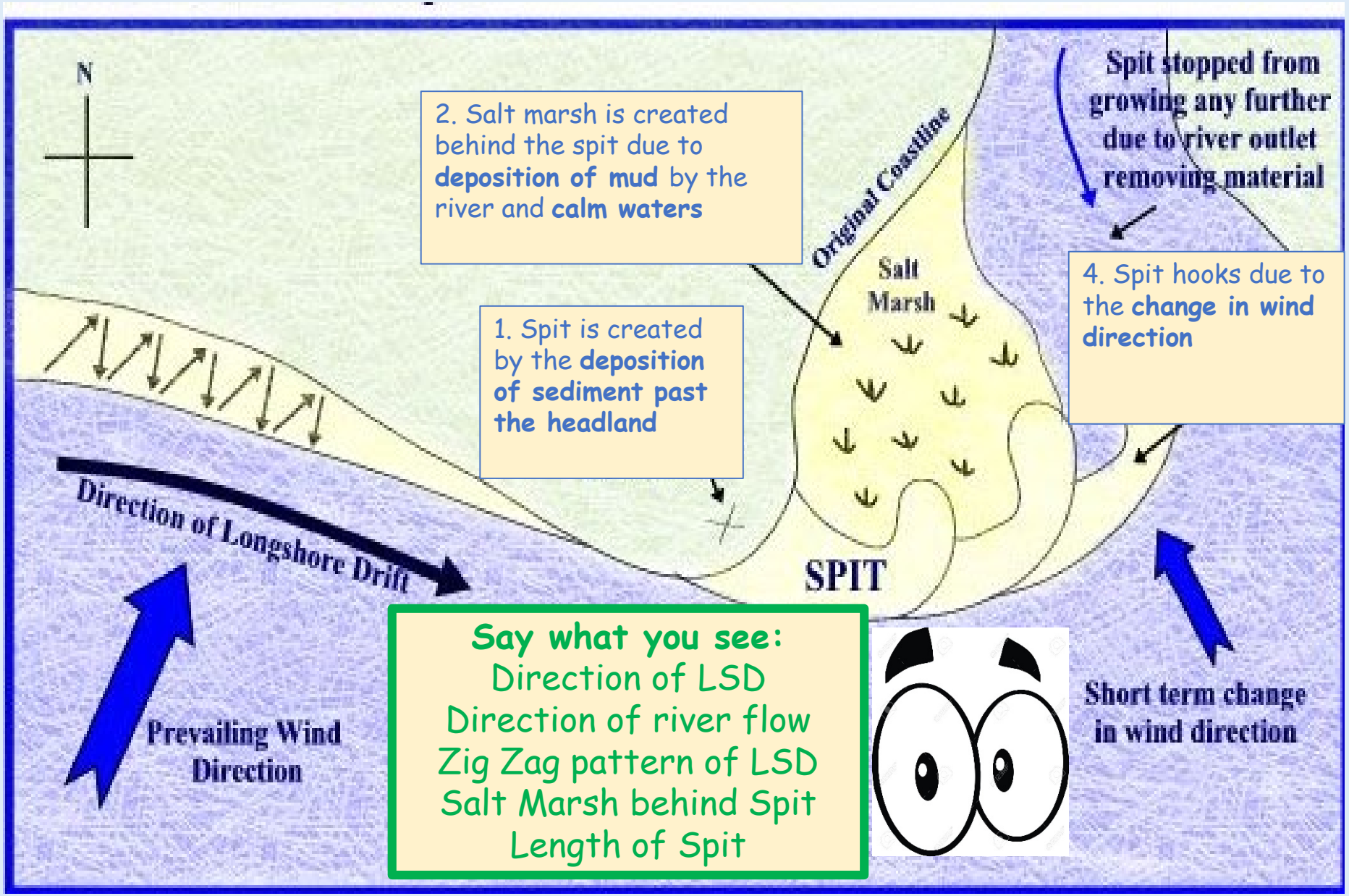
Features on diagram e.g. beach, notch

Swanage - Geology



Formation of a Spit

You MUST explain LONGSHORE DRIFT

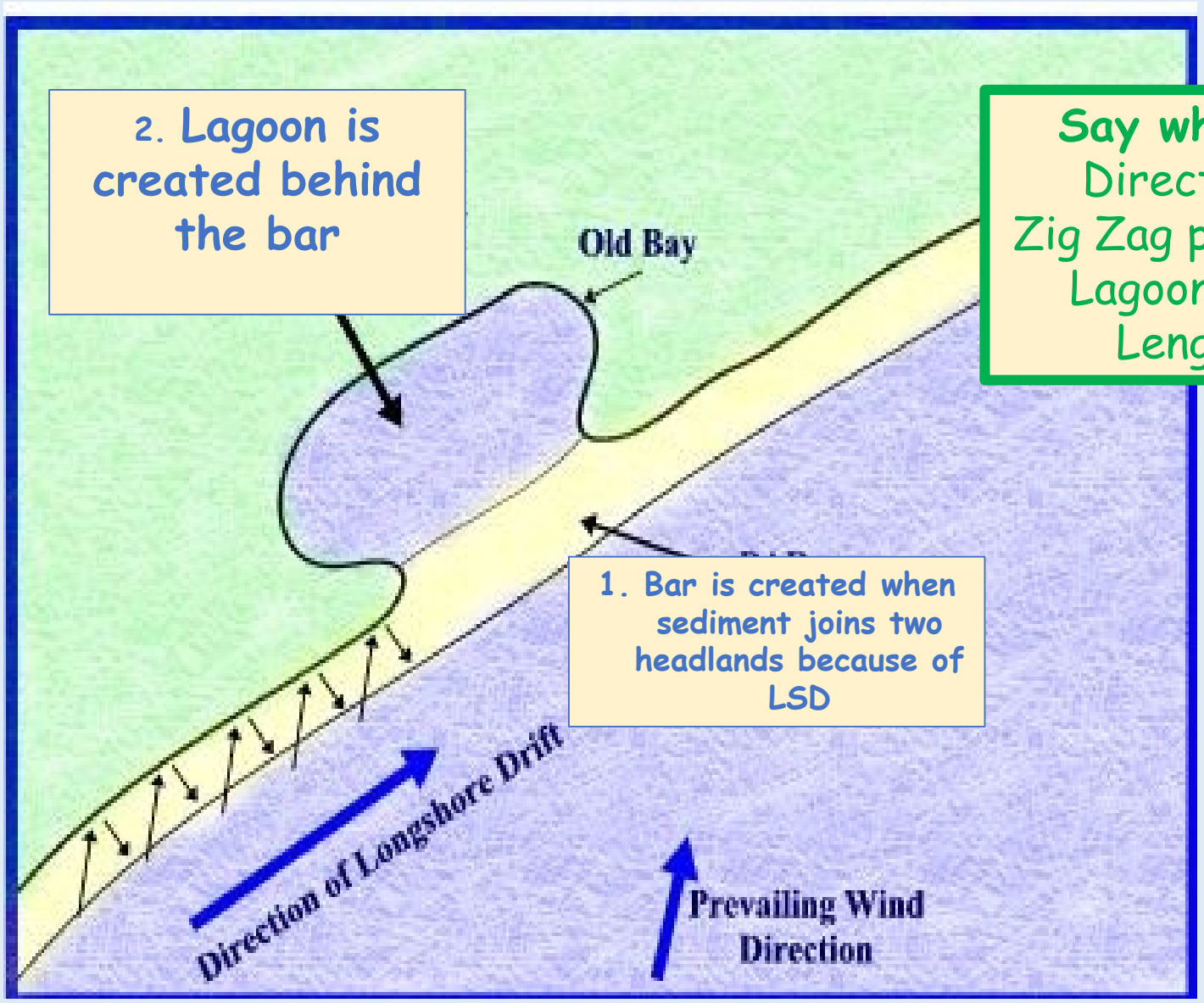


Say what you see:

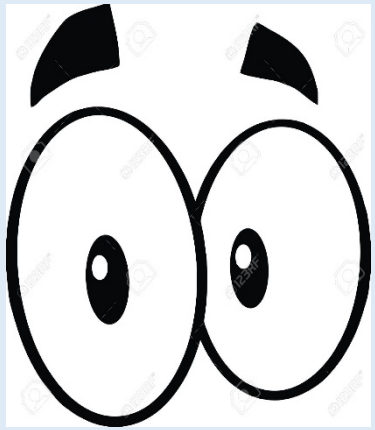
Direction of LSD
Direction of river flow
Zig Zag pattern of LSD
Salt Marsh behind Spit
Length of Spit

Formation of a Bar

You MUST explain LONGSHORE DRIFT



Say what you see:
Direction of LSD
Zig Zag pattern of LSD
Lagoon behind Bar
Length of Bar



Sand dunes

1. A sand dune is a mound of sand created by **wind.**
2. The wind blows grains of sand into **sheltered areas** behind an **obstacle usually vegetation.**
3. Grains of sand **accumulate** over time.

Hard Engineering Techniques

Sea Walls - curved concrete walls to reflect the waves back out to sea

☺Effective

☺Include a promenade or walkway which encourages tourism

☹Ugly so can put off people

☹Expensive to build and maintain

Rip Rap - large boulders piled at the foot of the cliff

☺Boulders break the waves dissipating the energy

☺Cheap and easy to maintain

☹Do not fit into the environment

☹Limit access to the beach putting off tourists

BOTH OF THESE STOP EROSION

Groynes - wooden or rock structures built at right angles to the beach to trap sediment

☺Quick to build

☺Trap sediment and broaden the beach so more friction

☹Ugly so can put off people/restrict access to the beach

☹Takes sediment out which can have an impact along the coast

STOPS LONGSHORE DRIFT

Soft Engineering Techniques

Beach nourishment – sand added to the beach to make it higher or wider

☺The beach can absorb more wave energy = less erosion

☺Cheap

☹Needs maintenance = expensive

☹Maintenance occurs in summer = disruption to tourists

Sand Dune regeneration – grasses/bushes/trees planted to stabilise dunes

☺Natural so attracts wildlife and habitats and tourism

☺Cheap

☹Areas have to be fenced off so puts off tourism

☹Takes time for vegetation to establish

Managed Retreat

Managed retreat allows the sea to flood or erode an area of low value land.

+ Create a large natural salt marsh = a barrier to sea helping to protect surrounding land
+ Creates habitats

- People forced to move from area

Case Study: Lyme Regis

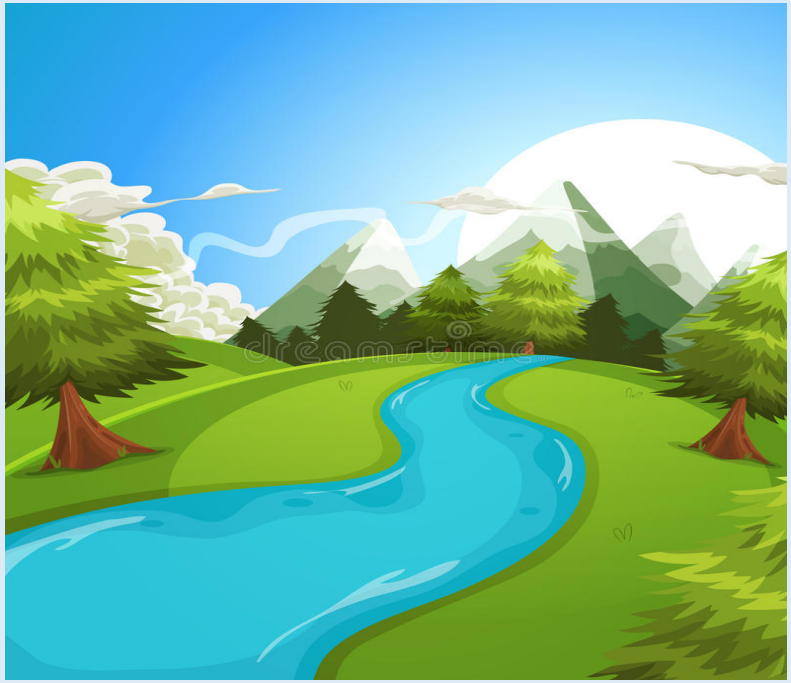
Location and Background
Located on the south coast of the UK in Dorset

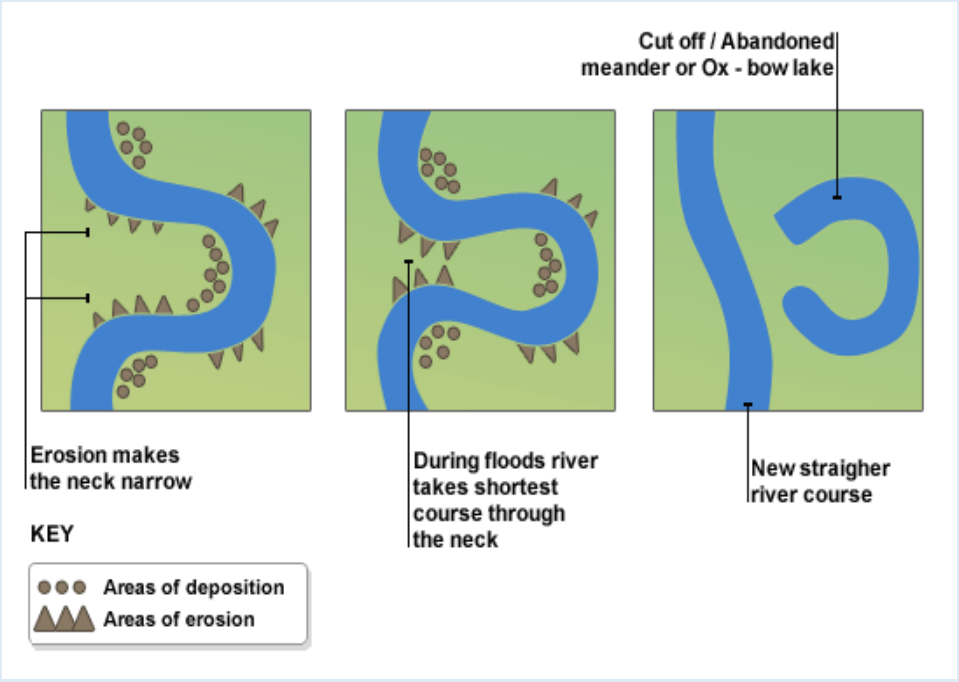
Issues
Unstable cliffs, powerful waves from the long fetch in the South West cause rapid erosion, damage to properties and sea walls breached

Management
New sea walls and promenades built, cliffs stabilised, wide sand and shingle beaches created to absorb the wave energy and extensions of the current rock armour to absorb and further wave energy. Total cost = £43 million

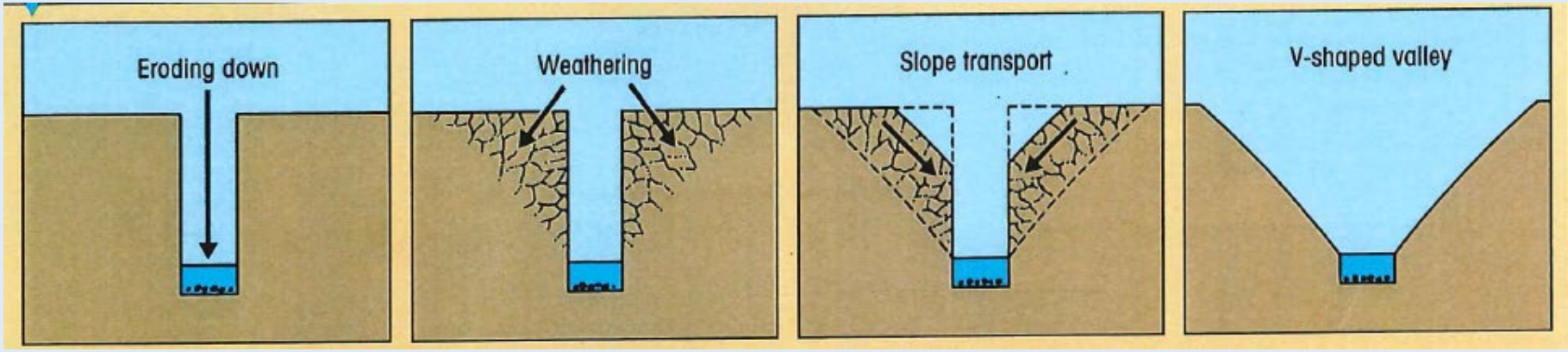
Success v Failure
More tourism but causes conflict with traffic
New defences withstood storms but some think it spoils the landscape

RIVER LANDSCAPES



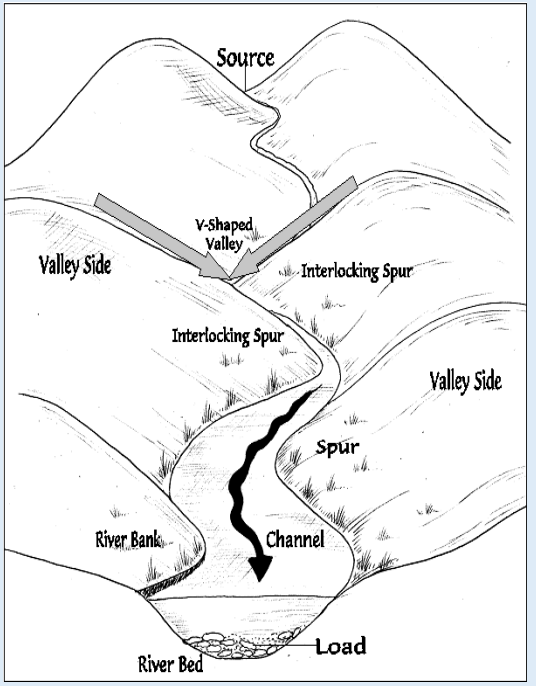


Formation of a V-shaped valley & Interlocking Spurs

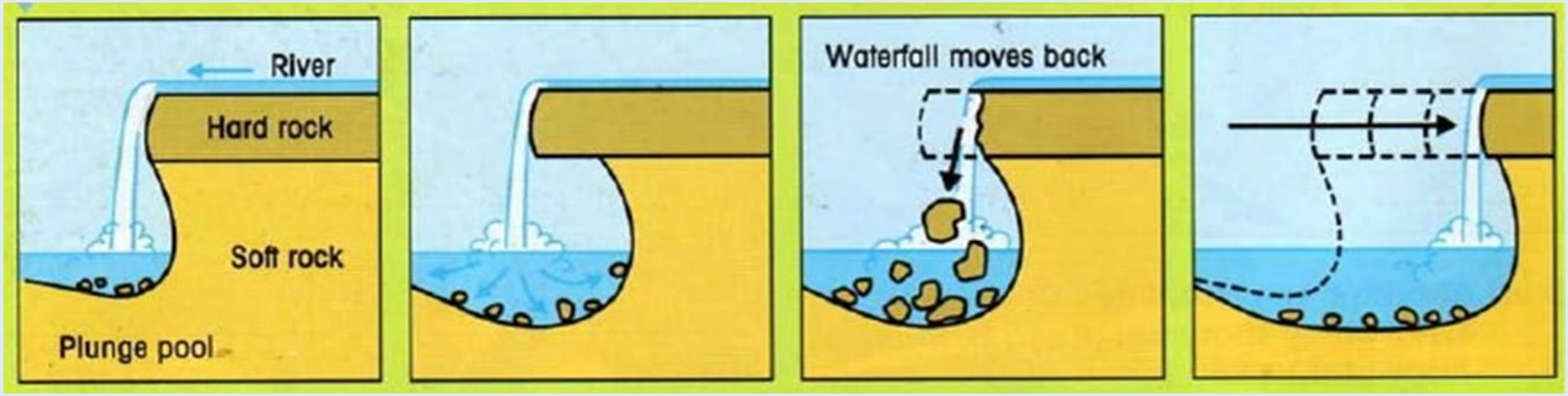


1. VERTICAL EROSION
2. WEATHERING (freeze thaw, biological, chemical) of sides
3. Material collapses into river
4. V-SHAPED VALLEY is formed

INTERLOCKING SPURS OF HARD OUTCROPS OF ROCK THAT ARE MORE RESISTANT TO THE EROSION OF THE RIVER



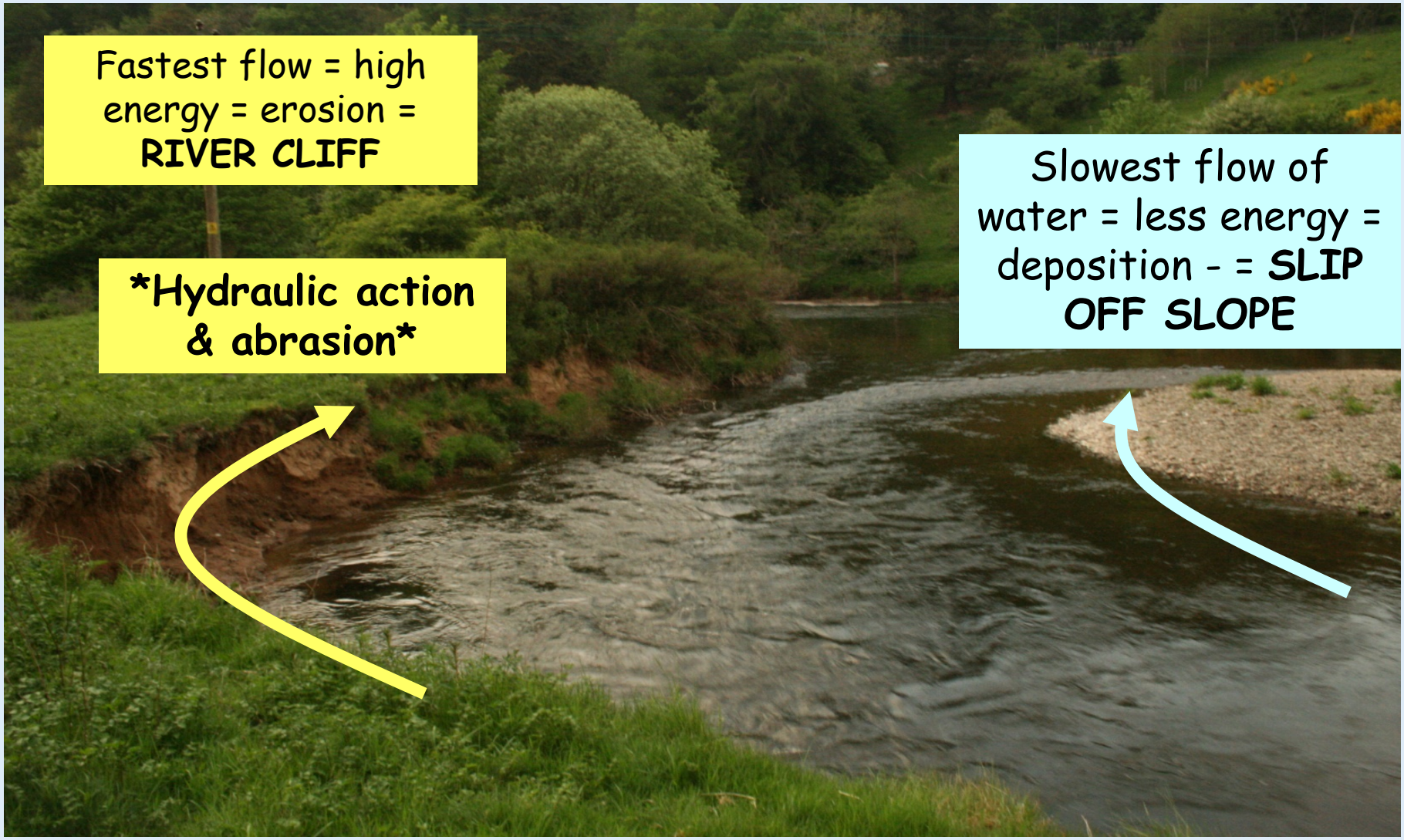
Formation of Waterfalls



1. Layers of **HARD** and **SOFT** rock
2. **SOFT** rock **erodes**, **undercutting** hard rock
3. OVERHANG collapses due to **gravity**
4. **Attrition** creates **PLUNGE POOL**
5. Waterfall **RETREATS** creating a **GORGE**

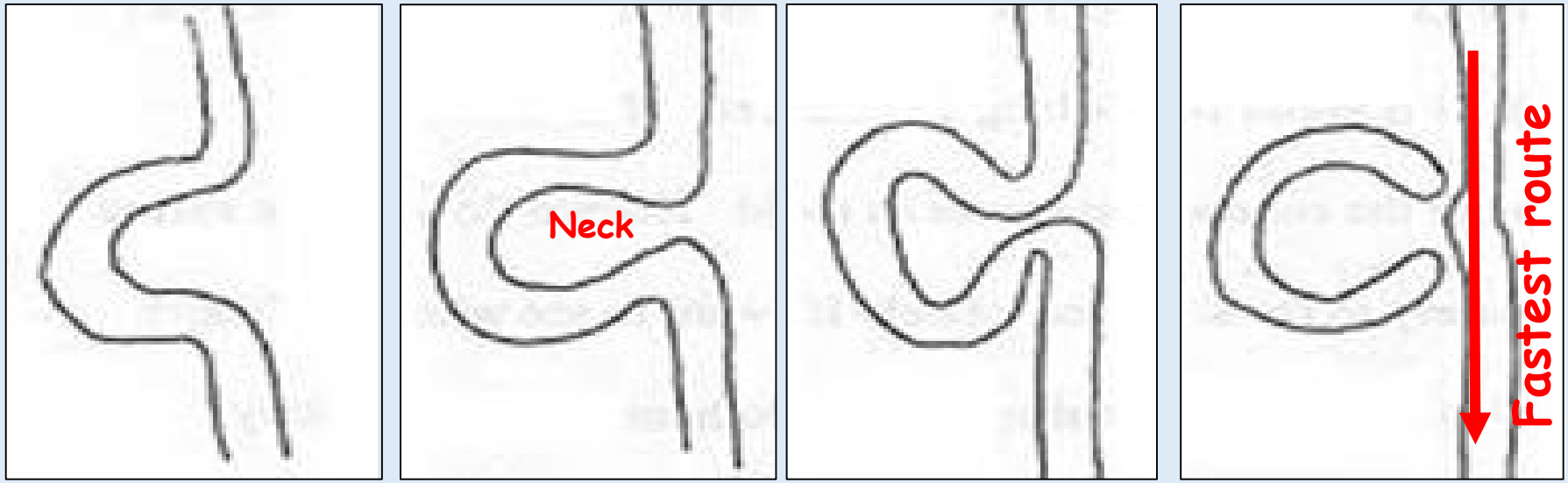
You MUST include HYDRAULIC ACTION & ABRASION

Formation of River Cliffs & Slip Off Slopes



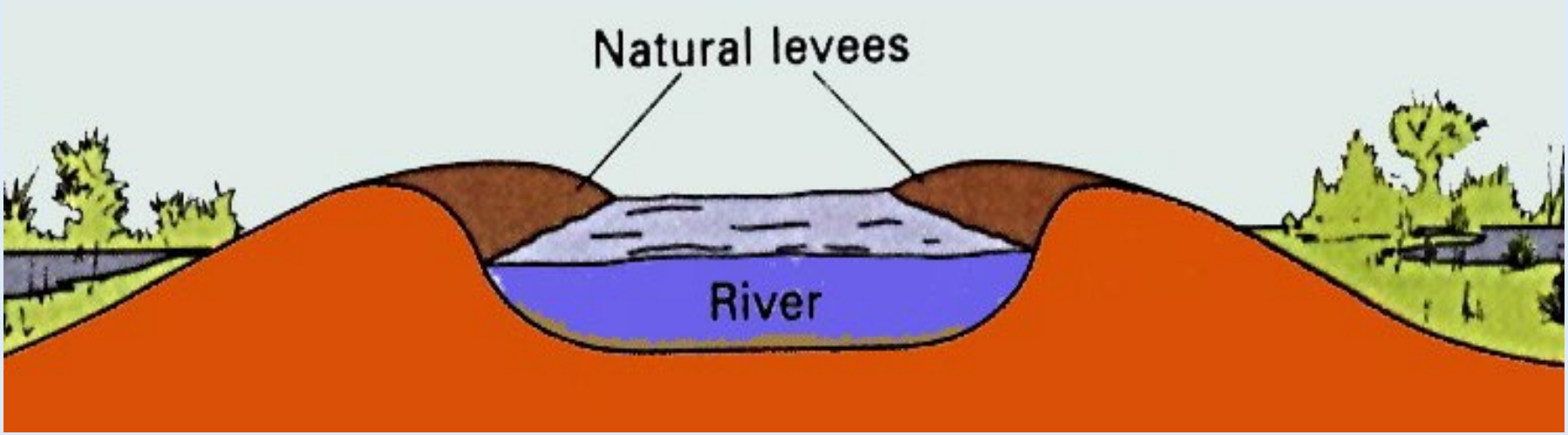
Formation of Ox Bow Lakes

FLOOD EVENT!



1. Fastest flow erodes OUTSIDE BEND
2. NECK narrows
3. FLOOD EVENT! = fastest route
4. DEPOSITION after flood = cut off
5. OX BOW LAKE is formed

Formation of Levees & Floodplains



1. River FLOODS
2. HEAVIEST material is DEPOSTIED
3. Continuous flood BUILDS up river bank = LEVEE

1. River FLOODS
2. LATERAL erosion occurs
3. Material is DEPOSTIED
4. Meanders MIGRATE = FLOODPLAIN

Estuaries

1. River meets the sea
2. As the tide rises river can no longer flow into the sea = loss of velocity
3. Deposition occurs = MUD FLATS which become salt marshes

Banbury

Why?

1998 – Flooding closed railway, shut roads & £12.5M worth of damage.

Strategy

Flood defence scheme

- ✓ 2.9KM earth embankment
- ✓ A361 road raised
- ✓ Flood storage area

Social:

- A361 stays open = less disruption (Can get to work)
- QOL improved – less anxiety

Economic:

- £18.5M
- Protected £100M of homes & businesses

Environmental:

- Habitats created by reservoir along with planting tree & hedges

Human & Physical Causes of Flooding

HUMAN

1. **Deforestation** = leaves **INTERCEPT** rainfall = roots **ABSORB** rainfall = cutting trees down = **MORE** water entering river
2. **Urbanisation** = **IMPERMEABLE** surfaces = water can't **INFILTRATE** = MORE water entering river

PHYSICAL

1. **Intense rainfall**
2. **Snow melt** = WARMER SPRING = snow melt = MORE water enters river.
3. **Geology** = Rocks like clay are IMPERMEABLE = water can't infiltrate = MORE water enters river.
4. **Relief** – STEEP slopes = water enters river faster = flooding

Effects of Flooding

PEOPLE

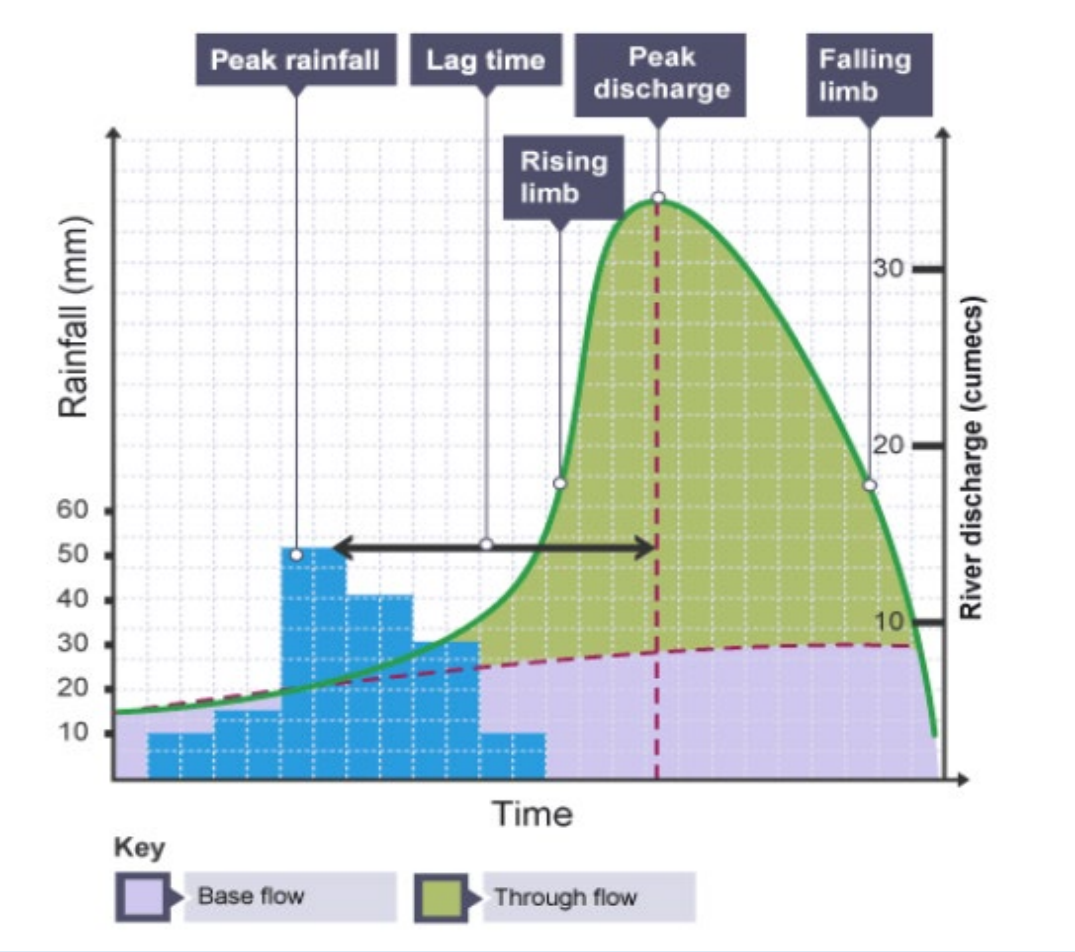
- Loss of belongings
- Damage to property
- Disruption to transport
- Disease & illness (Developing)
- Insurance claims (Developed)
- Contamination of water supplies and loss of services e.g. gas
- Crops and animals lost
- Death

ENVIRONMENT

- Landslides
- Soil contamination by sewage
- Vegetation destroyed
- Animals drowned
- Loss of wildlife habitats
- Soil erosion

Hydrographs

A hydrograph shows how a river's discharge changes after a precipitation event. It shows the relationship between rainfall and river discharge.



Hard Engineering

Dams and reservoirs

+ Reduces water levels in the river and stores water in the reservoir

- Expensive and floods large areas behind = habitat loss

Channel straightening

+ Cuts through meander speeding up the water removing water from the area reducing risk

- Can increase risk downstream as water speed increased

Embankments

+ Increases carrying capacity allowing more water to be held

- Concrete is unnatural and ugly

Flood relief channels

+ These are built to take water away from urban areas

+ At high flow, gates are opened to relieve the channel of excess water (Banbury!!)

Soft Engineering

Afforestation

+ Water absorbed & intercepted = reduction in surface run off

- Ineffective in heavy rainfall

Flood plain zoning

+ Areas at risk can be used for farmland & play fields

- Can be difficult to implement on already developed land

Flood storage areas

+ Reducing risk of flooding downstream by storing excess water

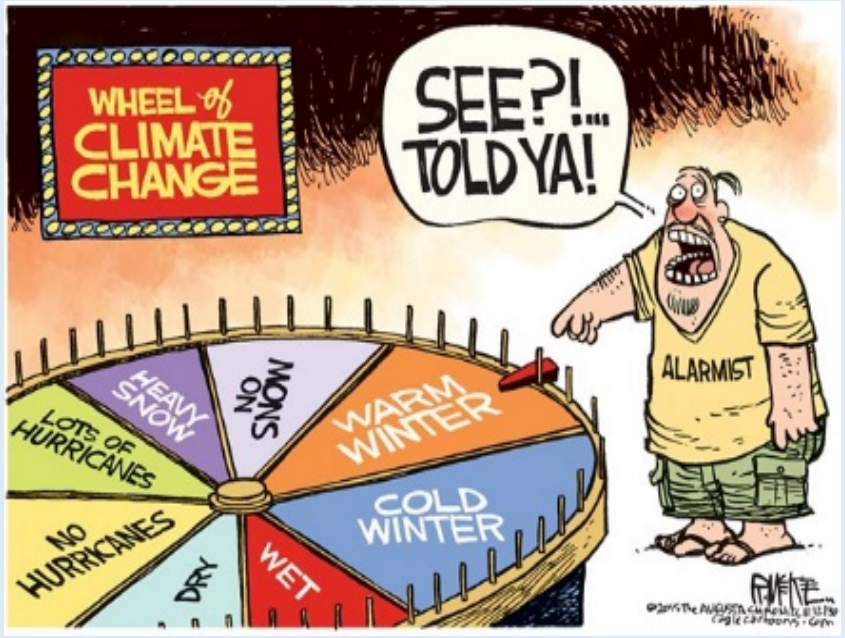
- Loss of habitats as land is flooding

River Restoration

+ Reduce likelihood of flooding downstream

- Slows velocity = flooding

WEATHER AND CLIMATE

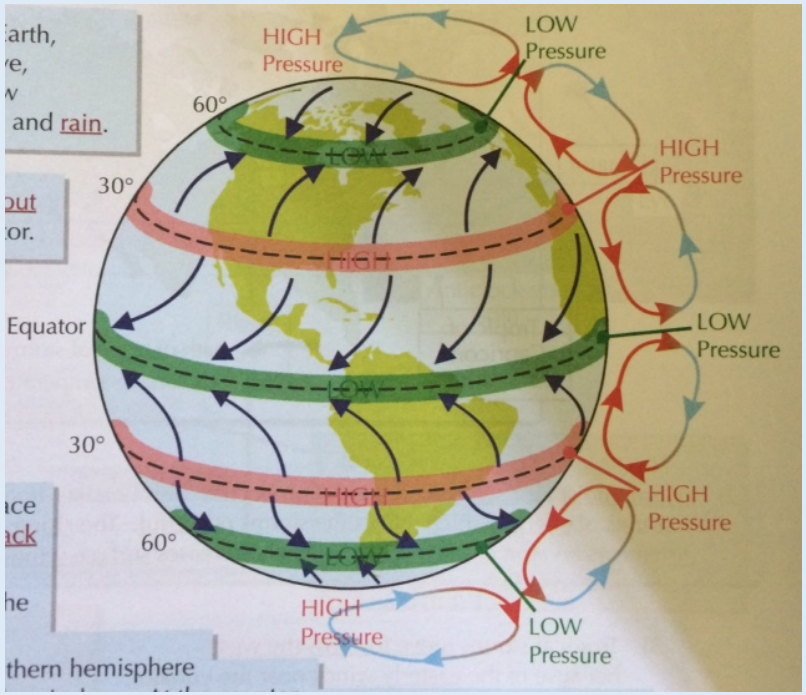


Global atmospheric circulation

Air circulates between High and Low Pressure Belts as Surface Winds.

1. Winds are large scale movements of air caused by differences in air pressure.

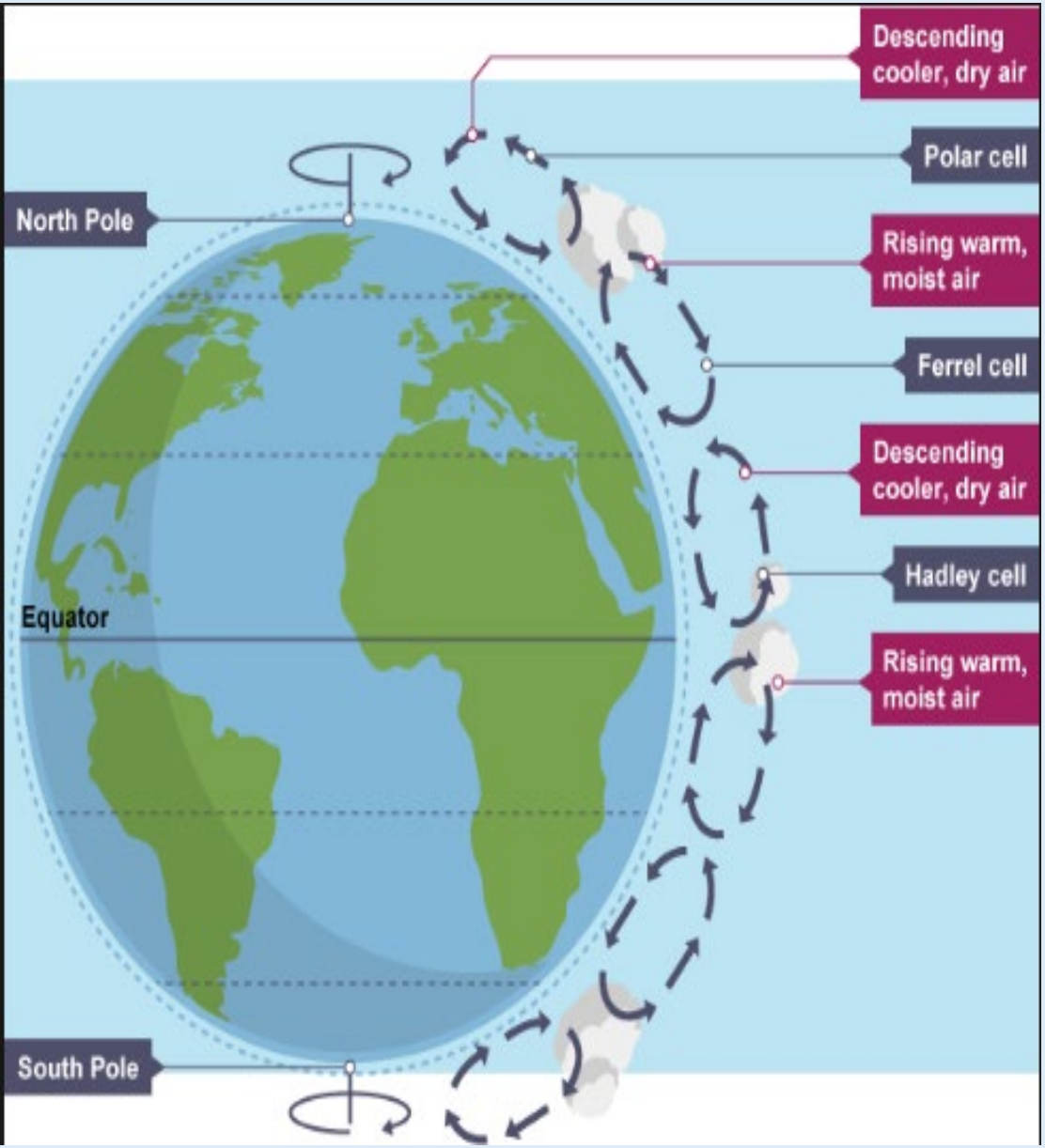
2. Differences in air pressure are caused by differences in temperature between the equator and the poles. Winds move FROM the areas of high pressure TO areas of low pressure.



3. Winds are part of global atmospheric circulation loops (or cells). These loops have warm rising air which creates a low pressure belt, and cool falling air which creates a high pressure belt.

4. There are three loops in each hemisphere. Here's how it all works….

Global Atmospheric Circulation



1. Hadley Cell

Warm, moist air rises at Equator = low pressure = rain = tropical rainforests. This sinks at **30°** North and South = high pressure = dry = hot desserts = Sahara.

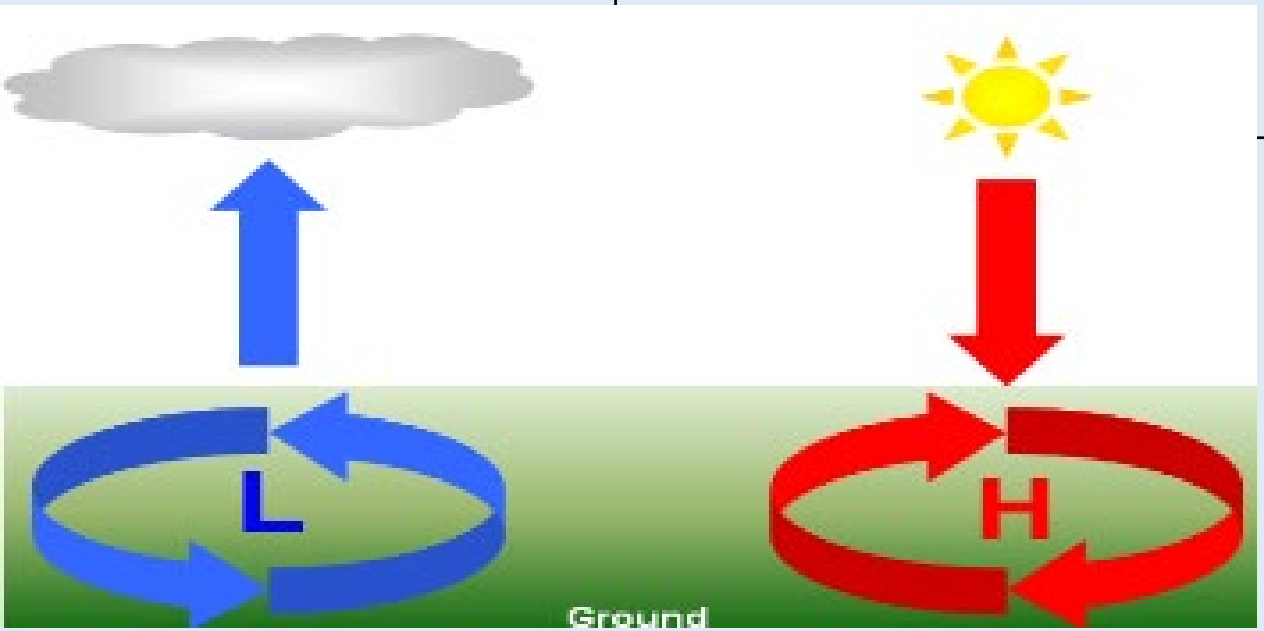
2. Ferrell Cell

Warm air travels North and South to **60°** = rises = low pressure = rain UK.

3. Polar Cell

Cold, polar air sinks at the poles (90°) = high pressure = dry

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



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

Managing Climate Change	
<u>Carbon Capture</u> This involves new technology designed to reduce climate change.	<u>Planting Trees</u> Planting trees increase the amount of carbon is absorbed from atmosphere.
<u>International Agreements</u> Countries aim to cut emissions by signing international deals and by setting targets.	<u>Renewable Energy</u> Replacing fossil fuels based energy with clean/natural sources of energy.

Adapting to climate change
- Changes in agricultural systems need to react to changing rainfall and temperature patterns and threat of disease and pests. -Managing water supplies – eg. by installing water efficient devices and increasing supply through desalination plants. - Reducing risk from rising sea levels would involve constructing defences such as the Thames Flood Barrier or restoring mangrove forests, or raising buildings on stilts.

Effects of Climate Change	
Social	Environmental
- Increased disease eg. skin cancer and heat stroke. - Winter deaths decrease with milder winters. - Crop yields affected by up to 12% in South America but will increase in Northern Europe but will need more irrigation. - Less ice in Arctic Ocean increases shipping and extraction of oil and gas reserves. - Droughts reduce food and water supply in sub-Saharan Africa. Water scarcity in South and South East UK. - Increased flood risk. 70% of Asia is at risk of increased flooding - Declining fish in some areas affect diet and jobs. - Increased extreme weather - Skiing industry in Alps threatened.	- Increased drought in Mediterranean region. - Lower rainfall causes food shortages for orangutans in Borneo and Indonesia. - Sea level rise leads to flooding and coastal erosion. - Ice melts threaten habitats of polar bears. - Warmer rivers affect marine wildlife. - Forests in North America may experience more pests, disease and forest fires. - Coral bleaching and decline in biodiversity.

Natural Causes of Climate Change

Volcanic activity

Eruption = **DUST** and **ASH** = blocks out sun = **COOLER** climate

Milankovitch Cycles

1. Eccentricity

The shape in which the Earth orbits the sun changes every 100,000 years approximately.

Circular = glacial periods Elliptical = inter glacial (warmer) periods

2. Axial Tilt

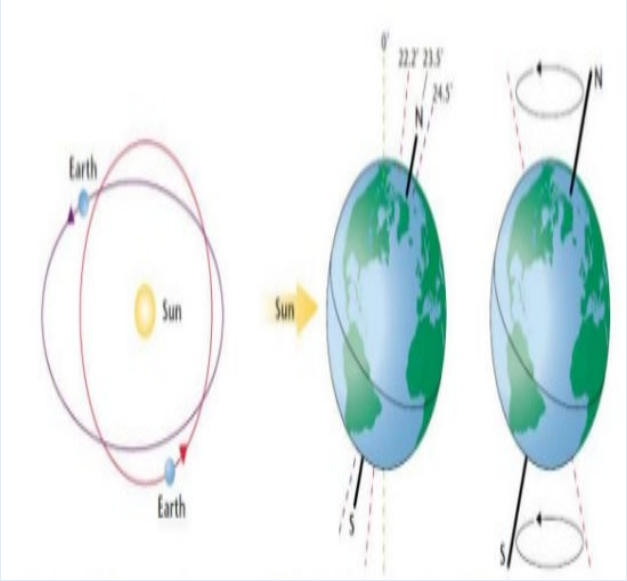
The Earth's axis changes every 40,000 years. The greater the tilt = the warmer the summer and colder the winter

3. Precession

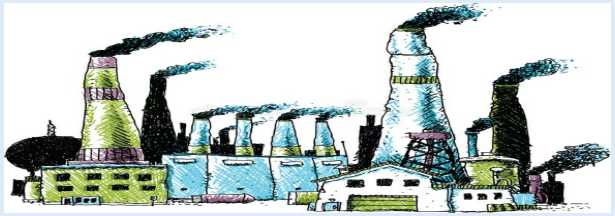
The Earth wobbles on its axis every 24,000 years, this changes the way the axis is facing leading to changes in the seasons.

If you DO NOT understand Milankovitch cycles – CHOOSE VOLCANOES!!!

READ THE QUESTION – Natural or HUMAN (Common error)



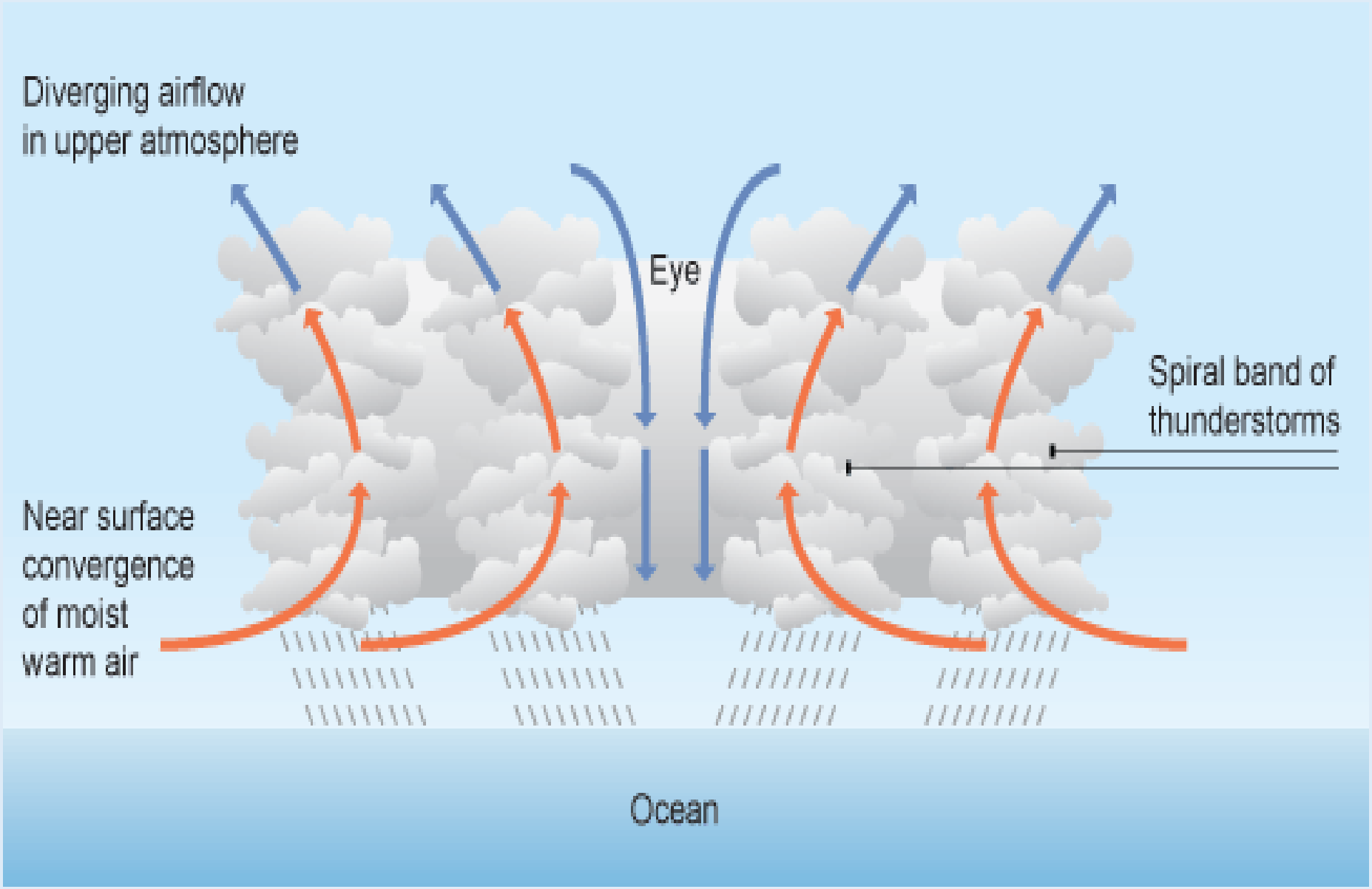
Human Causes of Climate Change



GLOBAL POPULATION IS INCREASING

1. **Industry**
   Rising demand for products = burning fossil fuels = increase in greenhouse gases = greenhouse effect
2. **Energy**
   Population growth = increased demand for electricity = increase in fossil fuel use = increased in greenhouse gases = greenhouse effect
3. **Farming**
   Population growth = increase demand for food = increase in machinery = increase in burning of fossil fuels. ALSO Methane levels increase due to the demand for meat in western diets.
4. **Transport**
   Increased wealth = increase car ownership = increase in air travel = increase in fossil fuel use = increase in greenhouse gases = greenhouse effect
   DEFORESTATION

Formation of Tropical Cyclones



Formation of Tropical Storms

It is important to remember the **simple sequence** for your exam.

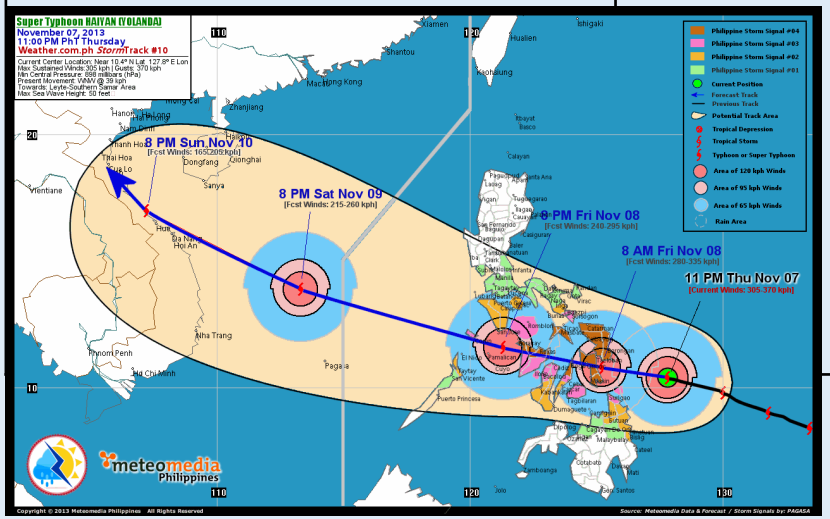
1. Warm air rises
2. As it meets cooler air, cumulonimbus (storm) clouds are created
3. Cool air sinks
4. Coriolis force causes the storm clouds to spin
5. Tropical storm is created

Typhoon Haiyan, 2013 Philippines

- Over 3,000km/h
- FLOODING and LANDSLIDES cause most damage

Impacts	Responses
SOCIAL 6000 people killed 600,000 people made homeless Loss of power Homes were destroyed	**INDIVIDUAL** - Countries like UK, Canada gave money to help towards aid (food, shelter)
ECONOMIC $2 billion worth of damage Damage to infrastructure (roads, railways) prevented access to the island	**ORGANISATIONS** **World Health Organisation** organised medical care to support the government
ENVIRONMENTAL Mangroves damaged Oil spills = water pollution Trees uplifted	**GOVERNMENT** Philippines was declared in a 'State of Calamity' and relied on the aid received from other governments. The UK government provided water, shelter food and household items.

Prediction	Planning	Protection
Monitoring wind patterns allows path to be predicted. Use of satellites to monitor path to allow evacuation	• Avoid building in high risk areas • Emergency drills • Evacuation routes	• Reinforcing windows, doors & roofs • Sea walls to reduce the impacts of storms surges, • Houses near the coast built on stilts in case of floods • Emergency kits



Extreme weather in the UK

- Rain – can cause flooding damaging homes and business.
- Snow & Ice – causes injuries and disruption to schools and business. Destroys farm crops.
- Hail – causes damage to property and crops.
- Drought – limited water supply can damage crops.
- Wind – damage to property and damage to trees potentially leading to injury.
- Thunderstorms – lightening can cause fires or even death.
- Heat waves – causes breathing difficulties and can disrupt travel.

UK weather is getting more extreme due to **climate change**. Since 1980 average temperature has increased 1 degree and winter rainfall has increased.

Somerset floods, 2014

Depressions in January and February brought record rainfall. High tides and storm surges swept the water up the Bristol Channel.

Social, economic and environmental Effects

- 600 houses and 16 farms evacuated
- Villages cut off disrupting work, schools and shopping
- £10 million damage
- Power supply and railway cut off

Immediate responses

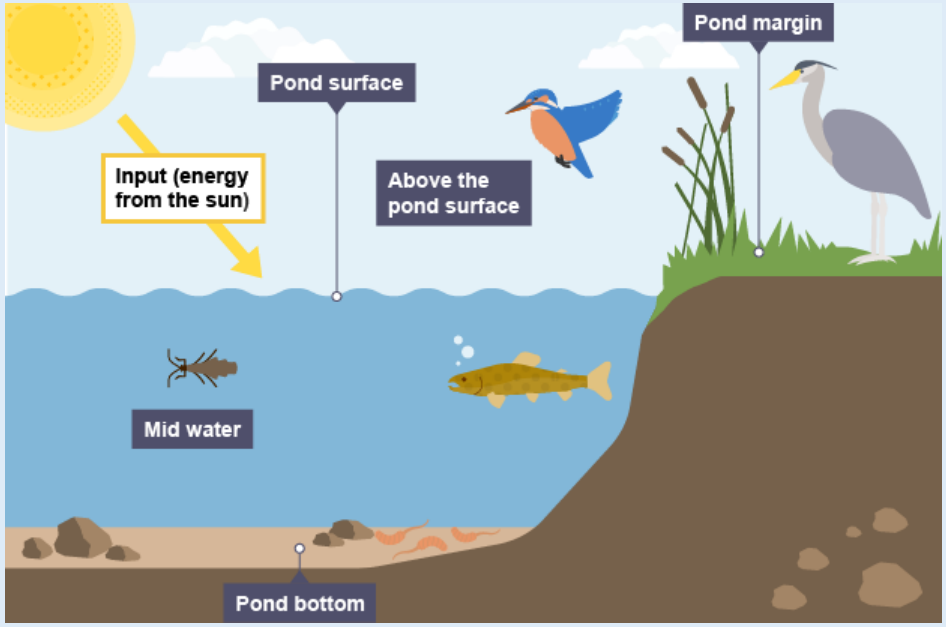
- Media campaign
- Boats used to rescue those stranded
- Community groups and volunteers gave support

Long-term responses

- £20 million Flood Action plan to reduce future risk, 8km of rivers dredged, Roads raised, River banks raised and pumping stations built

ECOSYSTEMS

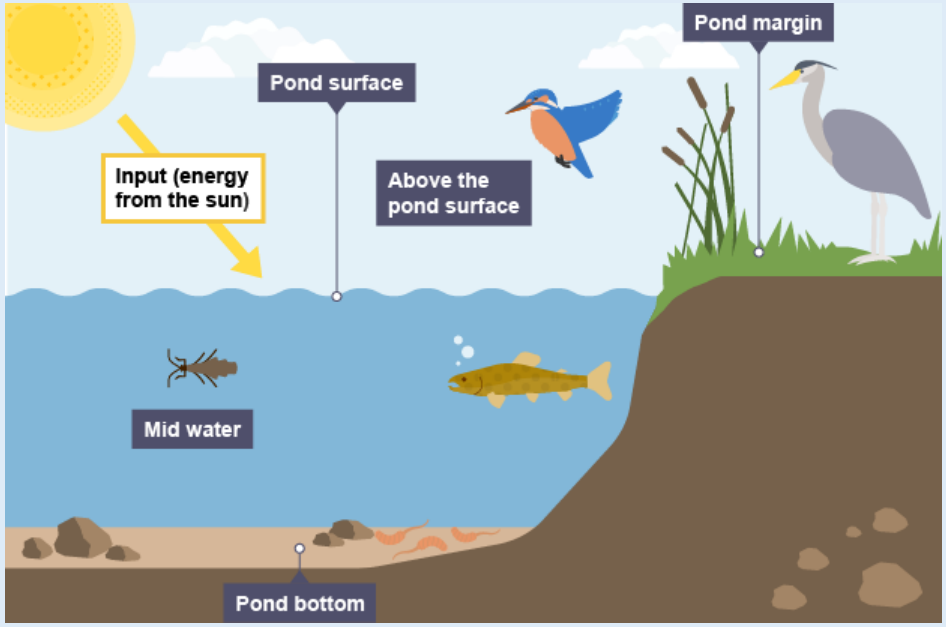
Small scale ecosystems



Pond

An **ecosystem** is a natural environment and includes the **flora** (plants) and **fauna** (animals) that live and interact within that environment.

Small scale ecosystems

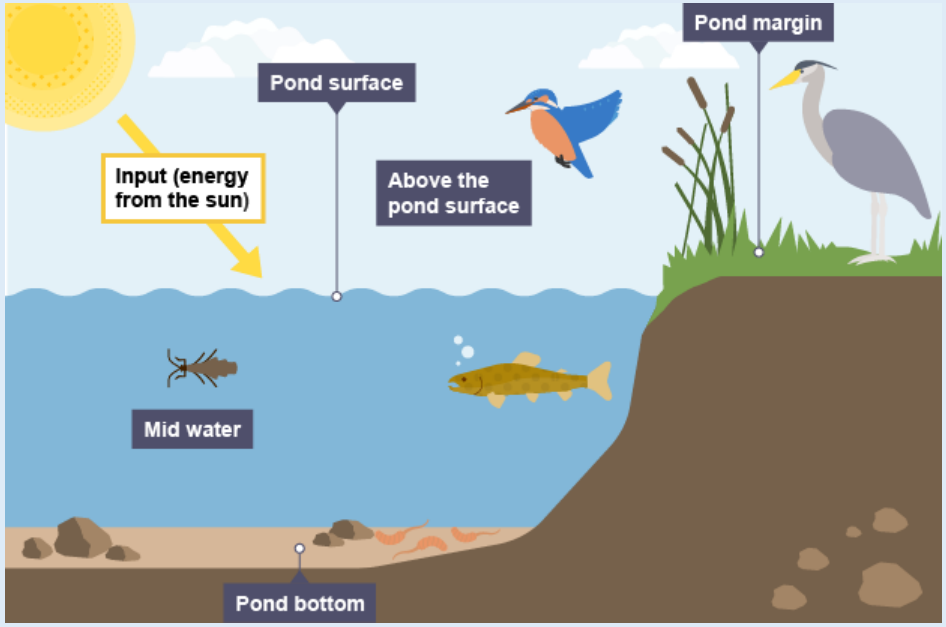


Biotic Factors or living components of the ecosystem: Flora, fauna and bacteria

Abiotic factors or non-living: Ecosystems are dependent on the following abiotic or non-living components:

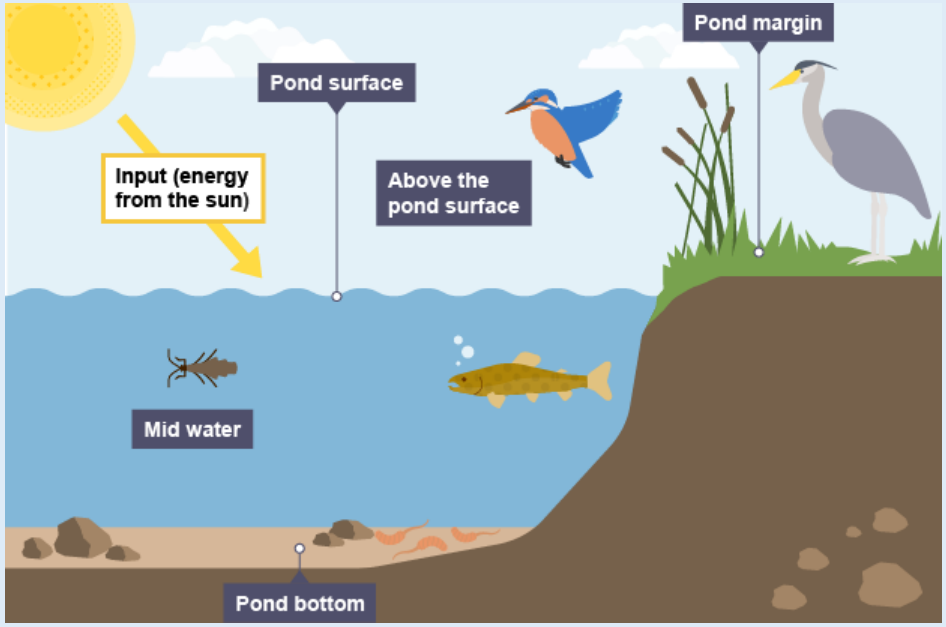
- climate
- soil
- water

Small scale ecosystems



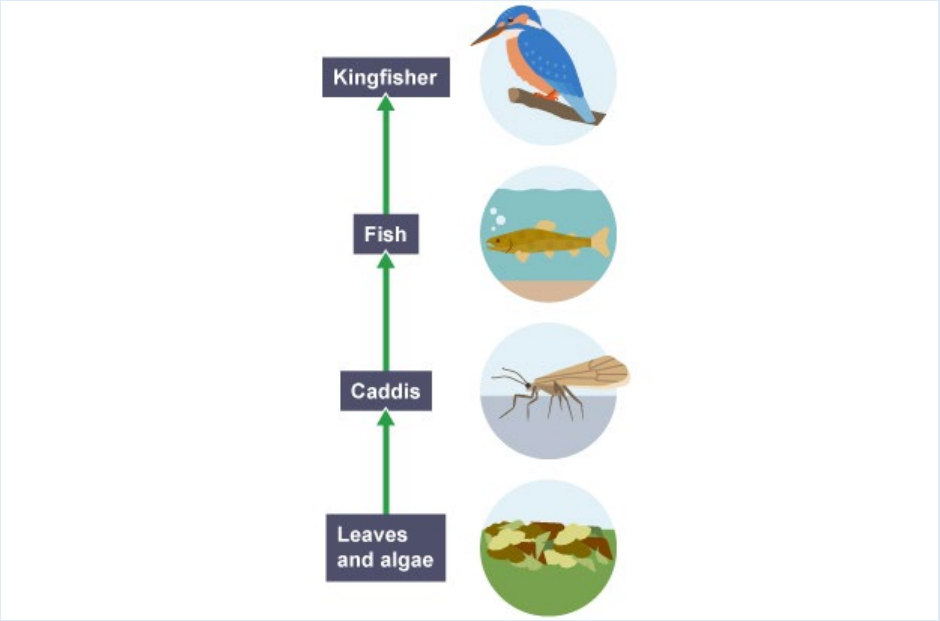
- **climate** - the temperature and amount of rainfall are very important in determining which species can survive in the ecosystem
- **soil** - the soil type is important as this provides nutrients that will support different plants
- **water** - the amount of water available in an ecosystem will determine what plants and animals can be supported

Small scale ecosystems



The **biotic** parts of the ecosystem have a **complex relationship** with the **abiotic** components - changing one will lead to a change in the other.

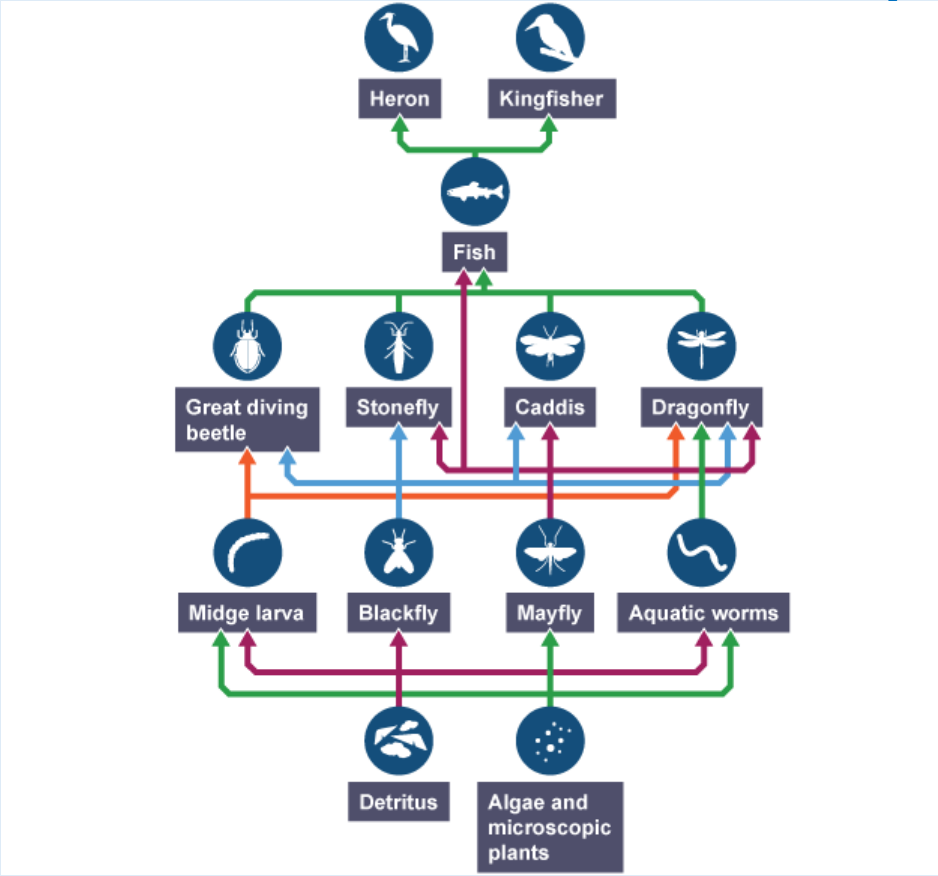
Small scale ecosystems



The food chain

- shows how each living thing gets food - energy and nutrients are passed from one organism to the next.
- The **producer** provides the basic source of food which other organisms, the **consumers**, then feed on.

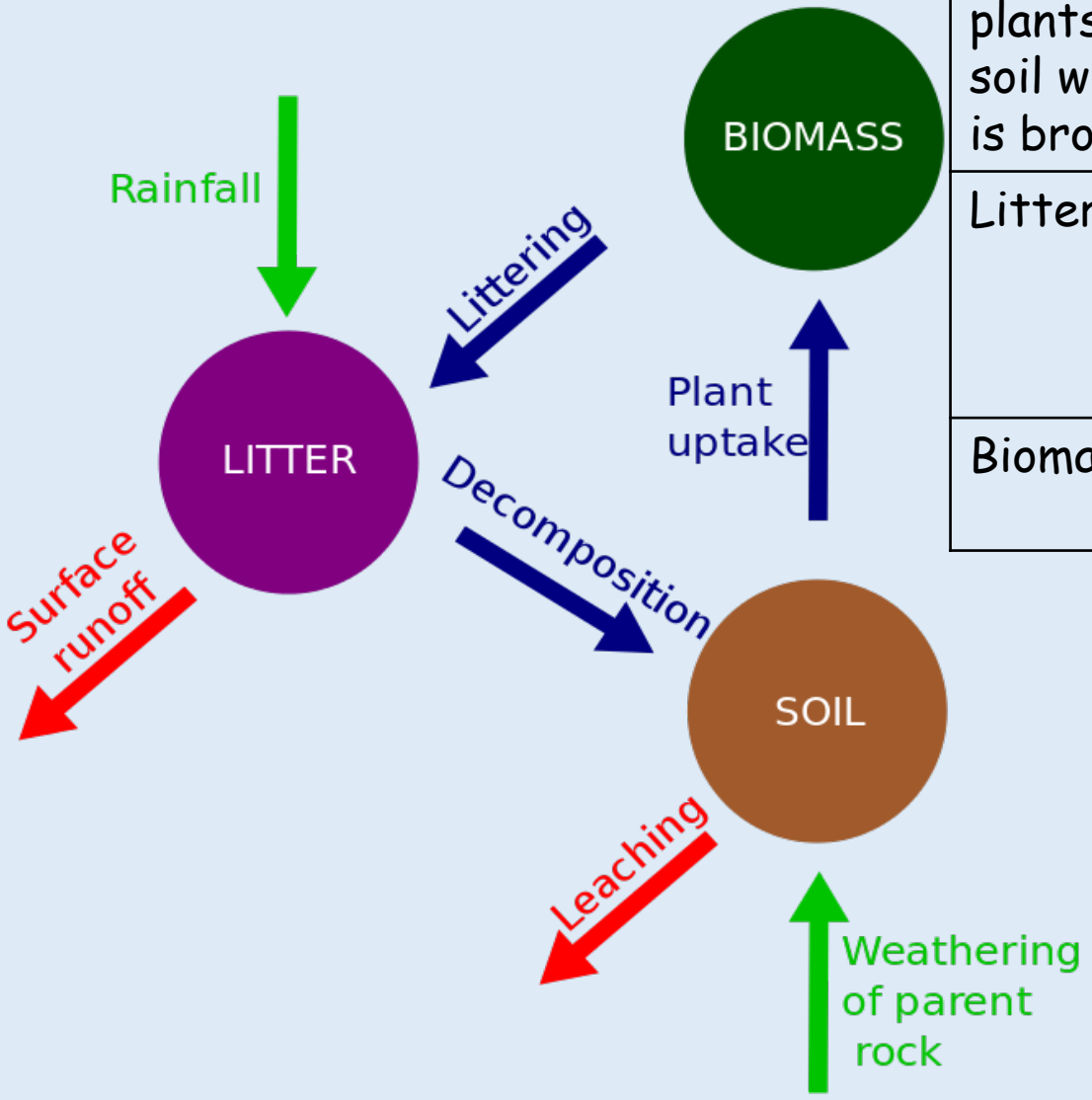
Small scale ecosystems



The food web

This shows what eats what in a certain ecosystem

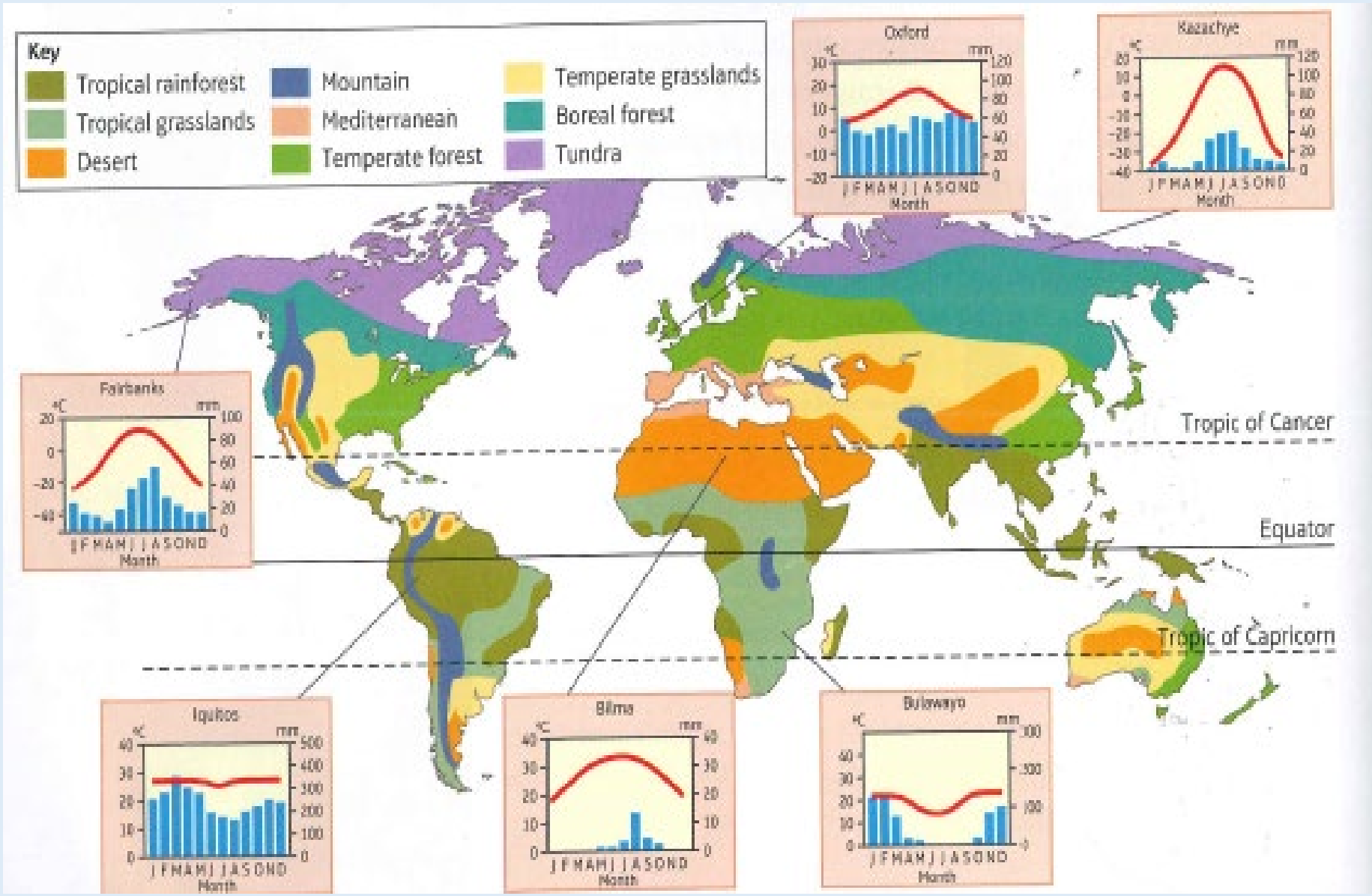
Nutrient Cycle

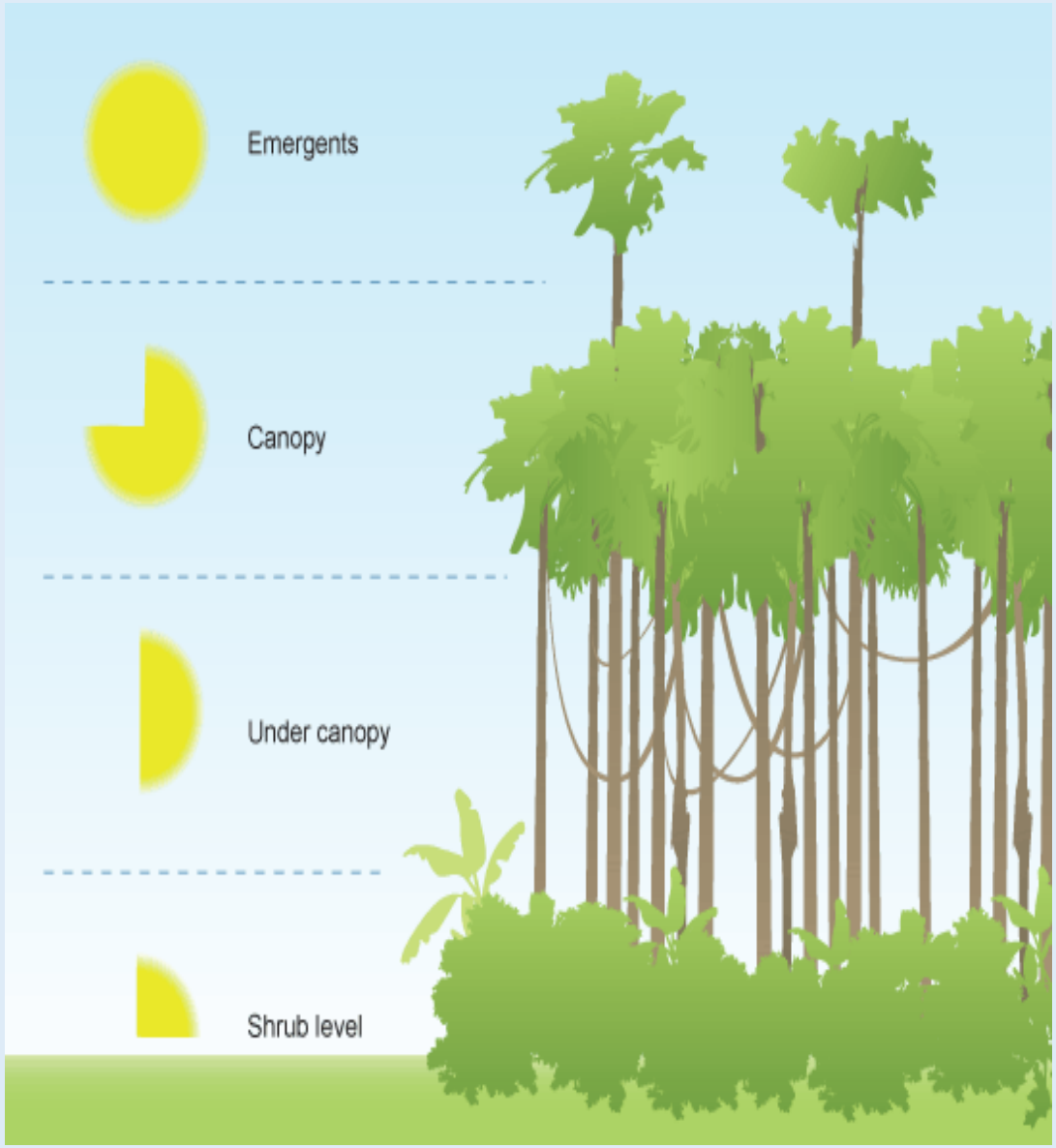


Plants take in nutrients to build into new organic matter. Nutrients are taken up when animals eat plants and then returned to the soil when animals die and the body is broken down by decomposers.

Litter	This is the surface layer of vegetation, which over time breaks down to become humus.
Biomass	The total mass of living organisms per unit area.

Location of World Biomes





Climate of Tropical Rainforests

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

Plant & Animal Adaptation in the TRF

1. Plants have **'drip tip'** leaves so that the water can drip off them.
2. Trees have **Buttress Roots** because the nutrients are concentrated at the top of the soil so the roots need to be shallow.
3. **Lemurs** have **gripping hands** & **feet**, **long tails** & **strong legs** to leap through the trees.
4. Chameleon **skin changes colour** to act as **protection** against predators.

Why should TRF be protected?

1. Biodiversity – TRF contain more than 50% plants & animals in the world.
2. Climate Change – TRF absorb and store CO2
3. Climate – TRF prevent climate from becoming to hot & dry. Produce 28% of the worlds oxygen.
4. Resources – Valuable wood, fruit, nuts & rubber
5. Medicine – 25% of all medicine come from TRF plants

Management strategies to reduce deforestation

- **Logging and replanting** - selective logging of mature trees ensures that the rainforest canopy is preserved = allows the forest to recover
- Ecotourism - this encourages sustainable tourism = jobs for local people. Money generated is used to protect and conserve the tropical rainforest for future generations to enjoy.
- **International agreements** - agreements have been made between different countries through debt-for-nature swaps. This is when a country which is owed money by another country **cancels** part of the debt if they ensure the conservation of its tropical rainforests.

Case study of sustainable management: Malaysia

The Malaysian government have implemented the following policies to ensure that the tropical rainforest can be conserved and enjoyed by future generations:

- Public awareness of the **value** of tropical rainforests increased through **education**.
- Local communities included and involved in forest **conservation projects**.
- Use of **alternative timber sources** such as rubber trees was encouraged.
- **Selective logging** of **mature and commercially viable trees** over a 40-year cycle to ensure that trees had time to re-establish themselves.
- **Ecotourism** promoted and developed in tropical rainforest areas.
- **Permanent Forest Estates** have been created by the government where no change of land use is allowed.
- Creation of **National Parks** to protect biodiversity.

Hot Deserts

Characteristics

Climate

•The climate is very **hot**. Summer can exceed 40°C. However, at night temperatures drop below 0°C.

•The climate is very **dry** with less than 250 mm of rainfall a year.

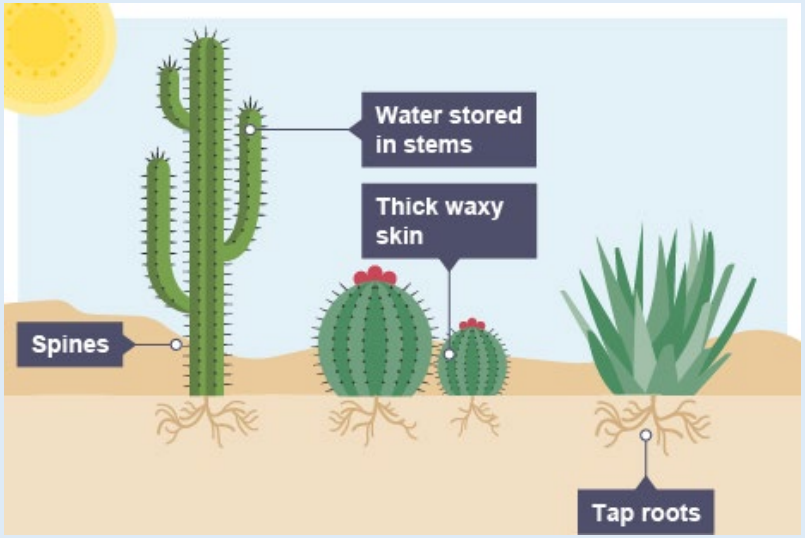
Soil

•Desert soils are thin & sandy.

•Desert soils are very dry. When it does rain they soak up the water very quickly.

Plant adaptations

- **Small leaves** - these ensure that less water is lost from the plant by transpiration because the leaf has a smaller surface area.
- **Spines** - some plants have spines instead of leaves, eg **cactuses**. Spines lose less water than leaves so are very efficient in a hot climate. Spines also prevent animals from eating the plant.
- **Waxy skin** - some leaves have a thick, waxy skin on their surface. This reduces water loss by transpiration.
- **Water storage** - some plants, known as **succulents**, store water in their stems, leaves, roots or even fruits. Plants which store water in their leaves and stems also have a **thick waxy skin** so that they lose less water by transpiration.



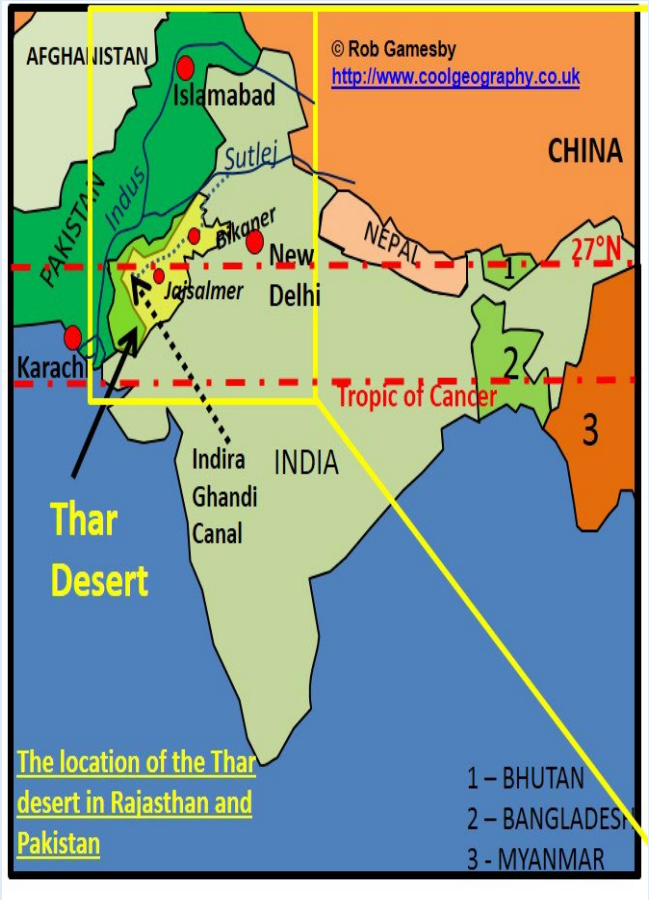
Desert animal adaptations

Camels

- **Thick fur** on the top of the body for **shade**, and thin fur elsewhere to allow easy heat loss.
- **Large, flat feet** to spread their weight on the sand.
- **A fatty hump which provides energy in times of food shortages** (they don't store water in their humps).
- Slit-like nostrils and two rows of **eyelashes** to help **keep the sand out of their eyes.**

A case study of a hot desert - the Thar Desert

The Thar Desert is located in **northwest India**. Many people living in this desert are **subsistence farmers** but with increasing development opportunities.
Due to **population pressures** this environment is increasingly under threat.



Development opportunities

•**Mining** - the desert has valuable reserves of minerals. Limestone and marble are also quarried in the area. **Limestone** is used for building and producing cement, and **marble** is used in construction.

•**Energy generation** - energy is produced in the Thar Desert using **solar panels**. This energy is used to clean water supplies contaminated with salt (desalination). **Wind energy** is also used to generate electricity. A wind farm consisting of **75 wind turbines**.

•**Farming** - irrigation in the Thar Desert has made commercial arable farming viable. Producing crops such as **wheat** and **cotton** has created many jobs and generated income for the local economy.

•**Tourism** - Tourists explore the desert with **local guides on camels**. Tourism is an important **source of income and creates many jobs for local people.** The multiplier effect of tourism creates many development opportunities.

Challenges of development

- **Extreme temperatures** - temperatures in the Thar Desert can exceed 50°C in the summer months. It is hard for people to farm, work in mines or as tourist guides during these months as it is simply too hot.

- **Water supply** - With only **120-240 mm of rain** falling per year in the desert, water must be used sensibly and sustainably. Without water the development of mining, farming and tourism and therefore the economy would not be possible.

- **Inaccessibility** - Most of the desert is inaccessible due to the extreme environmental conditions and poor **infrastructure**.

For example: Beyond the city of Jaisalmer, development is limited. This has created a honeypot site for tourists in Jaisalmer but not beyond. Inaccessibility to many parts of the desert has led to greater differences between rich and poor.

Causes of desertification

Desertification is the process of land turning into desert as the quality of the soil declines over time.

- **Population growth** - An increased population = greater pressure on the environment for resources such as wood and water.
- **Overgrazing** - an increasing population results in larger desert areas being farmed = the soil exposed to erosion.
- **Soil erosion** - this is made worse by overgrazing and the removal of wood.
- **Climate change** - the global climate is getting warmer. In desert regions conditions = warmer but drier too.

Strategies to reduce desertification

Desertification can be reduced by adopting the following strategies:

•**Planting more trees** - the roots of trees hold the soil together and help to reduce soil erosion from wind and rain.

•**Improving the quality of the soil** - encouraging people to reduce the number of grazing animals and grow crops instead. The animal manure can be used to fertilise the crops grown. The roots hold together the soil and protected from erosion.

•**Water management** - water can be stored in dams in the wet season and used to irrigate crops during the dry season.